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Barriers for private sector companies operating in waste management and recycling in Sub-Saharan Africa

A qualitative exploration

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Abstract

Global waste management is critical for sustainable development, yet it is often overlooked in development theory and global education. The greatest increase in waste generation is expected to take place in Sub-Saharan Africa, and the region is already facing a growing waste management crisis. Through qualitative interviews with companies and experts operating with diverse experience in the industry, this thesis contributes to the limited research on the barriers facing private companies operating in waste management and recycling in Sub-Saharan Africa (SSA). The main finding of the thesis is that there are fundamental industry barriers which the companies have limited ability to impact, yet an urgent need to navigate through. The industry is fragmented; there are numerous small-scale actors operating alone and few industrial synergies. The established collection systems are under-developed. This leads to a highly unpredictable raw material throughput, which in turn makes it challenging to operate efficiently and to offer stable supplies to the market. Limited information and lack of reliable data further aggravate inefficiencies in a value chain struggling to generate profits.

Several risk factors are refraining commercial investors from investing in the industry. Return expectations are low, and high discount rates are applied on new investments. There is a lack of public awareness on the consequences of inadequate waste management, and on the economic benefits of creating better solutions. It is therefore an urgent need for education along several dimensions. There is also a need to consolidate existing players, with increased transparency which may facilitate cooperative efforts, better investment opportunities and a large-scale impact. Despite political turmoil and competing priorities, national governments need to play an active role in setting a political framework and regulatory constraints.

Acknowledgement

I want to thank all the involved companies for taking their time to arrange calls with me and meet me in person. I am particularly grateful for how all the respondents welcomed my research with positivity and engagement, even in challenging circumstances from COVID-19.

I want to give a special acknowledgement to Tshego Nesvåg, for introducing me to the topic and for giving me access to her well-established relations in the industry in Ghana.

Finally, I would like to thank my supervisor Aksel Mjøs for giving valuable advice along the way. Further, for accepting to be the supervisor for a master thesis with a different methodological approach and topic than what he usually supervises for.

Hopefully, this thesis can grow interest and engagement on the challenges and opportunities in the industry. Inadequate waste management is a pressing development issue, and the need for solutions will become more urgent going forward.

Thank you,

Thea Thorleifsson

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Abbreviations and explanations

Bail plastic:	Press plastic into compressed blocks
Calorific value:	The heating value, the heat balance
Flakes:	The first process of recycling, separating the plastic into small parts.
EFW	Energy from waste
Incineration:	Burn large quantities of waste.
MSW:	Municipal waste management
PET:	Polyethylene terephthalate
Separate at source:	Separation at the time where waste is disposed to avoid that recycled material is contaminated by other material.
Solid waste:	Commonly known as trash and garbage
SME:	Small and Medium-Sized Enterprises
SSA:	Sub Saharan Africa
WTP:	Willingness to pay

Concepts described with images:

The Sub-Saharan African region

1. Introduction

1.1 Research objectives and research question

The volume of global waste generation has never been higher. As the world population grows, and more people are moving out of poverty, and often towards cities, the consumption of goods and services grow significantly (Hoornweg, 2014b). Hence, we produce more waste. According to the World Bank, the global waste generation is predicted to increase by 70% by 2050 (from 2,01 billion to 3,40 billion tonnes annually) (Kaza et al., 2018). The greatest increase in waste generation is expected to take place in Sub-Saharan Africa (Godfrey & et al., 2019).

Management of waste is critical for sustainable development, yet it is often overlooked in development theory and global education. Professor Hoornweg (2014) argues that one of the best predictions for future welfare, as the global population is moving towards increased urbanization, is how we handle the waste (Hoornweg, 2014b). Waste management and recycling are complex industries that are challenging to optimize as it requires coordination, involvement and cooperation between a broad range of stakeholders (Dukhan, 2014).

Inadequate waste management is causing significant social, environmental and financial challenges (Godfrey & et al., 2019). Despite that waste management is vital for the economy and public health, there is a lack of economic incentives to drive innovation for waste management (Kjorstad, 2014). Private companies globally are developing innovative solutions and ideas to combat the challenge of waste management and recycling. Nevertheless, because of a low willingness to pay for waste, generating profits in the industry remains challenging (Kjorstad, 2014).

In order to coordinate and succeed with waste management and recycling, the government can play an important role by setting a regulatory framework and providing financial support. The International Finance Cooperation (IFC) argues that Europe is perceived as a frontrunner for investments in the waste industry, and they emphasise that this is primarily driven "*by long-term political and regulatory stability in the region"* (International Finance Cooperation, 2014). Morton (2017) further argues that solid waste services are rarely marginal and often unprofitable, especially when there is a lack of overall collection systems or governmental support.

Many governments in the less developed part of the world, such as in SSA, are unable to impose the necessary regulatory standards. Many of these governments are highly inefficient, working with limited financial budgets, lacking executive powers and they are facing challenges with corruption. One might question whether it is even possible to tackle the waste challenge in areas where these constraints are not fulfilled, such as in Sub-Saharan Africa.

For countries without formal waste management or recycling systems, the scope of the challenges is growing exponentially as the demand for waste increases. The level of waste generated in Sub-Saharan Africa is expected to be three times higher in 2050 than the current level (Kaza et al., 2018). Waste collection levels vary with countries income levels, and the collection levels vary significantly from urban to rural areas, especially for low-income countries. For high income areas such as North America or Europe the collection level is on 80-98%. The lowest global collection levels are in Sub-Saharan Africa and South Asia with a collection rate of about 44%. However, even more pressing than the low collection rate is the fact that in SSA about 90% of the collected waste is disposed to landfills or openly dumped in the nature (Godfrey & et al., 2019).

Hoornweg (2014) argues that "*There is no ideal way to dispose of waste*". He further emphasise that all options are expensive and have myriad impacts, so waste managers need to select from among several challenging choices (Hoornweg, 2014a). Nevertheless, numerous innovative entrepreneurs, creative minds and proficient businesspeople are working to find solutions to handle the ever-increasing waste streams in the region. Some are creating school buildings with recycled plastic, others are educating thousands of school children on how to separate waste at source, and numerous of actors are working to provide waste management options for households and the commercial industry.

Calculations show that working towards higher levels of recycling, reuse and recovery could add about $ 8 billion to the African economy every year (Yonli & Godfrey, 2018). Waste as a resource can provide local economies with significant values for manufacturing and local production (Godfrey & et al., 2019). When some actors manage to create a business of waste, it creates economic incentives for other individuals to make use of existing resources and create value.

In 2018 the UNEP developed the first African Waste Management Outlook to describe the current state of the situation with challenges, opportunities and impacts of waste and waste management in Africa. The key takeaway was: "*Africa is facing a growing waste management crisis*" (UNEP, 2018). Godfrey et al. (2018) further argue that to get control over the waste stream in Africa; there is a need for intervention between the government, business and the civil society.

With this waste crisis as a backdrop, I will focus the thesis towards private sector companies operating within the waste industry in SSA. The thesis therefore aims at answering the following question:

What are the barriers for private sector companies operating in waste management and recycling in Sub-Saharan Africa?

Based on in-depth interviews with companies operating in the waste industry in Ghana, Ethiopia and South Africa, I am aiming to get an understanding of the challenges they are facing in daily operations. In addition, I have met several other relevant companies, organizations, initiatives and investors to better understand the overall context they operate in.

The field of waste management and recycling is broad and complex, and with are several possible approaches and value chains. There are a broad range of interesting topics to explore, such as illegal trade of electronic waste from developed to less developed countries, environmental concerns of plastic in the ocean or burning of waste. The main focus of this thesis is municipal waste from households and the commercial sector, mainly paper and plastics. In order to limit the scope of the thesis I will not go into details on all processes and varieties of waste management. Furthermore, I will keep the technical descriptions of recycling to the limits. A thorough understanding of all the different technological aspects will not benefit the analysis, as the most essential part of this thesis is to understand the overall economic picture and the business-related challenges, the private companies in this industry are facing. In addition, the thesis will have a contemplated focus on the urban areas in SSA, as this is where most of the private sector activity takes place.

1.2 Thesis structure

I wish to introduce this research with a thorough background and literature review, to discuss the current knowledge in the field. Moreover, to allow the reader to understand where this thesis situates with existing knowledge. The literature review will follow a natural division, starting with a broader perspective and narrowing down to private sector businesses operating in SSA. I will continue to introduce economic theories used to analyse the problem formulation. I will explain the following theoretical concepts: wicked problems, externalities, asymmetric information and incentives theory.

I will continue by explaining the methodological choices, as I find it necessary to explain why a qualitative research method was chosen in this thesis. This section will also explain the data collection and analysis process.

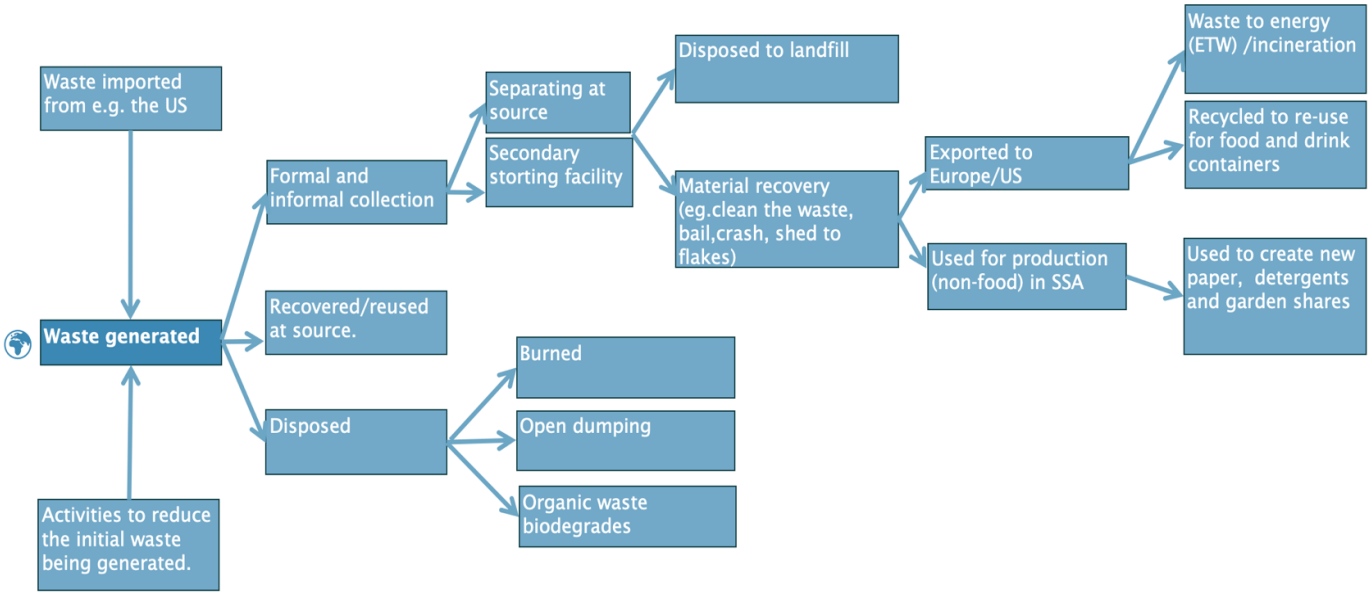
Further, the overall country- and company-specific informational will be introduced. This creates a basis for a comparative analysis of the findings of the most critical barriers from a business perspective. Based on relevant economic theory, interviews with the case-companies, background-research and important literature I will analyse the overall socio-economic, political and cultural barriers in the industry. Prior to looking further into the barriers on an operational level. I will analyse the role of different involved players and use the insights to outline solutions and draw generic insights at different levels. To conclude, I will continue to discuss different future paths and opportunities, as well as outlining the limitations and practical concerns.

2. Background and literature review

This chapter seeks to provide a basic understanding of the waste management and recycling industry based on currently available literature. The literature review is divided into three main sections. The first section aims at providing an understanding of the industry in general. The subsequent sections will focus on critical aspects of the industry in developing countries and in sub-Saharan Africa. The information outlined in this chapter is essential to get an overview of the industry, which is important to better follow the analysis and understand the barriers. Furthermore, to understand where my work is situated with already existing knowledge and literature, as well as to provide insights into areas where there is a lack of information and research.

Within recycling and waste management several models can be drawn to describe the process and value chain. The process depends on the contextual surroundings, the composition of different waste sources and the different available types of recycling or reuse. However, to better follow the reasoning below, I have outlined figure 1. The figure illustrates a typical waste management & recycling system and represents my interpretation. of the value chain and processes involved.

Figure 1: An overview of a waste management system in SSA. (Designed for illustrative purposes)

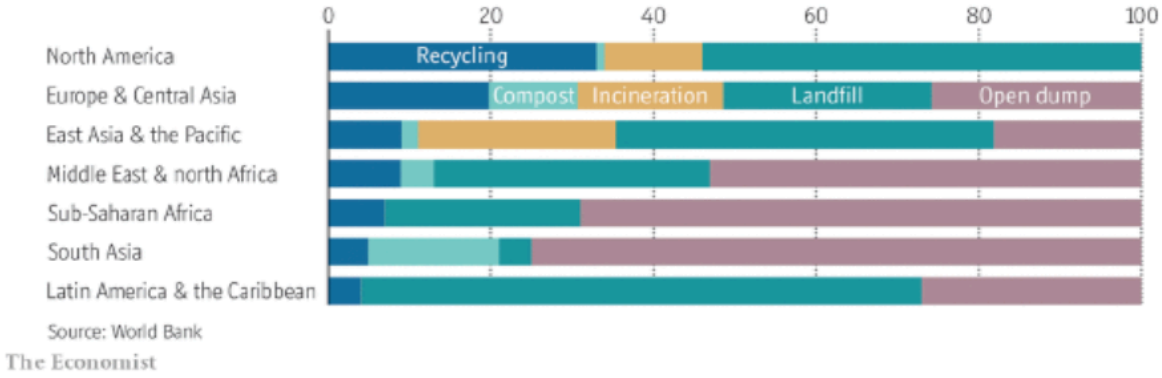


2.1 The global waste industry

The industry of waste management and recycling is young, and a lot of the development in the field is based on pilots and start-ups. The governance is primarily focused on setting targets and strategies, and there is overall little academic research on the field. There is also a lack of statistics and data on the industry, and a lot of the available information and estimations are based on assumptions (Kaza et al., 2018). Furthermore, there are undefined and incomplete definitions related to different types of waste, and different disposal and treatment options (Kaza et al., 2018). The best research available is literature and reports from trustworthy global actors such as the United Nations, the World Bank and the International Finance Corporation (IFC). Additionally, professional independent news agencies play an essential role in sharing information related to the current circumstances, innovation and challenges.

Most of the global challenges the world is facing are interconnected and affect one another in a vicious cycle. Inadequate global waste management is one of these. About 1 out of 4 people on the planet (2 billion people) do not have access to any waste collection services (UNEP, 2015). The global waste-disposal methods of 2016 are outlined in figure 2.

Figure 2: Waste-disposal methods (The Economist, 2018)



If waste is poorly managed and leaks into nature, it can, first of all, affect the ability to get clean drinking water and disturb the biodiversity and animal life. Waste can cloak drains hence increase the risk of severe damage from floods and the risk of transmitting diseases (Godfrey & et al., 2019). Furthermore, burning of waste leads to higher air pollution levels and does count for about 5% of global emissions (Kaza et al., 2018). Finally, higher levels of waste disposed in nature and on coastlines refrain inhabitants and tourists from beaches.

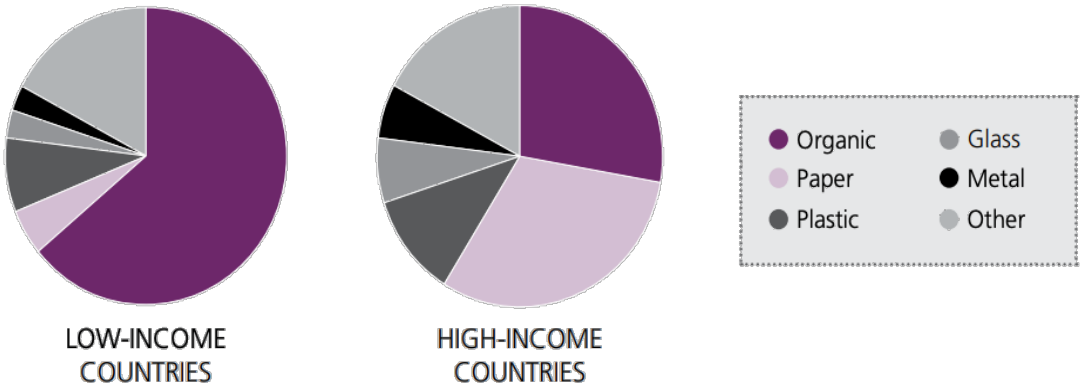
Coastal areas are important to drive the economy, and important for trade, social interaction and mental health (Ashbullby et al., 2013).

In order to process and deal with waste, it needs to be collected. In addition to prioritization of urgent issues, there are financial and governance constraints that make it unlikely to believe in a global collection rate of 100% (UNEP, 2015). Historical and contemporary human behaviour is to be blamed for enormous amounts of waste in our environment. Getting control of more of the global waste levels, will help to address and significantly improve progress towards global goals on health, security, education and economic growth. Nevertheless, the challenges of waste have not been a top priority for municipalities, governments or international cooperation.

Financing waste management is challenging, as it requires a complex infrastructure. Waste collection, and especially transportation is the costliest part of the value chain. The cost of transportation for waste management in urban areas is according to the World Bank about $20-$50 per tonne (Kaza et al., 2018). Based on what we know about the industry, there is a saying that "*waste companies rarely reach financial equilibrium*" (Dukhan, 2014). However, there is research proving that investments in the waste industry can be profitable (Summa Equity, 2020).

There are global reports and studies on waste management going in-depth on regional and local constraints and discussing potential solutions. The IFC argues that the scope and scale of the problem is global, but the solution for effective municipal waste management are systems that reflect the local waste composition. In figure 3, the IFC outlined how the waste composition is affected by the income level in the country. The composition varies significantly with the country's income levels. Especially the share of organic waste in low-

Figure 3: Waste composition by income (International Finance Cooperation, 2014)

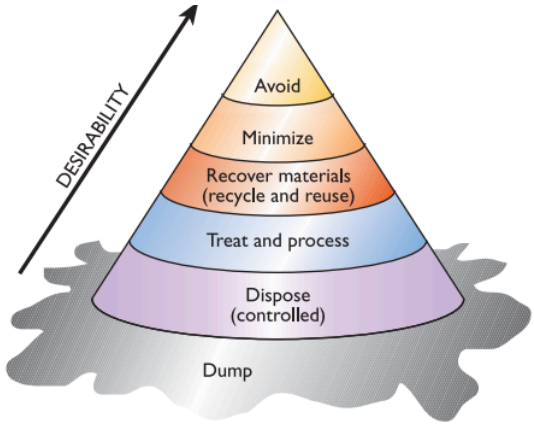


income countries, compared to the share of plastic and paper in high-income countries. IFC argues that in order to deal with waste it is vital to focus on the fundamentals of waste management and implement affordable solutions with technologies that can be operated locally (International Finance Cooperation, 2014).

There is also a need to scale up already implemented technologies and ideas around the world. Some argue that this can be done by a stronger end-use market (Godfrey et al., 2019). Others argue that a significant constraint to successfully implemented projects of waste management is through building awareness and knowledge of the actual consequences of not doing anything. (Paris, 2014) Moreover on the benefits of taking action; start a company, separate waste at source, pay for collection or join clean-ups.

Figure 4 illustrates the waste hierarchy on the desirability of different waste management options (UN-habitat, 2010). The most desirable option is to avoid the waste produced, while the least desired option is open-dumping and disposal.

Figure 4: The Waste Hierarchy (UN-habitat, 2010)



2.2 Waste management and recycling in developing countries

As with other global challenges, it is the most vulnerable part of the global population that will be most affected by the negative impacts of inadequate waste management. Additionally, be victims of unsafe working conditions and landslides of waste dumps. The most affected part of the population is additionally least positioned to influence the needed waste management decisions, regulatory framework or priorities. (Kaza et al., 2018).

The average waste collection coverage is about 30-60% in urban low and low-middle income countries (UNEP, 2015). The low collection rates imply that large volumes are dumped uncontrolled. In order to manage the overall waste management challenges in developing countries, some argue that the most critical priority is to enable more and better

collection systems (Godfrey, 2019). Without waste being collected, it is hard to succeed with local circular economy initiatives for higher levels of reuse, recovery and recycling. (Godfrey, 2019).

There is an ongoing debate on how developing countries should combat plastic waste. The most common discussions are linked to regulatory bans, better collection and disposal methods or replace plastic with biodegradable materials (Godfrey, 2019). Linda Godfrey (2019) argues that the best solution will be a combination of different solutions, tailored to fit for different local contexts.

Scheinberg et al., argues that the recycling industry in developing countries is more separated from waste management than it is in developed countries. In developed countries the two activities are often more connected or run by the same companies (2011). Moreover, they argue that the recycling industry in developing countries is not only a public service but primarily a private economic activity. The recycling activity is, according to Scheinberg et al., "*based on valorisation and trading, with strong links to the industrial sector and hundreds of years of history*" (Scheinberg et al., 2011). Despite the two activities being more separated in developing countries, Scheinberg et al. emphasize that by building a stronger recycling industry, the incentives for waste management will strengthen (2011).

2.2.1 Export and import of waste

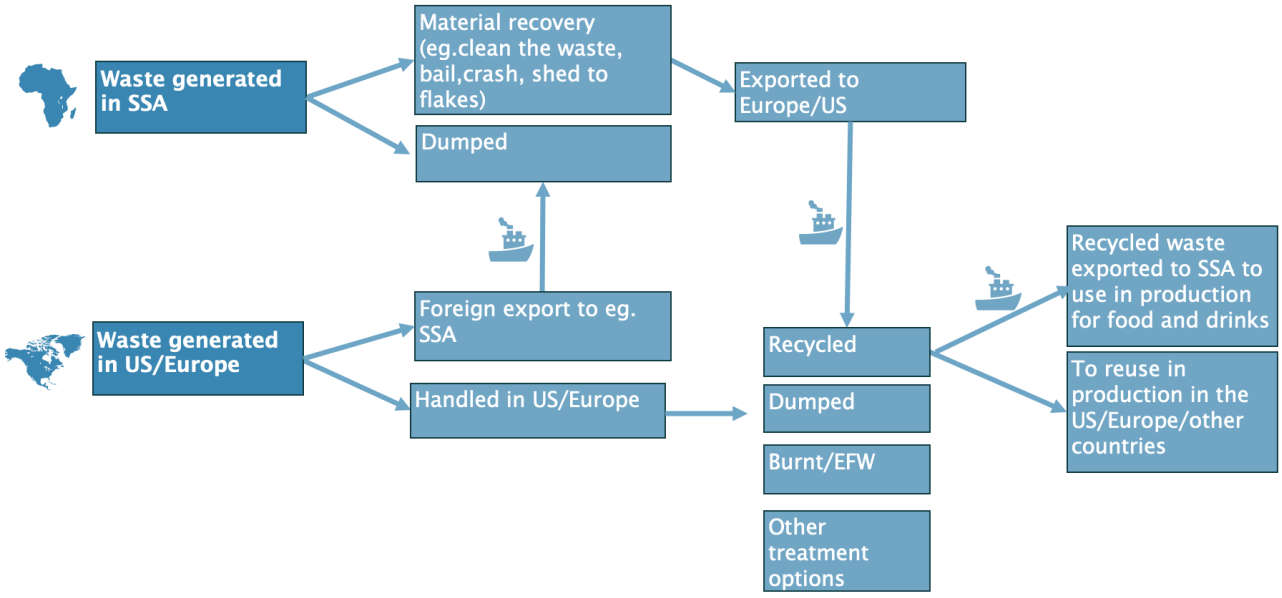
There is a comprehensive trade of waste internationally (Lerner, 2020). First of all, there is a trade of waste from developing countries to more developed countries, with the purpose of recycling waste. Because of lack of funding, lack of professional competence and other local challenges, there is an insufficient market for recycling in many developing countries. Used plastic is, therefore, being shipped to Asia, Europe or the US to be recycled (Delmon, 2014). In 2018 China imposed a new policy, National or Green Sword, to stop import of recycled plastic or unsorted paper, aiming to eventually ban most other types of waste. China was one of the main importers of recycled materials globally, and the policy has impacted waste management and recycling companies all over the world (Higgs, 2019).

At the same time, waste is exported to or dumped in developing countries. Unlike the usual idea of trade, companies and governments in less developed countries are often being paid from more developed countries to receive waste. Based on the financial situation for many businesses and governments, accepting the payments is tempting, even if it leads to

increased waste levels and related challenges (Lerner, 2020). Export of waste is the largest export commodity for the US (Humes, 2014). 750 thousand tonnes (1.5 billion pounds) of plastic waste was exported from the US in 2019. Ghana, Ethiopia and South Africa are among the African countries that imported American plastic waste in 2019 (Lerner, 2020) Unfortunately, the majority of the waste these countries received was the least valuable type of plastic, also the one that is most difficult to recycle (Lerner, 2020).

The illustration below, figure 5, is a simplified description of how the trade for waste, especially plastic, takes place. The illustration is based on my interpretation of the trade of waste between Europe/US and Sub-Saharan Africa.

Figure 5: The trade of waste (designed for illustrative purposes)



As figure 5 illustrates, the trade of waste is complicated. Waste is imported and exported in both regions. The difference is that the waste exported from SSA to developed countries is sorted and processed, and ready to be recovered and recycled. Hence, it creates more value. While the waste imported from developed countries is hard to recycle and often dumped, which creates significant environmental and human challenges for the region.

The irony of the situation, and what Ismawati, working for a foundation tracking the waste trade, argues that "*If recycling is so great, such an environmental good, why don't developed countries do it there? If you're so advanced that you can send rockets to the moon, why can't you build recycling plants in your own countries*" (Lerner, 2020). David Azoulay from the

Center for International Environmental Law argues that developing countries are given the role as the cause of the plastic crisis and developed countries such as the US as their "saviour" reaching out to help. While in reality, the situation is even worsening in developing countries because developed countries export low-value waste. (Lerner, 2020).

2.2.2 Technological solutions

Kaza et al (2018) argues that technology is not a *panacea*, which means it will not be the remedy or solution to all parts of the waste problem. Technology can better facilitate for solutions to waste management in many scenarios, and it is an important factor to consider for waste management options (International Finance Cooperation, 2014; Kaza et al., 2018). Nevertheless, to combat the waste challenge countries should implement locally appropriate solutions (Kaza et al., 2018).

The process of generating energy from waste (EFW) is a controlled form of burning waste where electricity or heat is created. Energy from waste is also called incinerator. The process of EFW does require developed technological solutions and is implemented in several developed countries. There are also pilots running in some developing countries (International Finance Cooperation, 2014). According to the IFC will technological solutions, such as energy from waste, not be the best way forward for emerging markets (International Finance Cooperation, 2014). Further, there are challenges such as poor quality of waste which argues against waste to energy as a winning waste strategy (International Finance Cooperation, 2014).

Rough estimations from the World Bank show that there are significant investments needed to implement technological intensive waste management and recycling systems in developing urban areas. If technological solutions similar to what is used in developed countries is implemented in, would be expected to triple by 2040 to about a cumulated $17-125 billion depending on what technological solution that is implemented[1]. (UNEP, 2018). David Azoulay argues that actors from developed countries are implementing and encouraging advanced technological solutions that are driving governments and companies in less developed countries into significant investments for intensive technological solutions.

[1] Calculated based on several constraints, such as looking at the urban population, no maintenance costs, neither currency nor inflation fluctuation(UNEP, 2018)

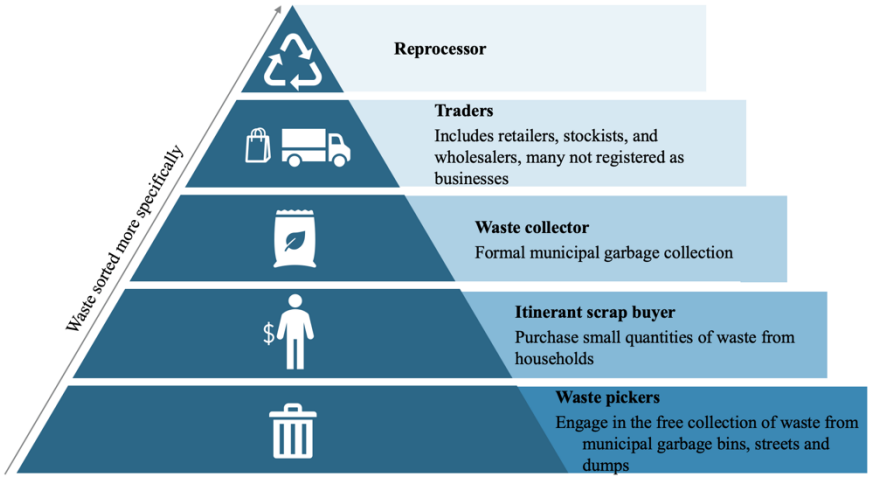
However, they could have solved their problems by implementing more suitable and cheaper solutions. (Lerner, 2020).

2.2.3 The informal sector

The majority of the available data emphasise the importance of the informal sector operating in waste management. Waste pickers, according to the World Bank, is 5% of urban jobs in developing countries(Delmon, 2014). In many urban areas in developing countries, the informal sector is vital for enabling any sort of waste management systems. The informal channels do collect and recover "*many more tons*" than the formal sector, and in some areas, they do manage about 15-20% of the total waste composition (International Finance Cooperation, 2014).

Research and tv-reports are covering the hard working conditions for informal waste pickers, especially on landfills (NRK, 2019). Yet, individuals engage in the informal sector of waste management because of existing opportunities to earn profits. Potential revenues are primarily based on waste pickers and scrap collectors that are able to trade, process or sell what they collect to recyclers. Figure 6 is developed by IFC and the two lowest levels of the pyramid illustrates how the informal sector engages in waste management activities.

Figure 6: Informal recycling sector: Waste Trade Pyramid (International Finance Cooperation, 2014)



The collection of recyclable material is often collected by the informal sector in SSA. This is partly why the data is hard for the industry to access, or does not exist (UNEP, 2018). UNEP argues that the informal sector is cooperating with governments and producers in some cities, while in other cities their efforts are not recognized (UNEP, 2018). Despite this, the

informal sector remains valuable for the municipalities. The sector reduces the overall landfill space and can in some places also reduce transportation costs and cost of collection (International Finance Cooperation, 2014).

2.2.4 The private sector

There is generally a lack of data on private companies operating in less developed countries. There is some literature stating the importance of the private sector to handle waste management and recycling (Dukhan, 2014)(Morton, 2017). However, there are few broad case studies and varied literature on private companies and their role in waste management and recycling.

The private sector is operating in a variety of different fields in the value chain depending on the local waste composition and the country's regulations and laws. This will also depend on the general economic activity and level of private investments in the country. Some companies operate larger technical facilities, run collection services, operate landfills or develop reuse activities. Depending on their involvement and activity in the value chain, there are different financial and technical risks (Morton, 2017). What is more unclear, is what these different risks are and how they vary depending on where companies are positioned in the value chain. Existing research provides little insight into the real challenges and barriers these private sector companies are facing. The existing research also fails to answer the question whether it is at all possible for private companies to operate profitably while working to overcome the challenges.

There has been research linked to the importance of connecting private waste management and recycling companies to public initiatives or funding through public private partnerships. Dukhan (2014) argues that the private sector should contribute to organizational and technical skills, while the governments should put in place regulations, and finance large scale project management. However, little research provides information about the longer-term value and riskiness of these partnerships in countries without an efficient state and government, especially in places where there is a lack of government enforcement and trust.

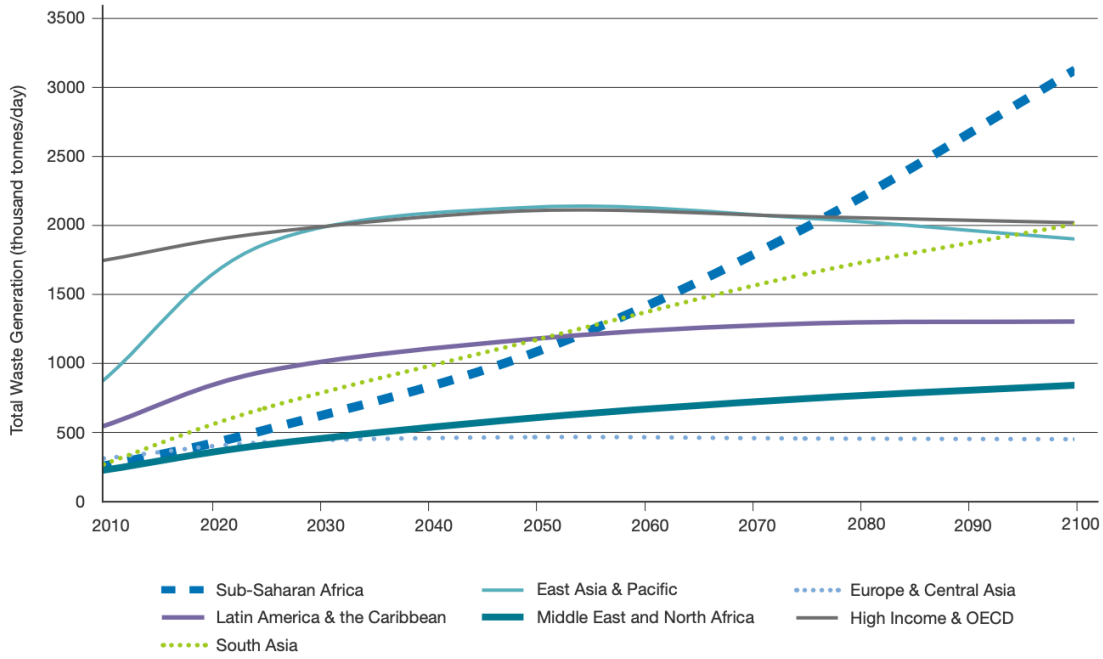
Duncan (2014) argues that the private sector can fill the gap with a lack of governmental involvement in waste management, but only temporary. The involvement of the private sector is not sufficient to get an integrated waste management system (Dukhan, 2014). An integrated waste management system is complicated. It would be interesting to understand

how private sector companies can play a role in developing parts of a waste management system, and by doing so, improve the situation.

2.3 Waste management and recycling in SSA

World Bank Data from 2016 shows that Sub-Saharan Africa currently only accounts for about 9% (174 million tonnes per year) of the total world waste generation (Kaza et al., 2018). However, the continent is currently seeing changing consumer behaviour and a growing middle class demanding more products and services (Godfrey et al., 2019).

Figure 7: Total municipality solid waste (MSW) generation by region, Hoornweg et al., 2015

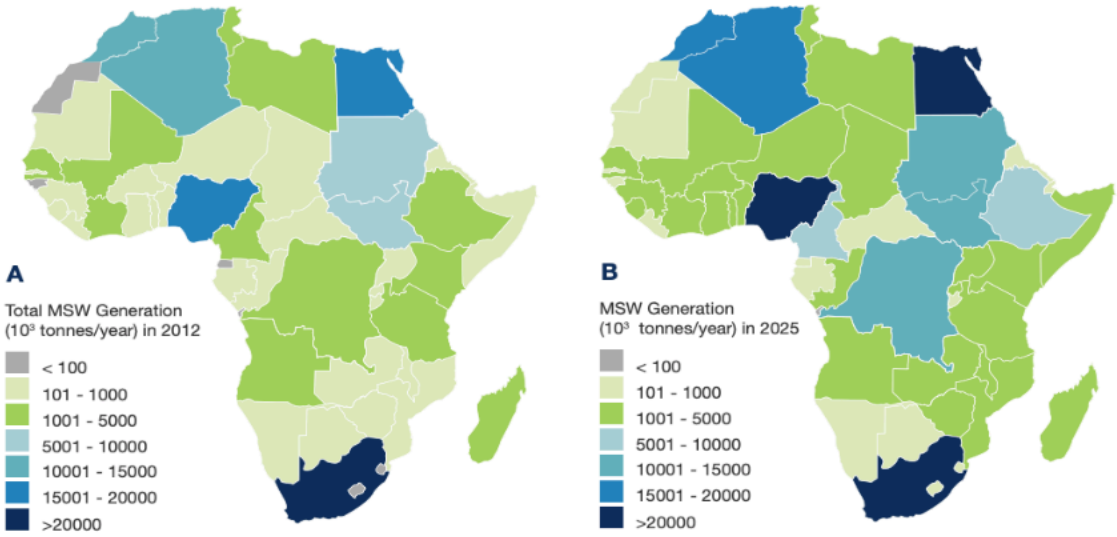


The region is expected to have the fastest-growing level of waste going forward (Kaza et al., 2018). Figure 7 developed by Hoornweg et al (2015) was distributed in UNEP's "Africa Waste Management Outlook" report and shows how total waste generated per day is expected to develop in the African region compared to other regions.(Hoornweg et al., 2015; UNEP, 2018)

Eventually, by 2050 Sub-Saharan Africa is expected to be generating more waste than any other region in the coming decades (Kaza et al., 2018). This enormous growth in waste levels is happening in an area already struggling to deal with current waste levels. Policies and strategies from government and private companies have in the last decade been unable to

keep pace with the rapid growth of waste levels (Onibokon & Kumuyi, 1999). In figure 8 the distribution of total waste generated among the African countries in 2012 and 2025 is described (UNEP, 2018).

Figure 8: total MSW generation of African countries in 2012 and 2025, (UNEP, 2018)



Europe, Central Asia and North America have a collection rate of about 90% (Kaza et al., 2018). Nearly all the Sub-Saharan African countries have policies outlining how waste should or should not be handled, yet the collection rate in SSA is calculated to 44%[2]. The rate varies significantly from country to country and from urban to rural areas. In some countries the rate is below 20%, and in others it is above 80% (UNEP, 2018). There are several constraints to enforcing the waste policies and enabling a higher collection rate. UNEP (2018) describes the constraints in the region related to weak legislation, corruption, political instability and conflicts.

[2] The ratio is calculated based on how much waste that is collected compared how much is disposed. They emphasize the number is based on limited data and based on modelled data (UNEP, 2018)

2.3.1 The costs of waste management in SSA

According to Ede Ijjasz-Vasquez from the World Bank (2018) waste management is for many local administrators in low-income countries, the largest single item on budgets. Nevertheless, the percentage spent on waste management in budgets is significantly higher than in higher income countries, as illustrated in table 1. Waste management costs can be as high as 30-50% of total budgets in some municipalities in Sub-Saharan Africa (Dukhan, 2014). This is primarily due to the high infrastructure investments and operational expenditures needed.

Table 1: Solid Waste Management as a Percentage of Municipal Budget, (Dukhan, 2014)

Income group	Average percentage of municipal expenditures on solid waste management
High income	4%
Middle income	11%
Low income	19%

The overall cost, financially, socially and environmentally, of not managing the waste in Africa, is exceeding the cost of developing waste management solutions today (Godfrey et al., 2019). UNEP argues that there is a lack of financing towards waste because the waste industry in Africa is looked upon as high-risk investments (UNEP, 2018).

2.3.2 Regulatory framework in SSA

In 2020, The World Bank developed a report on how business-friendly countries are (The World Bank Group, 2020b). The sub-Saharan economies were together with Latin America, the region with fewer improvements over the last years and the most difficult regulatory framework (World Bank Group, 2020). The World Bank calculated the "*ease of doing business*" in SSA and the regional average was at about 50, on a score from 1-100. Ethiopia scored below the regional average, while Ghana and South Africa ranked above the regional average (The World Bank Group, 2020a). The report indicated that the regional average for the majority of the regulatory indicators was below the global average. Besides, there was a striking difference between the regional average and global average on getting electricity. Futhermore, was the time and cost of trading across borders in the region challenging, mainly associated with the customs and inspections in the region (The World Bank Group,

2020a). It is interesting to understand how this affects the private sector operating in the industry.

UNEP describe a general lack of public awareness and negative attitudes towards enforcing policies on waste (UNEP, 2018). There are more countries on the African continent with plastic bans than any other continent (Ndiso, 2019; UNEP, 2018). Despite that most of the plastic bans are not fully enforced or followed-up, these bans have had some effect and reduced the amounts of plastic going into the landfills (UNEP, 2019). However, there is a health-related risk of banning these products, especially for food security, preservation and hygiene (Godfrey & et al., 2019).

2.3.3 Involved players in the industry in SSA

There are several networks, partnerships and initiatives to drive the debate on inadequate waste management and low recycling levels in Sub-Saharan Africa. The World Bank is reporting on the waste situation in SSA and how it is developing. They are creating guidelines and showing different potential future scenarios. The IFC is calculating expected costs, the costs of the current waste pollution and outlining different solutions. UNEP outlines the African Waste Management Outlook, which is a great tool to understand the regional waste challenge, the composition and the current situation (UNEP, 2018). They primarily shed light on the environmental challenges related to unmanaged waste and how global public health can be affected by continued inaction.

According to Reuters, multinationals such as Coca-Cola, Nestle and Unilever are working to build initiatives for recycling at a national level (Ndiso, 2019). PETCO is the South African model for recycling and is a non-profit that is run by multinationals such as Coca-Cola and Unilever. The company was started to enable the multinationals to contribute towards their producer responsibility (Godfrey et al., 2019; Ndiso, 2019). UNEP (2018) argues that there are actually "*few African countries actively engaged in the global resources recovery business*". PETCO are using existing players in the value chain, both formal and informal players to build a recycling model (Godfrey et al., 2019). PETCO is currently doing pilots in Ethiopia, Tanzania and some central-Asian countries. (Ndiso, 2019). They provide subsidies to the market of plastic recycling to ensure a better flow of volumes and financial security (Ndiso, 2019). However, sceptics argue that PETCO is a way for the multinationals to regulate the level of recycling (Ndiso, 2019).

Initiatives such as the Global Plastic Action Partnership (GPAP) is established with the aim to obtain political commitment in order to address plastic pollution faced in the SSA. The GPAP will primarily work to collaborate with the business community, targeted government institutions, local communities and other key stakeholders. They aim to connect private sector and national public leaders to develop national action plans to better facilitate for an investment landscape which can support the implementation of targets. (GPAP, 2020)

2.3.4 Constraints affecting the private sector in SSA

Most of the literature reviewed above explains structural challenges in the industry, which indirectly or directly affects private sector companies. However, there is limited literature analysing how the structural challenges in the region affects the private sector companies. Ndiso (2019) emphasised that despite there being waste and plastic disposed of in nature, a lot of African companies struggle to get enough waste to sustain their businesses (Ndiso, 2019). This is primarily due to lack of recycling infrastructure and the fact that much waste ends up at landfills. Gustavsson et al. (2011) emphasised that lack of infrastructure, control and trust are also causing inefficient use of resources, and an unnecessary amount of food waste in the region. About 37% of food produced in Sub-Saharan Africa is lost in the early stages of the supply chain, causing significant amounts of food waste in a region where people are suffering from hunger (Gustavsson et al., 2011).

Large scale waste management options that require complex technologies, such as EFW, are expected not to be financially viable or suitable to implement in Africa, especially not in the short-term(UNEP, 2018). What is recommended to combat the challenge in Africa is to develop initiatives and companies with a wide variety of business models. There will be a need for centralized and decentralized initiatives with private actors, governments and community-driven initiatives(Godfrey et al., 2019). The constraints, regulatory framework and political stability, vary across SSA. Despite this, to solve the waste challenge, the experience and expertise from the different approaches and initiatives throughout SSA should be shared across the regions, cities, municipalities, and rural areas (Godfrey et al., 2019).

Some recent literature looks into how the coronavirus pandemic is already affecting the waste situation in Africa, naturally focusing on short-term consequences. First of all, the pandemic is increasing the need for single-use plastic for security, and is developing an

overall acceptance of more single-use plastic (Lerner, 2020). The pandemic is also delaying the construction and financing of new recycling and waste management initiatives (Lerner, 2020). The informal sector is providing people with a livelihood, and during the lockdown due to the coronavirus in several African countries, waste pickers at landfills were among those risking arrests and fines to pick waste for survival (Lerner, 2020). This illustrates the importance of the industry for livelihood in low-income areas.

In general, there is a low number of case studies on private sector waste companies in SSA. I do hope that this thesis can contribute to better understanding the business perspective of operating in the industry in SSA. This thesis is developed to understand the challenges private sector companies in the industry are facing. Furthermore, to make it clear for investors, public policy and private companies what barriers to overcome in order to enter and survive in the industry.

3. Theory

Waste is tightly connected to our economy and economic theory. Waste is generated because of economic activity around the world, and waste as a raw material generates economic activity and livelihood for millions of people. Waste is visible, which makes it an environmental concern that differentiates from for instance high levels of CO2 in the atmosphere. In this part of the thesis, I will introduce key theoretical aspects that are relevant to the waste challenge. Most of the relevant theory is well established economic theory with significant amounts of in-depth research and knowledge. Yet, my intention is to provide a brief understanding of the important theoretical concepts that will be used to analyse the problem formulation.

3.1 Wicked problems

The concept of wicked problems was introduced by the Berkeley professors Rittel & Webber in 1973. Wicked problems describe global problems that are hard or impossible to solve (Rittel & Webber, 1973). The theory is connected to the economic theory of planning and is described as "*unstructured, cross-cutting and relentless"* (Weber & Khademian, 2008). Wicked problems are hard to solve because of four reasons: 1)incomplete or contradictory knowledge, 2) the number of people and opinions involved, 3) the large economic burden and 4) interconnected nature of these problems with other problems"(Rittel & Webber, 1973).

To find solutions to solve wicked problems, it requires engagement from a variety of actors and stakeholders such as government and community engagement. Recent research from 2020, outlines how food waste management is a wicked problem, and how it should be solved. The research outline four perspectives to solve the problem - "*changing the behaviour of actors, connecting actors and activities within the system, constituting sociocultural meanings and innovating solutions to food waste reduction*"(Närvänen et al., 2020).

Research indicates that sustainable innovation is a solution to solve wicked problem. (Hautamäki & Oksanen, 2016). Sustainable innovation is, according to Hautamäki and Oksanen (2016), innovation that balance three-dimensional performance: social,

environmental and financial. Moreover, with a long-term perspective to improve processes in societies, economies and in the environment. In addition to meeting people's needs with an inclusive approach. Hautamäki and Oksanen (2016) argues that innovation that is motivated by an urge to solve the wicked problem, while being inclusive and systematic in the approach, can be a solution to solve wicked problems (Hautamäki & Oksanen, 2016).

3.2 Externalities

The theory of externalities has existed as a part of the broader theory of welfare economics for more than half a century (European Commission, 2000). Since the 1960s, especially *environmental* externalities, have attracted increased awareness and attention. The concept of environmental externalities was described by the Princeton economists William Baumol and Alan Blinder as the following:

"*Some transactions affect third parties who were not involved in the decision, such social costs are called externalities because they affect parties external to the economic transaction that cause them. Externalities escape the control of the market mechanism because no financial incentive motivates polluters to minimize the damage they do*" (Nordhaus, 2015)

Both to deal with waste and not to deal with waste creates an externality to society. Externalities can be both positive and negative. "A (negative) externality is a by-product of economic activity that causes damages to innocent bystanders"(Nordhaus, 2015). A classic example of a negative externality is when a company disposes waste in a river, which inconsequently kills all the fish and marine activity in the area. Hence, the company did not calculate the overall damages related to his/her activity (Kolstad, 2011).

Waste can be considered as a negative externality. However, the different types of waste affect the environment differently. For most companies, households and cities, waste becomes a negative environmental externality connected to a product or service. It becomes a negative externality because the environmental damage the product or service pose is not included in internal financial calculations, hence not reflected in a market (Nordhaus, 2015).

A positive externality is when an economic activity creates positive value for the society or individuals, without being formally included in calculations. A positive externality is also created if a company employs people with special needs or do voluntary work that is not

reflected in financial calculations (Kolstad, 2011). To treat, collect, reuse and recycle waste without being compensated for it, is a positive externality for the society. Waste management creates a positive externality for all the beneficiaries of less waste in nature. Waste management is also a positive externality for the climate because of reduced environmental cost and energy recovery (European Commission, 2000). In different parts of the value chain, there are different beneficiaries to dealing with waste. Some players in the industry are primarily involved for a public health perspective, others for an environmental perspective or a business perspective.

3.2.1 Global externality

The waste challenge can be described as a global externality because inadequate waste management is causing challenges across borders (Nordhaus, 2015). Unmanaged waste, especially plastic, is affecting the global oceans, and burning of waste is increasing CO2 levels in the atmosphere. Moreover, does waste affect the global supply of clean drinking water and the spread of infectious diseases. The challenges are increasing, and there is a lack of both political and economic mechanisms to solve the problem. In total, the challenge is, therefore, causing the world a negative global externality. Global externalities are becoming increasingly common with growing globalisation and economic development (Nordhaus, 2015). The global community face enormous environmental challenges, and because the challenges are interconnected and global, there will eventually be a need for global solutions.

3.2.2 Internalising externalities

Externalities are a type of market failure, where the market is not effectively dealing with a cost or benefit. The economical solution to externalities, is, therefore, to factor in and internalise all costs and benefits related to an economic activity (Nordhaus, 2015). There are several possible ways of internalising an externality that is applicable to waste management and recycling (Soos, 2010). I will introduce the concepts briefly, but it is not in my intention to go in-depth on the theoretical aspects of all the macroeconomic solutions.

Polluter pays

Extended producer responsibility

Extended producer responsibility (EPR) is a policy approach where the producers are made financially responsible for the pollution (waste) they produce. The idea of the approach is to aim for less production of the initial source, creative thinking for new product-designs, and

to get a funding stream to projects working to deal with waste (OECD & Ministry of the Environment, 2014). Further, the idea is that the producers must include the end-life of their products as a vital part of their value-chains, hence be responsible for the waste they create. To be responsible for the end-of-life of their product is not only to collect an equivalent amount, but to seek for smarter solutions to eventually decrease the waste disposed of their product (OECD & Ministry of the Environment, 2014).

User pays

Another approach is to tackle the problem from the end-users, households, companies, industry and hospitality institutions, that are responsible for disposing of the products. Polluters pay principle to users could be to impose taxes on users or ban illegal disposal. The economics behind implementing taxes on a product is to increase the price and effectively decrease the usage of the product. To increase the price of illicit disposal, hence making it more expensive to pollute would be a desired option (Soos, 2010). However, taxes on certain waste products, such as plastic, are expected not to have a significant impact because the initial cost of plastic is low (Jia et al., 2019). Charles Kolstad, an environmental economist, argued that rewards such as encouraging and incentivise socially desirable behaviour will be more effective than penalties (Kolstad, 2011).

Global mechanisms

Some argue that the Kyoto protocol mechanisms, similar to emissions trading, could be a solution to effectively deal with larger waste streams (Soos, 2010). The ideal situation would be to get all countries to agree on a set of rules and effective solutions to deal with waste management and recycling. Especially rules and regulations on the global trade of waste. Unfortunately, there is a lack of global environmental governance (Norichika et al., 2014).

3.3 Asymmetric information

Asymmetric information occurs when different parties in a market have unequal knowledge available. This asymmetry further results in an inefficient allocation of resources as parties have different information on a given transaction and the value of that transaction. According to popular economic theory, such market failures should be managed by public intervention (Norman & Orvedal, 2010).

Asymmetric information is a significant problem in all global markets and is often the source of inefficient markets (Norman & Orvedal, 2010). Asymmetric information makes it challenging to build strong relationships between the different actors operating in the industry (Laffont & Martimort, 2009). Moreover, makes it harder to achieve profits and challenging for companies to obtain loans and funding (Laffont & Martimort, 2009).

For undeveloped countries with weak institution, the problem becomes even more systemic and hinder flow of investments to emerging markets (de Wet, 2004). The source of the asymmetry is strengthened by weak institutional structure, corruption, low protection of creditors or contracting parties (de Wet, 2004). This asymmetry in combination with low creditor protection and high risk counterparts are some important challenges for why investors often shy investing in developing countries (de Wet, 2004; Laffont & Martimort, 2009).

3.3.1 Principal-agent-theory

The principal-agent-theory is often used to describe asymmetric information. The principal agent-theory builds on a situation when an agent (employees, leaders) is making a decision on behalf of a principal (employees, leaders). The problem arises when the goals and incentives are mis-aligned, and often because the agent has significantly more information than the principal. Moral-hazard is a theoretical term used to describe a principal-agent-problem where the agent uses the information-advantage for self-interest, and by doing so exploit the principal. In addition, the principal is unaware of it, because of a lack of information and ability to monitor. (Andersen & Idsø, 2020) (Laffont & Martimort, 2009)

To solve the principal-agent problem it is important to align the incentives of the different parties. Moreover, enable easy access to data and numbers in the industry. Also, reduce the incentives for the agent to exploit a potential information-advantage. For complex problems, the government should play a role by setting a regulatory framework to make the situation better for the investors. (Andersen & Idsø, 2020) (Laffont & Martimort, 2009)

3.4 Incentives theory

Conflicting objectives & decentralised information in a market creates a challenge of incentives (Laffont & Martimort, 2009). Not all people are well educated or aware of the consequences of certain actions, which creates different objectives. The incentives need to be aligned in order to work for collective efforts.

In order to incentivise a population for a desired behaviour, governments can either punish wrong behaviour or applaud the right behaviour (Thaler & Sunstein, 2008). Governments can punish, individuals involved in open dumping, or reward companies that recycle by distributing carbon credits. Other financial mechanisms could be initiated to mobilize the local community, for instance, provide people who separate waste at the source with cheaper health services, cheaper school fees or cheaper electricity.

To improve the situation, governments, companies and organizations can invest and engage in education. Furthermore, build a supportive environment to enable children to attend school (UNICEF, 2019). With increased awareness and education on waste management and recycling, people can understand that there is value in the products they dispose of, mainly if they are disposed of correctly. Also, to understand the challenges and risk related to their behaviour.

Another tool to incentivise for action, is to use indirect incentives. Indirect incentives are also called *nudging* and is used as a tool to achieve the desired behaviour. Nudging is an attempt of influencing people without rewards, punishments or coercion (Thaler & Sunstein, 2008). In the field of waste management, this could for instance be to decorate waste bins in happy colours to *nudge* more people to use them (Thaler & Sunstein, 2008).

I will use the theoretical concepts described above, as a framework to analyze the barriers the private sectors companies are facing. Especially, understand how fundamental economic constraints are creating challenges for the private sector companies. Nevertheless, how economic theory can be used to outline potential solutions for the pressing waste challenge in SSA.

4. Methodology

In this section, I will elaborate on the methodology used to explore the problem formulation. I will justify the choices I have applied in the research process and explain how I will analyse the empirical data.

4.1 Reseach design and methodology

The industry of waste management and recycling is a relatively new market with rapid changes and development. Worldwide, there is a lack of trustworthy, credible and accessible data on the industry. Especially in an emerging market context in SSA, there is little data on private sector companies operating in the industry. An analysis using qualitative data, based on experiences from the industry, can therefore provide in depth-knowledge and analysis on an important question in the industry. Because of the structures of the market, and the nature of the problem formulation, a qualitative research is the best possible research method to analyse the market. Yet, there are both pros and cons in using a qualitative analysis.

According to Ghauri & Grønhaug, is a qualitative method well-suited for research of an exploratory nature, especially in early-stage markets (Ghauri & Grønhaug, 2010). The overall methodological choice in this research is personal interviews, which allows going in-depth on the context SME's operates in, as well as challenges and opportunities. The qualitative data from the personal interviews will be the primary source, which allows for flexibility and adjustability during the research period. The flexibility in the process is a strength while researching in geographical areas where there may be cultural differences in terms of formalities, planning and documentation. An advantage of using qualitative data is that it allows me to choose whom I consider as best suited to help me understand the problem in order to answer my research question.

The qualitative methodological approach, with the time limits and scope of the thesis, will provide a conclusion with a lot of situational matters involved (Copi et al, 2006). One single true conclusion that applies to all parties involved in the industry will not be provided. The conclusion will rather be of significance based on the insights from the case companies (Johannessen et al., 2011). Nevertheless, the goal of this thesis is not to count and measure in

detail, moreover, to understand processes and mechanisms that eventually create barriers for the private sector companies.

My problem formulation is exploratory due to the complexity of the market and limited existing knowledge and research. Waste recycling in SSA is a limited field of study, with problems that is not well understood or clearly defined; hence an exploratory research method is advised (Saunders et al., 2016). An exploratory research design is characterized by little formal structure, and the aim is often to identify patterns and clarify a problem, and to provide a basis for further research.

A study can have an inductive and deductive approach. My analysis is primarily an inductive approach, seeking to develop patterns based on the results. The research has an inductive approach since the data is based on experiences and observations without a hypothesis or clear expectations of the output.

To answer the problem formulation, I will use the case study method. Case-studies are well suited to give deep insights in a topic and to get a better understanding of current social phenomena. Case studies is also applicable because the context of waste management and recycling is complex, and an important part of the problem to investigate (Ridder, 2017). To analyse one single company or organization, would not provide my research with the depth and width needed, I have therefore done a case study with multiple cases. Multiple cases will increase the understanding of the problem and enable comparison (Stake, 2005). Moreover, I will be able to find patterns and reliable results. Companies throughout the region meet different challenges, and a multiple case study can enable me to find cross-case similarities and differences (Ridder, 2017). The level of generalizability and representativity is limited for case studies, especially since the number of companies involved is relatively low. Further, because the operational context could vary significantly from company to company. Yet, the in-depth insights from the companies can provide a better understanding of what causes the challenges, and possible solutions.

4.2 Reseach methods

4.2.1 Data collection

The early phase and background data collection

During the reseach process, I conducted informal interviews with several actors involved in the industry. I contacted a variety of actors in the industry and spent time understanding the industry and gain knowledge into which companies or individuals I wanted to contact in the process. The background interviews with experts in the industry were a vital part of the data collection, being meetings with experts in the industry.

I contacted a broad variety of companies within the value chain, to make sure I could get as much information as possible. In addition to private companies, I contacted NGOs, awareness programs and several partnerships across the region, with the intention to better understand the context in which the private companies navigate in. The following table (table 2) describes the background data collection:

Table 2: Background data collection

Company/initiative	Name	Role	Country	Date of meeting	Skype
Empower.eco	Carl Nesset	COO		02.03.2020	Personal
Waymore	Subramanian Ramvjji	Founder		03.03.2020	Skype + live
Bergens Næringsråd	Elisabeth Skage	Project leader #plastsmart		11.03.2020	personal
Africa Long-Term finance initiative	Jose A. Albuquerque de Sousa	Professor NHH		17.03.2020	Skype
Ingeniører uten Grenser	Helene Svendsen	Project coordinator		24.03.2020	Skype
TKN consult	Tshego Nesvåg	Expert		07.12.2019	Live + skype
Kavli Holding AS	Marius Næss	CPO		19.03.2020	Skype
Plastic REVolution Foundation	Erik Solheim	Head of the foundation		02.03.2020	Live

The main data collection

The primary source of information for this research is based on interviews with stakeholders in the waste industry in Sub-Saharan Africa. The sampling of companies in the region was based on the non-probability sampling method. This sampling technique have no specific rules related to the sample size, but in every research the sample must be somewhat representative to the population. I have interviewed five companies, which together with the background interviews, was possible given the timeframe and structure of the research. The case-companies are not chosen because the five companies are representative for all companies in the region, but are chosen based on their characteristics (Saunders et al., 2016).

The non-probability sampling method was further used to choose the companies for my research, where I used judgemental sampling and self-selection sampling. Judgemental sampling enables me to use my judgement to select the companies I found most suitable for answering the problem formulation, based on several characteristics and objectives (Saunders et al., 2016). My main priority was to get in contact with private actors operating Sub-Saharan Africa. The overall goal was to interview private recycling companies in different countries in the region. The five companies were involved in similar parts of the value chain yet based on different activities with different organizations in terms of scope, scale and size. This enabled an understanding of how the challenges evolve as the companies grows. The majority of the companies were also publicly sharing their values and the importance of sustainability both socially and environmentally.

Through self-selection sampling I sent out emails to companies that met the characteristics and objectives I wanted, and asked if they were willing to meet with me (or do skype interview) to contribute to my research (Stake, 2005). I did not have any clear preference on what official role the employee was assigned as long as that person was an employee in the company with insights about the industry, challenges and the value chain. My sample is listed in table 3.

Table 3: Primary data collection

Case company	Activity	Number of employees	Country	Waste collected (estimated)
Penda Papers	Paper material recovery	150		5500-7000 tonnes per year
Coba Impact Manufacturing	Plastic manufacturing and recycling	200		5500 tonnes per year
Waste Plan	Waste management, primarily for the commerical sector	1600		120 000 tonnes per year
Jekora Ventures	Waste Management, primarily for households	300		20400 tonnes per year
RePATRN	Plastic bottle material recovery	121		10 000 tonnes per year

Since we have an exploratory problem formulation, I conducted semi-structured in-depth interviews to collect the primary data. This type of interview is "*well suited to ensure a deeper insight",* as well as to get a better understanding the informants reasoning during the interview (Johannessen et al., 2011). Semi-structured interviews are primarily based on an interview guide, but with the opportunity to open up for unplanned topics and adjustments for each company/person (Saunders et al., 2016). The interview guide is available in Appendix 1. The interview guide is divided in different categories, based on how I intended to outline the analysis. For the interviews intended as background interviews I used parts of the questions from the interview guide together with predetermined questions for NGOs, government representatives and investors. These are attached to the interview guide in appendix 1. Most questions are open-ended to ensure a better communication and dialogue.

The original plan was to conduct nearly all interviews face-to-face, but due to the outbreak of COVID-19, I had to reschedule the interviews to skype-interviews. Unfortunately, some companies were struggling with the effects of the outbreak and had to cancel the research-process with me. The respondent could decide if video or telephone was preferred, as I wanted my respondents to feel comfortable in the setting. Most of the interviews were conducted in English, but all interviews with Norwegian-speaking respondents were

conducted in Norwegian. I asked every respondent for consent to record the interview, to improve the quality of the data analysis. This enabled me to fully focus on the interview's response, rather than constantly taking notes. I did take some notes, to make sure I was active in the conversation and could follow-up on the most important or interesting aspects.

Secondary data

In addition to the primary data, I will use documentary secondary data in the analysis (Saunders et al., 2016). The documentary secondary data includes reports from the UN and the World Bank, as well as relevant newspaper articles and journals from relevant global agencies. The secondary data primarily helped me to better understand the context prior to doing the interviews. Moreover, the use of secondary data enables the research greater in-depth analysis and a broader perspective. As well as a tool to include essential information to the analysis, not mentioned by the case-companies. The case-companies webpages were used as a supplement to company-specific detailed information. The secondary data used in the analysis, has initially been analysed for a different purpose and objectives than this thesis, and because of this, I will mainly use the secondary data to add on to the primary data. It will therefore mainly be used to establish a context, build stronger knowledge and better understand the problem.(Saunders et al., 2016).

4.2.2 Data analysis

To analyse the data from the semi-structured interviews, I conducted a template analysis to thematically analyse the data. After each interview, I transcribed the information necessary for my analysis. Moreover, to see patterns in the data, I used categories and colour-codes to organize the data in different themes. I organized it on country specific information, company specific information, challenges on a macro-level, challenges on a micro level and information about other key players. The themes were primarily the same as outlined in the interview guide, which made the process easier and less time-consuming. The template analysis made it easier to see patterns, relationships and extract meaningful information (Saunders et al., 2016). Aguinis et al. (2013) argues that for qualitative data, some of the data collected will be of more importance. Moreover that some informants might provide the research with more applicable and relevant information or better describe or illustrate certain problems. (Aguinis et al., 2013).

4.2.3 Evaluation of the reseach

To ensure the research has been conducted in a trustworthy and serious manner I will evaluate the quality of the research, by analysing its validity and reliability.

Validity

The validity of a research depends on how well I have managed to understand and communicate the actual motives and perspectives of the respondent (Saunders et al., 2016).

The internal validity strengthens if the sample selected represents the reality, as well as if the methodological choices are selected to strengthen the credibility. In this thesis, semi-structured interviews have been used to understand personalities and cultural differences, as well as enabling the ability for situational changes throughout the process. To ensure that I was well prepared and would have the overall understanding of the context in which the company operates in, I developed a comprehensive interview guide and did a lot of research prior to the interview. Through my interview guide I had prepared a variety of questions and topics to get the respondents perspectives from different angles, this aligns with Saunders et al.'s perceptions of how to get high validity in semi-structured interviews (2015). The industry in which these companies operates in is complex, with a variety of abbreviations, different types of waste, various types of recycling and several standards in different countries. Accordingly, I posed a number of questions for clarification, to make sure I understood the respondent correctly.

The external validity strengthens if the results can be generalized and replicated (Saunders et al., 2016). Case-studies are normally not intended for generalization and one can argue that a sample of five companies is too little to understand all mechanisms and challenges in an industry in the SSA region. However, with a larger amount of companies, I would not have time to get in-depth understanding. The ability to get in-depth understanding from several case companies, builds a fundament for further analysis and replication of the findings to other situation. Especially since all methodological choices are described and the interview guide is accessible for all.

Limitations that could have affected the validity is the sampling method, based on my judgements in an early phase of the study – there is always a risk that other companies were more suitable for the thesis. However, the comprehensive background research, especially conversations with experts involved in the industry, strengthens the validity of the research.

In order to get better comparison on the case companies, it would be beneficial if the companies were more similar. Nevertheless, the diverse set of companies enables better in-depth knowledge on the complexity in the industry.

Reliability

By analysing the reliability, I wish to understand if I would have obtained the same result if the research was replicated, with a different sample. Generally, in qualitative research, the reliability is low because the results depend on the respondent's experiences and level of knowledge at the time the research was being done. Moreover, are semi-structured interviews flexible and adjustable in its form, which makes it harder to replicate.

The barriers for private waste management companies will change over time, which means that a similar research in ten years would naturally provide new findings. In this thesis, I was also looking into the overall structural barriers that are constantly affecting all businesses in the region over a longer time period. In addition, I have interviewed a variety of different players in several countries with different business models and in various parts of the value chain. This argues for slightly higher reliability than regular qualitative research, because of the broader perspective. Despite this, the overall aim of qualitative research is to get at better overall understanding of an actual problem, not to conduct research that is suitable for replication.

It is interesting to look further into characteristics to the research which might have affected the research results. Any mistakes or biases made by me during the interviews could have affected the responses and the way in which the conversation developed. Some of the interviews were done with the web camera on, while some without. This could unintentionally affect my bias towards the individual. Selection-bias prior to choosing the companies to interview is an important aspect of the methodological decisions of the thesis. The companies I interviewed, might not be a representative part of the actual population, and all companies or players in the industry might therefore not recognize with the findings.

There could also be biases or mistakes made intentionally or non-intentionally by the respondents. This is clearly a limitation in my research because the name of the companies is visible for all readers, it is in the best intention that the companies are viewed from their best side. They have little or no incentives to tell me about the real internal challenges of the companies. On the other hand, there all overall structural challenges that would be beneficial

to improve for all parts of the value chain. Most of these companies were more than happy to take part of the research, and I did not feel that the respondents held back information - rather they opened and shared willingly details of their company, processes and challenges. My hope is that the good, creative parts of these companies can be visible for investors wanting to learn more about this industry by reading this research.

4.2.4 Ethical concerns

There are ethical concerns related to doing personal interviews and sharing company-specific information. Prior to doing my research, I registered the projects at the Norwegian Centre for Research Data (NSD) and informed about the study and described how ethical concerns was being considered in the process. Furthermore, I asked in the first email to the companies if the companies were at all interested in participating and if I could use their company name in the thesis. I asked all companies for permission to record prior to starting the recording.

I avoided asking sensitive questions, and when I got sensitive information, I asked if that was information I could share or not. All personal data and transcripts will be deleted after the thesis has been completed. I did my best to be objective and focused during the entire process as I was the only researcher for the project without the opportunity to discuss and align interpretations.

5. Overall country & company information based on case interviews

In the following chapter, I will present the findings based on interviews with several private sector companies operating within waste management and recycling in SSA. Moreover, include insight from background interviews and relevant contextual literature. I will use the information outlined in this chapter to analyse the problem formulation and present the most critical barriers to private sector involvement in SSA in the next chapter.

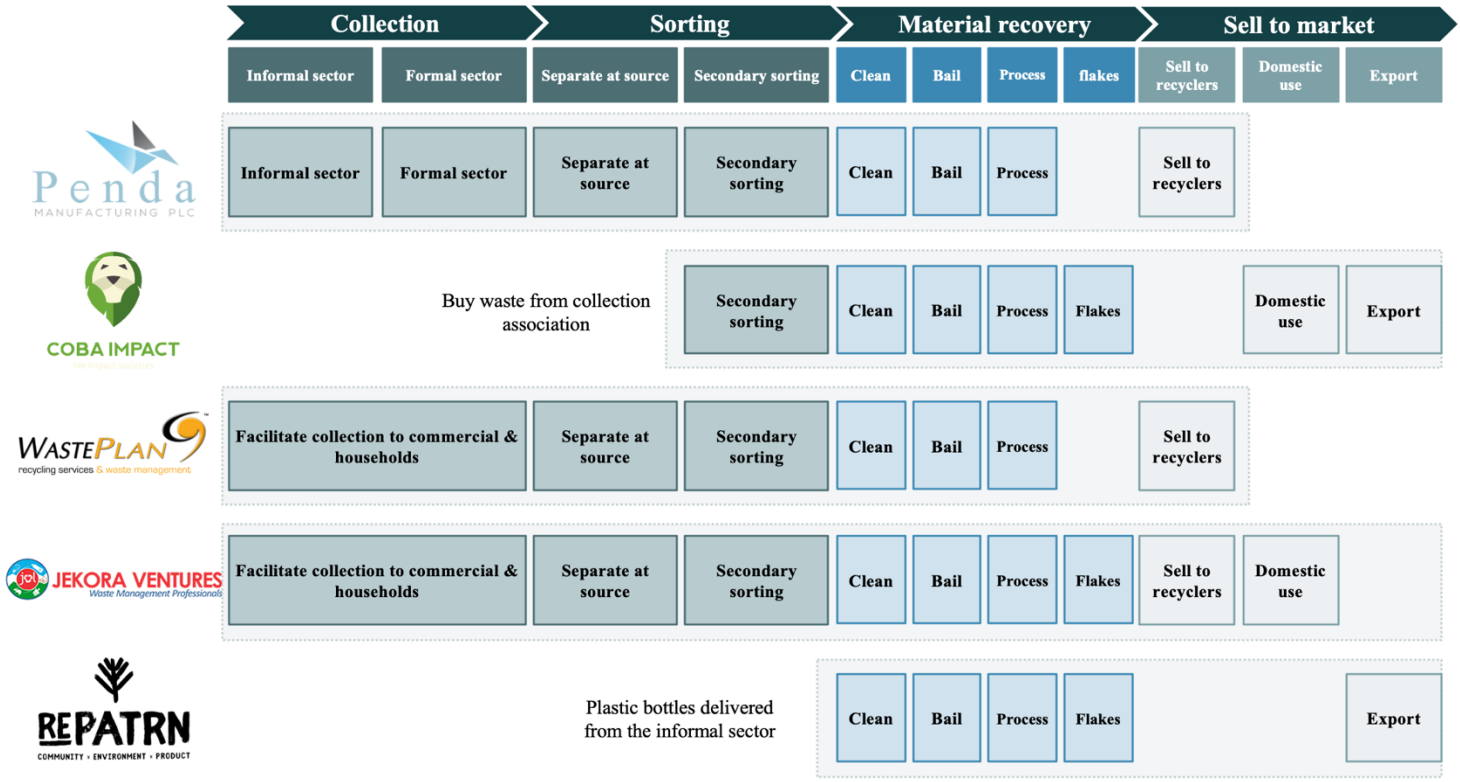
I will start by introducing country-specific information before introducing the companies in each country. The country introduction will provide a basic understanding of the context the companies are operating in, based on information from the in depth-interviews. Table 4 summarise general information about the companies of analysis.

Table 4: Company-specific information

Case company	Activity	Number of employees	Country	Waste collected (estimated)
Penda Papers	Paper material recovery	150		5500-7000 tonnes per year
Coba Impact Manufacturing	Plastic manufacturing and recycling	200		5500 tonnes per year
Waste Plan	Waste management, primarily for the commerical sector	1600		120 000 tonnes per year
Jekora Ventures	Waste Management, primarily for households	300		20400 tonnes per year
RePATRN	Plastic bottle material recovery	121		10 000 tonnes per year

Based on the overall findings, I have developed figure 9, which shows my interpretation of the value chain and where the companies are situated in the value chain. As each company are introduced, a simplification of the table will be visible to better follow the complexity of the industry.

Figure 9: The case companies in the value chain (for illustrative purposes)



5.1 Ghana

Country-specific information*(World Bank Data)*

- Capital: Accra
- Current size of population: 31 million
- Population growth: 2,2%
- GDP/capita: $ 772,3 (2018)
- Economic growth: Second-fastest growing African economy. 6,1% growth (2019)

5.1.1 State of waste

Ghana has had significant challenges related to inadequate waste management over time. Waste disposed of in nature, on the beaches and at landfills is a common sight throughout the country. Inadequate waste management in Ghana is already having a severe impact on public health, fisheries and aquaculture, tourism and pollution levels (Ashbullby et al., 2013; Golden et al., 2016). For instance, in 2017 the capital Accra had an accident with more than 150 people killed due to a flood caused by clocked drains from waste (UNEP, 2018).

About 50% of all waste in Ghana is collected in landfills, and the other half is disposed of in nature (Plastic REVolution). The collection rate across the country varies drastically, the city Wa in Ghana has a collection rate of 28%, while the capital Accra has a collection rate of 80% (UNEP, 2018). In Accra, there are some collection services in the richer communities, and for parts of the commercial sector. In the less developed communities, there are no or limited collection services available. The rural areas in Ghana, is usually not a part of the limited waste statistics, but there are typically larger households; hence more waste is generated per household (UNEP, 2018). Yet, the largest cities in Ghana have received the most attention.

Overall, there is a lack of developed infrastructure and appropriate management options in Ghana (Jekora) Yet, there are about 15 companies operating to collect waste throughout Ghana (Jekora). Ghana is divided into different operational areas, where different waste management companies are assigned an area to operate by the government. There is a competitive bid and contracts are given out in 5-year contracts and the size of the area depends on the needed logistics. There is a market for recycling in Ghana, and Ghana

imports pellets to produce PET bottles locally. Ghana exports waste to get it recycled in Europe and repurchase it to have it in production (RePATRN).

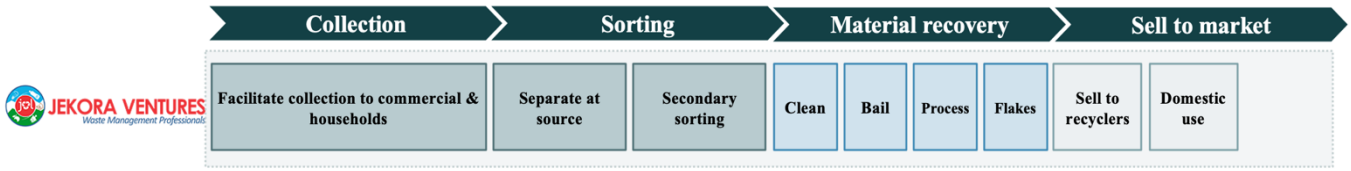
5.1.2 Political involvement in waste

Ghana is considered a stable democracy in the region. Nevertheless, they are struggling with two competing political blocks, with a different regional anchor. Furthermore, there are huge inequalities within the country (Plastic REVolution). Despite the challenges, in the recent years the government of Ghana has put the waste challenge, and especially the plastic challenge on the agenda. Ghana is the first African country to join the Global Plastic Action Partnership (GPAP), aiming to "*eradicate plastic and waste pollution worldwide*". Followed by this, Ghana formed NPAP: The Ghana National Plastic Action Partnership and created a fee on plastic (UNEP, 2018). After signing the agreement for GPAP, the president of Ghana announced the following: "*Through every sector and level, from local government to waste management pioneers and young student leaders, Ghanaians are actively contributing to the fight against plastic pollution*" (Cann, 2019).

Despite the public statements and policies, there is still a lack of political will and policies to govern the industry (Jekora). Several policies exist in isolation in Ghana, but the main issue is on the enforcement (Jekora). Annan from Jekora emphasises that about every year, there are new policies created, but they are not being implemented or enforced. The policies, fees and taxes on waste and plastic, are meant to finance initiatives to remove plastic from the environment. In reality, some argue that it has been another income to the financial department with no transparency on the actual spending of it (Plastic REVolution) There is currently only one company, Zoomlion, that gets support from the government. (Jekora)

5.1.3 Findings from case companies in Ghana

Jekora Ventures



Jekora Ventures is a waste management company with 300 employees operating in Accra. In 2019, Jekora became a top company on municipality assessment for waste management. The company is assigned to an area from the government which they have to collect household and industrial waste from. Jekora has cars, waste trucks and motorbikes to handle the solid waste collection and disposal. The company facilitate collection of all waste types, food waste, plastic, paper, glass and textiles. They collect about 20400 tonnes of waste in a year, and 6% of that is recyclables due to lack of separation at source. After the collection is done, they send what is recycled to a recycling centre, and the rest is sent to landfill. Jekora does a first stage process of recycling: collect, clean and bail. Prior to selling it to recyclers.

The overall company goal is to approach waste management in an integrated and sustainable way. They want to provide an integrated approach, using local appropriate technology and innovation. Jekora is especially focused on the environmental, social and public health aspects of waste management, which they argue differs them from the conventional approach in Ghana. For the social aspect, Jekora periodically runs educational programs to increase awareness and education on waste and threats and benefits of action. They educate people on how to separate at source, besides running educational series on TV for school children in local languages.

Their funding is internally generated, with no external support. The company does not obtain any support from the government, and their financial model is based on the polluter-pays-principle. Which means that the customers must pay for the waste they generate. Because the citizen's ability to pay is low, Jekora is offering monthly bills and weekly bills to be more customer friendly. By selling the recyclables to recyclers (paper and plastic), they do get a second revenue generation model, besides the money they get from households. This puts pressure for such companies to continue operating in the market.

(Annan M, Interview with Jekora Ventures, 31.03.2020).

rePATRN

RePATRN is a plastic processing company started by Jefferey Provencal. Mr. Provencal is a Swiss citizen with Ghanaian parents, which made him aware of the enormous differences between how waste was handled in Switzerland and Ghana. In Switzerland, there was a market and an industry for waste, while in Ghana, waste was generally not collected. Mr. Provencal decided he wanted to bridge the gap and show that there was value in the material: "*One person's trash is another person's treasure”.*

RePARTN uses the informal sector to collect bottles, they are separated at source, and the colour separated bottles are delivered in RePATRN 's facility. At RePATRN 's facility, they remove labels and caps, bail the bottles to big blocks, shed them to flakes, pack them and ship them to Europe and the US. The actual recycling happens in Europe or the US. The export prices are reasonably stable, and the exact contracts depend on the customer engagement and negotiation agreement. The company has a goal of eventually perform the full recycling process in Ghana, which will therefore create jobs and much needed value.

The company collects about 10200 tonnes of PET plastic in a year. The company is funded by German investors and is, at this point, financially sustainable. Which means they are currently able to meet the stakeholder’s expectations and desired output. They have 121 employees who work with the processing. Their suppliers for the waste are shared on among 125 contracts, individuals and companies.

The company’s central values are "*community, environment and product*" (rePATRN, 2020) RePATRN have a partnership with Environment 360, an NGO doing educational programs with the informal sector and collecting bottles in the process. They are raising awareness and contributing to community engagement. Environment 360 sell their bottles to rePATRN and use their funds for children education in Ghana. (rePATRN, 2020)

(Provencal J, Interview with RePATRN, 01.04.2020)

5.2 Ethiopia

Country-specific information *(World Bank Data)*

- Capital: Addis Ababa
- Current size of population: 109,2 million
- Population growth: 2,5%
- GDP/capita: $ 2202,3 (2018)
- Economic growth: Fastest growing economy in SSA, 9.0% growth (2019).

5.2.1 State of waste

The Ethiopian population is the fastest growing economy in Sub-Saharan Africa. Furthermore, is the population rapidly entering the middle class and coming out of poverty. As such, the overall demand for waste objects such as plastic bottles and soft drinks is growing with about 10% every year. Water bottle producers and soft drink producers are emerging out of Ethiopia regularly. (Coba)

About a decade ago, there was little private sector involvement in the waste management and recycling industry in Ethiopia. Back then, the concept of recycling did not exist in Ethiopia, and all the waste that was collected went to landfills. Today there are about 7-8 recyclers in Addis, and according to Coba they collectively buy more than 80 000kg a day from collectors. This means that a large number of recyclables has been salvaged from landfills over the years (Coba). Without the private companies in Ethiopia, recycling would not exist (Coba).

Addis Ababa is organized in different associations by suburbs, and the collection is done through collection associations. A cluster of suburbs is assigned by the government and dedicated to each recycler. If the association sell their waste to their assigned recycler, they will get a small subsidy from the government. If the association sell their waste to another company or recycler than their assigned, they will not get the subsidy from the government. The system is designed to work as described above, but according to Coba it does not always work out in practice (Coba). Many players do not respect the way Addis Ababa is organised through associations, and there are, for instance, Chinese recyclers that enter certain areas

and pay more for the waste than what the contracts outline. This gives incentives for private deals.

The recycling model which has been applied in South Africa, PETCO, is about to be introduced in Addis Ababa. Coba emphasizes that PETCO will hopefully improve the value chain of the collection service with more control and efficiency. It can also bring about better organizing, financing and guiding for associations to secure the collection for private companies.

The informal sector is vital to collecting waste and diverting it from landfills throughout Ethiopia. The overall health-related risks of uncontrolled landfills received increased attention after 115 people were killed in a waste landslide at the Kashe Landfill in Addis. The majority of the victims were women and children. (Maasho, 2017).

5.2.2 Political involvement in waste

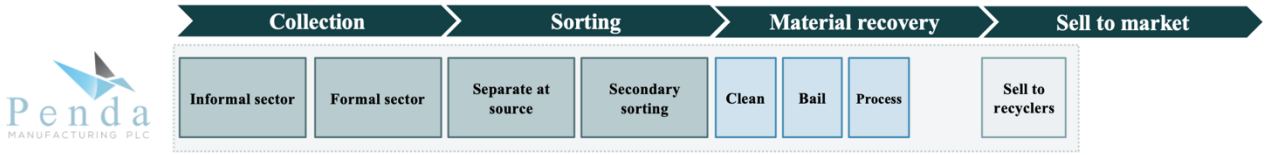
Waste management is a rising concern in Ethiopia with increased waste streams. Innovations are taking place in the private sector, especially in the urban areas, alongside a stronger commitment from the government. According to the UN, Ethiopia is a regional leader in working towards waste management (UNEP News, 2019). The country is aiming to become a green middle-income country by 2025 (Penda Papers). Ethiopia has a national ban on "*production and importation of non-biodegradable plastic bags <30u*" (UNEP, 2018). The capital Addis Ababa have invested in a waste-to-energy plant, which is expected to supply ¼th of the electricity demand in the capital (UNEP, 2018). Despite several policies and future goals, the strategies and plans are poorly coordinated, and the popular support is weak.

Ethiopia is one of the African countries with the strongest growth rate, but there are considerable political challenges (Plastic REVolution). Ethiopia has been negatively impacted by decades of devastating welfare with its neighbouring countries, internal tension and strict state government controls. It is now a fast-growing country, but from a very low base. There are also still strict governmental restrictions on the Ethiopian economy limiting the ability of private sector companies to secure real estate, get the licenses to operate and to trade internationally. Currently the limited access to foreign exchange is a particular important challenge. The currency market is highly regulated. Access to USD is rationed which limits imports and the ability to pay overseas suppliers. Companies in the waste

management business struggle to generate foreign currency to buy machinery and equipment abroad (Coba). Ethiopia is also a land-locked country which means that the transportation cost on imports is higher than most other African Countries (Penda Papers)(Coba).

5.2.3 Findings from case companies in Ethiopia

Penda Papers



Penda Papers is a paper recycling company founded in 2015 with an overall goal to create a circular economy for paper and create new jobs. The company have partnered with the government in a public-private partnership and are aiming for success along three dimensions - financially, environmentally and socially. Overall, Penda has about 150 employees and the majority work with the collection. Collectively, Penda collects and process about 5500-7000 tonnes of paper waste per year.

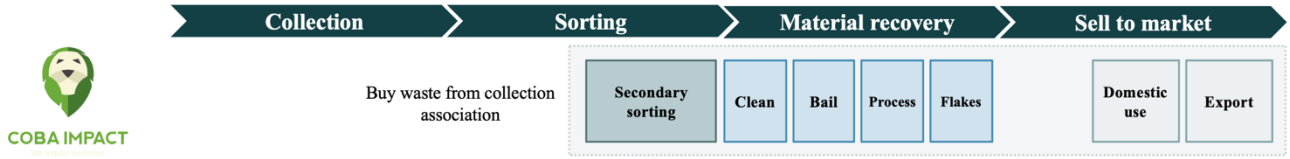
Before Penda's establishment, there was no market for paper in Ethiopia. Paper was at that time imported for production, despite the fact that large volumes of wastepaper were sent to landfills. Today, Penda provides waste collection services for paper through Addis Ababa. They are collecting paper from three different sources, 1) directly from the commercial sector by means of trucks and compactors, 2) through government waste collectors and micro-enterprises and 3) through drop-off stations where individuals earn 2 birrs (0.058$) /kg to drop-off paper. (Penda Papers, 2020). After being collected, the paper gets transported to sorting facilities. On Penda's facilities, the paper is sorted, bailed and processed before it is sold to recycling facilities. The company is also planning to install small-scale on-site recycling units.

Penda Papers focuses on creating an impact along the way and employ underprivileged women and unemployed youth. Further, Penda has partnered with the International Organization for Migration to employ returning migrant women with no or little resources. In addition, the company have partnered with an organization which employs survivors of gender-based violence (AWSAD), for recruitment. To increase the overall awareness of

waste challenges in Ethiopia, they are also running education programs for schools on the benefits of recycling.

(Nielsen. M, Guthe. N, Riiber Knudsen T, Interview Penda Papers, 03.02.2020).

Coba Impact Manufacturing



Mr. Amara and Mr.Makris started Coba impact manufacturing in 2011. The two friends had grown up in Ethiopia, and both had prior experience from the plastic industry. Mr. Makris had been working in the industry in Europe, and Mr. Amara had intimate knowledge of the local plastic market in Ethiopia from his family business, Unicent, which is supplying the local beverage industry with plastic crates.

Coba impact manufacturing is manufacturing recycled plastics to the packaging industry and supplying recycled preforms and closures (bottle caps) to producers of plastic containers. Coba Impact Manufacturing is closely linked to the collection associations in Addis Ababa. Coba operate trucks that collects the waste at the collection associations in Addis which are transported to Cobas collection centres. Coba does sorting, crashing and washing of the plastic bottles before creating flakes. The flakes, which are grounded small parts of plastic, are used as inputs in the local plastic production or sold to the international market. The price of flakes is determined by the international commodity market, affected by the user demand and the product.

Working with multinationals requires a set of standards and certifications. The multinationals must further approve the production facilities and the recycling companies must be certified. Coba has obtained an ISO 2200 certification, and it is the only company in the industry in Ethiopia which has obtained this certification. The company is funded by the owners and are currently operating with revenues at about 11-12 million USD per year. There are 200 employees and they collect and process about 5475 tonnes per year.

If the South African model for recycling, the PETCO-model, is introduced in Ethiopia it will enable Coba to skip the process of segregation and sorting of the plastic, but rather get exactly the material they need, and they may focus on the processing (Coba). The structural

changes can enable them to make the process more productive and rather spend time to increase the value of the process, such as pelletizing or make new bottles.

Coba is looking into a joint venture with Unicent, which are the leaders in the bottle crates manufacturing business in Ethiopia. By doing so, they become the largest group in Ethiopia, in plastic manufacturing and recycling. The joint venture will make them a cash stronger company and more competitive. Their competitiveness can increase because Unicent is a profitable company with large resources. While Coba can contribute to the joint venture with foreign exchange export generating USD which again can be used in the business to buy raw materials and machinery.

The funders goals are to be leaders in the plastic industry and getting there in a sustainable and environmentally way. The company are working to increase its recycling business. Considering the dynamics of the market, this is a good business opportunity. It was further argued that this is because it does not require any foreign exchange since the raw material can be bought locally, and the international demand is high. Currently, Coba has been involved in educational training for the collection associations. They are additionally involved in a women empowerment program in collaboration with Coca Cola to employ more women.

(Amara. G & Makris. C, Interview Coba Impact Manufacturing, 24.03. 2020)

5.3 South Africa

Country-specific information *(World Bank Data)*

- Capital: Cape Town, Pretoria, Bloemfontein
- Current size of population: 57,78 million
- Population growth: 1,4%
- GDP/capita: 6374 (2018)
- Economic growth: Poor economic growth. Stagnant growth in the recent years. 0,2 % in 2019

5.3.1 State of waste

There is overall a lot more research and data available on waste management, recycling and waste composition in South Africa than any other country across the SSA region. South Africa is the most developed economy in the region and has the most developed/only developed waste management and recycling system in SSA.

About 61% of South African households have the possibility of a waste collection service of some kind. In South Africa, it is estimated that the informal sector collects and recovers about 80-90% of consumer paper and package waste (Godfrey & et al., 2019). Calculations show that when the informal sector recover waste from landfills in SA, they get more space on the landfill, which saves governments and municipalities $ 20-50 million each year. (UNEP, 2018).

South Africa has a waste management municipality act, which requires municipalities to provide sanitation (with waste as a part of it) and other essentials services for the domestic sector. The municipalities facilitate the service but will contract out as much as they want, typically what they are unable to provide. They sub-contract out in three-year contracts to the private sector. There are no such services for the commercial sector, which means that the commercial sector in South Africa depends on private sector companies operating with waste management and recycling. (Waste Plan).

Compare to the rest of the region South Africa has a well-developed recycling market. The country has a relatively strong end-use market is, and there is a demand for recyclate. (UNEP, Africa). The South African company Extrupet is the most advanced recycling

company throughout Africa, and the only company successfully doing bottle-to-bottle recycling (Extrupet, 2020).

Despite the fact that the market is well developed in South Africa, the recycling and waste industry is regarded as a tough market and business environment to be in for private companies (Waste plan). Waste Plan describes an unstable recycling market both locally and internationally, which certainly also applies to the South African market.

5.3.2 Political involvement in waste

South Africa has a well-developed infrastructure, compared to the region. Nevertheless, systems are incomplete and far from equal and accessible to all. The country is struggling with huge inequalities along several dimensions. Moreover, the South African economy is a 0-growth economy (Waste Plan). The South African ran has devaluated significantly, and as such imported machinery and equipment has become relatively more expensive.

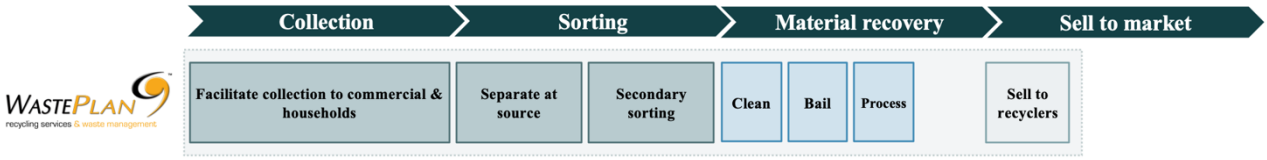
South Africa have implemented several policies and regulations for better waste management and more recycling. The country has implemented a" *national ban on thicker plastic bags <30u, and levy on the retailer for thicker ones".* (UNEP, 2018). Despite the implementation of policies and increased awareness of sustainability, the country did not meet its National Waste Management Strategy for 2016. The country's inability to meet their targets implies that the regulations and legislations have not resulted in the needed actions. (UNEP, 2018).

In 2019 the South African government changed the national minimum wage in the country, to 20 South African rand an hour, which is about $1,17**.** A higher minimum wage can enable more workers better living conditions, but it will also lead to higher overall costs for the employers in South Africa. (Waste Plan)

The cost of energy is a challenge in South Africa. The South African Rand continues to devalue, which affects the fuel price. Higher fuel price increases the cost of transportation, which affect recycling and waste companies since they require a lot of logistics and transportation to run their businesses. (Waste Plan)

5.3.3 Findings from the case company in South Africa

Waste plan



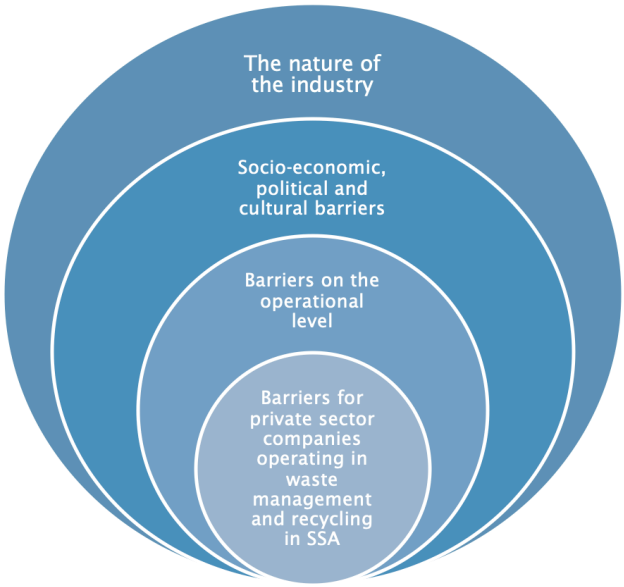
Waste plan was started in 2004, based on an overall goal "*to give hope for a better future*". The company wanted to see the opportunity to create value and employment from waste that would otherwise be dumped. The company has 1600 permanent employees and covering the recycling sector with a market share of about 30-35%. The company is in the first lane of recycling which means they collect recyclables from their customers, separates the waste into grades and sell it to the market. Waste plan focuses primarily (80%) on the commercial and private sector in selected areas in South Africa. They collect waste for health care providers, universities, hospitality, food/beverage industry and more. 20% of their activity is based on a subcontract with the government to handle domestic waste in the Western Cape region of South Africa. The company is privately funded and operating at a financially sustainable level.

The company's core values are respect, integrity, humility, family and fairness (WastePlan, 2020). Together they are working towards a goal of "*Zero waste to landfill*", and by collecting about 120 000 tonnes of waste annually, they are saving about 62 000 tonnes from landfills every year. They are currently not involved in upcycling, adding more value the end-product, but are looking into projects for smaller pyrolysis plants, increased composting and more focus on organic waste. Hence, involving in a larger part of the value chain. (Pientaar. M, Interview Waste plan, 16.03. 2020).

Based on the findings above, I have outlined the context in which the private sector case-companies are operating in. Company specific information is also important to compare and find patterns on an operational level. The value chain they operate in is complex, and there are a variety of processes and details that are not described above. However, the information given above is sufficient to understand the case-companies main activities, and how the situation is evolving in the different countries. To continue, I will use the contextual findings and information as a basis for further analysis of the main barriers the private sector companies are facing in the industry in SSA.

6. Analysis

Figure 10: Barriers for private sector companies operating in waste management and recycling in SSA



Globally, regionally and locally there are challenges to build, maintain and finance waste management systems. The private sector companies operating in waste management and recycling in SSA, are meeting a significant amount of challenges. In figure 10 I have outlined how I will continue to understand the barriers the private sector companies face. Moreover, how I will structure the analysis. The companies are primarily affected by the nature of the industry, and the socio-economic, political and cultural barriers. The challenges are mainly structural challenges in which the private companies have limited ability to impact. In order to understand the barriers the companies are facing, I will start to analyse the fundamental socio-economic, political and cultural barriers affecting the private sector companies. In addition, how relevant players can change the business environment in the right direction. Based on the overall picture, I will eventually provide in-depth knowledge into the challenges the companies meet in daily business operations and discuss if there are challenges the companies have prerequisite to impact.

Only a few years back in time, plastic pollution and inadequate waste management was a political question with little attention and focus. In recent years, the issue has received increased recognition at an enormous speed. Indeed, the attention to the pressing waste is here to stay; the question is about the solution (Plastic REVolution).

There are numerous actors involved in waste management and recycling in Sub-Saharan Africa. In developed countries, waste can be described as an "*Out of sight, out of mind*" issue. The waste is not out of sight in SSA, hence not out of mind. Creative entrepreneurs across the region are creating innovative ideas to solve parts of the challenges that are so visible. Over the past decade, innovations based on different motives, technologies and

concepts have emerged across the continent (Godfrey et al., 2019). Private companies are getting more attention worldwide and are headlining on newspapers with creative solutions to reuse the waste in creative manners. Shisalanga uses plastic milk bottles to build roads in South Africa (Reynolds, 2019). Sanivation creates sustainable fuel from human poo in Kenya (Sanivation, 2020). In Côte d'Ivoire Unicef have built a plastic brick factory to build schools from recycled plastic (UNICEF, 2020). T3 trash in Kenya is creating textiles from waste. Nelplast in Ghana is creating building blocks from waste. In Nigeria, a school let parents pay for their children's tuition with plastic waste (Ojekunle & Moynihan, 2019).

Despite all the talk politically, on international meetings and in the news, there is still a lot more waste being unmanaged (Plastic REVolution). With the rising involvement of the private sector, how come the challenges are still larger than ever?

6.1 Analysis of the socio-economic, political and cultural barriers in the industry

"*By the end of the century, 83% of the world population will be concentrated in Asia and Africa alone. Finding solutions for the handling of waste, therefore, becomes a fast-growing and urgent matter"* (Provencal J, Interview with RePATRN, 01.04.2020). In order to find solutions, it is vital to understand what barriers one must overcome in order to succeed. In the following part I will analyse the socio-economic, political and cultural factors that affect the private sector companies operating with waste management and recycling in SSA.

6.1.1 Government involvement

The political framework and the regulatory constraints of each sub-Saharan country affects the private sector companies operating in the industry. Waste management is a part of the essential infrastructure in building a society, which should, in theory, be handled by the government. Norman & Orvedal (2010) argued that governments should play a role in adjusting for the market failure caused by positive and negative externalities. Kolstad (2011) further argued that governments play an important role of internalizing externalities. Governments play a vital role in incentivising the population and businesses to internalize the negative externalities they contribute to by calculating waste management as a part of the product or activity they do.

If there are other players than the government involved in building the essential infrastructure, it should therefore, be supported by or in collaboration with the government (Penda Papers). Despite nearly no governmental support in the industry, the private sector companies rely on government partnerships and positive collaboration with governments. (Penda Papers). Yet, Riiber Knudsen from Penda Papers argued that it is hard to collaborate with the government when possible political turmoil creates uncertainty (Penda Papers).

There is little transparency on government support to the private sector companies operating with waste management and recycling in SSA. Waste plan argues that the government comes up with all sorts of grants, and share them publicly, but rarely see them come through (Waste Plan). In Ghana, Annan from Jekora also argues that there is lack of transparency on which companies that do get support and not. In addition to a few explanations on why certain companies do get support from the government. Little transparency and the risk of corruption makes the process frustrating for several companies. The lack of transparency on a governmental level, increases the level of asymmetric information in the market (Norman & Orvedal, 2010). Especially since the involved parties are not fully informed on the effect and targets for the public intervention.

Norman & Orvedals (2010) state that public intervention is needed to deal with market failures, especially in an emerging market context. Both to internalize externalities and increase the level of asymmetry in the market, requires public intervention. Funding is urgently needed, and government funding for waste management has been an important part of implementing waste systems in developed countries. However, the needed intervention is not only funding and economic support. With limited financial resources the government can focus more on building a better working business environment. It is hard for private sector companies to operate without supportive working conditions on a national level. The government therefore play an important role in building a predictive business environment.

Lack of trust in the state and the feeling that people do not get anything back from the state is a big issue in most African countries. Lack of trust drives a vicious circle, where people are not interested in paying taxes, and the state has little financial resources to use for development (Plastic REVolution). Riiber Knudsen from Penda Papers argued that the corruption in Ethiopia is a challenge, especially for foreign companies, because the corruption often benefits the local companies. This can, according to theory on asymmetric information, further refrain investments and refrain valuable innovation from foreign

countries (de Wet, 2004; Laffont & Martimort, 2009). This is the opposite of what the local governments should seek for.

In theory Soos (2010) argued that there are a lot of options to internalise externalities for the waste management and recycling industry. However, it is a challenge for governments to find the best policies because it is challenging to understand the actual complexity of the industry. The industry of waste management and recycling is a logistical challenge because different types of waste need to be processed differently. Especially for plastics, the technical complexity is even a challenge for people working with it (RePATRN). Further, it is a challenge for governments to stay informed about the rapid development and understand the pressing challenges.

It is also a challenge to ensure the policies have the wanted effect. Unfortunately, there are development concerns related to implementing strong policies and regulations in the region. Ramvjji from Waymore emphasised that when governments introduce plastic bans; there is a possibility that it will have a reverse effect on a macroeconomic level. By banning certain products, markets can be eliminated or create fewer jobs. Unintended consequences of policies pose a challenge for policies worldwide. Nevertheless, in SSA, there are fewer jobs available, and the debate between environmental goods and providing livelihoods might not necessarily be a popular political decision (Waymore). Regulations from governments often have a negative impact for foreign companies, which again is not the wanted effect (Penda Papers).

Because inadequate waste management is a global externality, it does require involvement on a global level (Nordhaus, 2015). Until now, the global community have not succeeded in collective efforts for global waste reduction efforts. Moreover, as Norichika et al. (2014) emphasises global mechanisms to internalize externalities is challenging because there is a lack of global environmental governance. However, there are collective efforts with partnerships and organizations in regions and in collaboration between smaller groups of countries. It is further not unlikely that regulations on a sub-national level can be of importance, because the waste composition and consumption patterns vary.

The governments in the region are facing significant challenges related to the waste management. Moreover, there are several contextual and situational challenges for how to build the best policies to solve the challenges. Specially to create policies that enables

effective solutions with few financial resources and challenges with corruption. It can also be challenging to get the popular opinion on implementing policies when the public behaviour and level of knowledge in the population is not aligned. This will be discussed in the following part of the analysis.

6.1.2 Public behaviour and incentives

There are overall challenges with public awareness, behaviour and misaligned incentives in the waste management and recycling industry in SSA. The general population, the users, are an important part of the market for waste management and recycling. Närvänen et al. (2020) outlines that changing the behaviour is one of the most important perspectives to solve wicked problems (Närvänen et al., 2020). Annan from Jekora emphasised that the mentality of the citizens is not aligned with the idea of waste management; hence, there is an urgent need for education (Jekora).

Public awareness on waste management

Overall, there is a challenge with open dumping and lack of household collection. In SSA there are many people who throw waste out on the streets or in nature, even if there are available bins. However, it is duly noted that in the peri-urban areas the access to bins can be challenging and citizens therefore have little or no alternative to dispose their waste. Open dumping is also due to a lack of public awareness on the potential issues and challenges related to it. In the more developed parts of the world, there have been long-standing public education programmes, and throughout several generations, the majority of people have been thought to take care of their waste in a somewhat responsible manner. Throughout SSA there has generally been little, or no such public education, primarily because the issues have arisen in a short time perspective, with challenges rapidly rising.

In many Sub-Saharan countries, it becomes a challenge to prioritize waste compared to other essential services such as food or basic health. Ramvjji from Waymore emphasised that "*When you don't have food, why would you care about the environment*". Because inadequate waste management affects the public health and the environment, it can affect basic needs such as food or clean drinking water. One of the characteristics of a wicked problem is the interconnected nature of the problem with other problems (Rittel & Webber, 1973). When the majority of people are unaware of the consequences of unmanaged waste, it makes more sense to prioritise other important challenges.

Svendsen from Engineers without borders argued that: "*It is a human thing that you want your close surroundings to be clean. Local politicians, governments and individuals can see the health and environmental damages of waste. It is not that they do not see the problem, but there are prioritizations that need to be done"* (Ramvjji, S. Interview Waymore, 03.03.2020). The local governments must prioritize with little funding and must spend their efforts on the most urgent concerns (Ingeniører uten Grenser). Inadequate waste management will eventually cause significantly greater damages than today, which one can argue might force people and governments into action.

The overall willingness to pay for collection services are low because there are other urgently essential problems to address. Jekora Ventures are given an exclusive area to collect waste, from the government in Ghana. However, many people sign up for the service, receive the services, but do not pay. Annan further emphasises that they "*can't just stop collecting and are obligated to continue*" because it is for the common good of the country that they collect waste (Annan M, Interview with Jekora Ventures, 31.03.2020). However, when people do not pay, the companies generate little income. The overhead costs, such as for instance service on trucks, are therefore hard to cover (Jekora). This creates a dilemma for the company on doing what is good for the environment or keeping their overhead costs liveable.

In many developed countries, the government pay subsidies or direct funding to companies contributing positively to the environment, especially when they are assigned a specific area to collect. In SSA, it becomes challenging when the government are not compensating the private companies for collecting household waste. There are few incentives to contribute to the negative externalities of inadequate waste management. Moreover, the fiscal budget is so limited and thus the priority for waste management companies is ranked very low in SSA.

To enable household and businesses to do separation at source in SSA, it requires education on why, how and what to do. Provencal from RePATRN argued that "*If you get people to separate their waste, and not throw everything in one trash can, there is already an added much value*" (Provencal J, Interview with Repartn, 01.04.2020). However, if there are no existing methods to address the waste, then there are few incentives to separate. An important reason why there is a lack of collection of waste and waste management is because there is a lack of affordable and well-established solutions. Provencal further emphasizes that the systems and the capacities have to be in place to take in the separated waste.

Separation of waste can make the process of waste management easier and more efficient. Separating at source or a secondary sorting facility is therefore essential going forward. There is about 1 million youth joining the workforce in Africa every month. About 20% of them are positioned to get formal jobs, and the vast majority lives informally (Plastic REVolution). Africa needs to generate an enormous amount of new jobs, where most jobs are unskilled jobs. Since there are vast amounts of labour accessible in the region, it might be possible to create large secondary facilities for sorting.

Waste management has up until now not been a priority, and to some extent neglected (Jekora), both by individuals and for local governments in the region. In order to avoid drastic adverse potential outcomes, it will be necessary to incentivize the people into taking action (Laffont & Martimort, 2009). Governments could, for instance, cut off the electricity for households that are not separating at source or offer cheaper electricity for households that do separate at the source. Similar could be achieved with similar cuts or discounts for internet connection. As Kolstad (2011) emphasised, the preferred option is to applaud or benefit the right behaviour, rather than to punish. To incentivise for collection or separation at source, without punishments, governments or companies in SSA can give small payments or deposit schemes, discounts for school fees, on groceries or school supplies. Yet, these activities are not possible to get through without for instance well established electricity system, internet connection or funding to give out discounts.

Public awareness of recycling

Companies in Ghana are collecting plastic and using it in production for noon-food packaging and products such as garden shares, furniture and detergent containers. However, they do not say that the material they use is recycled plastic, because of the fear of public misconception that the material is second grade, and therefore should come at a discount. Whereas in Europe, this would enable companies to sell at a premium, in SSA (Ghana) they have to do it behind closed doors because they are afraid that the consumers will not believe in the quality of the product (RePATRN). There is an uncertainty from the user's perspective on using recycled plastic products. People believe that products or textiles made from recycled products are harmful. Again, improved education, for the end-users, for pupils at schools, for teachers, for businesses and governments, could help significantly (Waymore).

When people do not know that certain actions can create positive externalities, it is hard to incentivise the population to act. People at all levels in society must be responsible for

handling waste and be aware of the possible health effects. Further, be responsible for the environmental externalities and the negative public health and development consequences inadequate waste management can have. Also, the benefits the positive externalities can create. There is an urgent need for public awareness informing that waste generated from human activities needs to be treated. Moreover, there is a need for better education and more shared knowledge within the existing players in the industry. I will continue to look further into this in the following sub-chapter.

6.1.3 Uncoordinated efforts within the industry and lack of collaborative initiatives

Overall, it might seem that there is much innovation happening in the industry of waste, plastic and recycling. In the reality, it is only one part of the industry, waste-to-products, where there is much innovation (Waymore). This is also the part of the industry that gets most of the attention, specifically; how to use existing waste for new products. There are many young, creative and innovative players involved, using imagination and technology to make use of existing waste, often on a smaller scale. (Waymore).

On the other side, as regards how companies get the initial plastic and waste, from the source to end; it is arguably a more closed sector with less innovation. This part of the industry is characterized by a lack of transparency in the value chain and a lack of open discussion. Ramvjji from Waymore argue that in this part of the industry there seems to be close to no shared learning, such as conferences, organizations, partnerships and publications. There is also is less dialogue among players and no collective efforts. This is primarily a case for developing countries, especially since there are informal structures with limited accessible information. Ramvjji from Waymore argues that "*There are a lot of old people in this part of the industry. Older people are not curious. Young people ask questions*" (Ramvjji S, Interview with Waymore, 03.03.2020).

Overall, the industry of waste management and recycling lack clarity as well as numbers and data available. Uncertainties regarding actual market volumes, market shares and financial aspects represent a considerable challenge for all players in the industry. The data that companies do get are besides not necessarily reliable. Research finds that transparent and accessible data is vital to implement and analyse different strategies to fight the waste challenge (Eshet et al., 2006).

Several of the respondents argue that people involved in the industry do not share information, and what they share is not shared in transparent manners (Coba Impact Manufacturing) (Waymore). Asymmetric information in the market due to withholding information makes it harder to build strong relationships between the different actors operating in the industry (Laffont & Martimort, 2009). Furthermore, it is challenging to get correct figures on what is happening in the market and create reliable estimates (Coba Impact Manufacturing). In a competitive market, it is natural that players do not fully share everything related to future development, scale or performance. However, shared information could enable better cooperative efforts, because actors could build on experience and develop the market in general.

There are innovative companies in the region working to increase transparency and reduce the risk of corruption in the industry. Empower.eco are creating a technological platform to track and collect plastic waste. They are aiming to create a platform that stores information about collected waste, and that can be trusted without the risk of people manipulating data (Empower.eco). A more developed market could enable better working businesses for all parts of the value chain. In addition to higher levels of effectivity and increased incomes. If the government increased the regulations and laws on levels of transparency, it would become equally beneficial or negative for all companies. Moreover, increase the efficiency-flows and development in the market.

Across the region, respondents are arguing that there is a confusion of the concept of recycling. UNEP argue that a few of the African countries are involved in the full process of recycling (UNEP, 2018). Several of the case-companies state that they do recycling, on webpages and in meetings. Provencal from RePATRN argues that "*The problem in Ghana is that no-one really knows what recycling is. There is no recycling*" (Provencal J, Interview with RePATRN, 01.04.2020). What most companies in Africa do is material recovery, people pick things from the general waste stream and prepare it to send it to recyclers. The full process of recycling for reuse for food and beverage packaging is too expensive and technological complicated for most of the private companies in SSA (Coba Impact Manufacturing). The misunderstandings and lack of openness can have significant negative impacts on policies because not even the government fully know what recycling is (RePATRN). It can also affect investors refraining from investing because of misunderstandings, unclarities and lack of open data.

Based on the case-interviews there seems to be a fragmented industry with lot of small players operating separately. There are different actors with little cross-collaboration and collaborative efforts. To better connect actors and activities in the industry is important to solve wicked problems (Närvänen et al., 2020). One could therefore argue that there is a need for consolidation, to connect existing players into larger actors. This could drive change at an industrial scale and enable a more efficient value chain, as well as allow potential technological development and investment opportunities. Larger players, with more competence and scale, could also make it easier to attract investments or find investment opportunities. The seek for investments, will be discussed in the following part of the analysis.

6.1.4 Lack of investments

Without government incentives or subsidies, it is not possible to get enough value from collected waste, to pay for large investments or operation of high technological upcycling opportunities. In Norway, the waste companies are paid from the municipalities to handle the waste. Solheim from Plastic REVolution emphasised that "*To think that it is enough value in plastic for operating and investing in Africa is unrealistic*". In order to combat the challenge, increased investments to the waste sector are vital.

All the respondents from the case-companies express the urge for more funding. In order to even dream about opportunities with more upcycling to increase profits, there is a need for more funding. Provencal from RePATRN emphasised that the key takeaway from our conversation was the following: "*We need money and we need smart money, that is the key*" (Provencal J, Interview with RePATRN, 01.04.2020). Increased investments, especially private commercial funding from professional investors, is necessary for all companies to continue growing (Penda Papers). The struggle to get access to funding, can also be a result of the fragmented industry, with a lot of small players. If more players got connected into larger players, they could spend more time and efforts on collecting money and raising capital. Also, become a more trustworthy and serious company to invest in.

Navigating in a landscape characterized by uncertainty and unclarity makes it harder for companies to get access to funding (de Wet, 2004). Laffont & Martimort argues that asymmetric information in a market makes it harder to achieve profits. It will also make it harder for private companies to obtain loans and funding (Laffont & Martimort, 2009).

Investors refrain from investing in industries and markets where it is hard to get an overview or an understanding of future scenarios. (de Wet, 2004; Laffont & Martimort, 2009).

With the asymmetry in the market, there is also an increasing principal-agency-problem. There is often not a symmetry between what the leaders (agents) and the investors (principals) know about the industry and connected challenges. In the complexity of the market, the involved players naturally have more knowledge about all processes and challenges. The more asymmetric information in the market, the higher the risk that the owners and investors are not fully informed about everything they should know. Hence, it can refrain investors from a potential investment in the industry. It can be challenging for investors to get access to the agent's information or monitor day-to-day operations, which makes it hard to decide on or evaluate an investment. (Andersen & Idsø, 2020) (Laffont & Martimort, 2009).

The private sector companies might also be more aware of potential corrupt activities they take part in but refrain from telling investors. This is an example of moral hazard, where it is nearly impossible for the investors (principal) to monitor processes and be aware of the corruption the employees (agents) take part in. It becomes a risk of non-compliance or fines for investors involved in corruption (Andersen & Idsø, 2020) (Laffont & Martimort, 2009). In order to overcome these challenges as an investor, it requires in-depth understanding and background research on all processes in the value chain. Not all investors can enable such time-consuming research ahead of an investment.

UNEP argues that investments in the waste industry in Africa is considered a high-risk investment (UNEP, 2018). Riiber Knudsen from Penda Papers argues that the risk factors in the industry are massive and many, both investments in Africa in general and especially in start-ups in Africa. These risk factors keep reasonable investors way. He emphasises that the global pandemic of covid-19 is making the situation increasingly hard, because there is even less financial support available in Africa. On top of that, there is no governmental support programs to keep the businesses running, as we see in many developed countries. Riiber Knudsen describes the situation as "*truly devastating"*. (Riiber Knutson, Penda Papers, 05.06.2020).

Riiber Knudsen from Penda Papers also argues that the expectation of return is very low in the industry, which is naturally refraining a lot of investors. Professor Albuquerque attended

a conference with all African central banks represented. He emphasised that the central banks tried to argue that the financial situation in Africa is not as bad as it is being perceived by the international investors. He further argued that much prejudice is refraining investors from investing in Africa. Moreover, he argues that investors are over-estimating the discount rate in Africa for a variety of different reasons (Professor Albuquerque). Also, that projects that should have a positive net-present-value (NPV) if you use the correct discount rate, are currently not going to get financed. In order to improve and correct the market, Professor Albuquerque further emphasised that it is not only about having the rules and regulations in place but building trust over time.

The shortage of dollars in Ethiopia, are also refraining private international investors in the country. This is due to a risk of prolonged restrictions on repatriation of funds in Ethiopia. This risk can frighten private investors, since they are not guaranteed to get money out of Ethiopia, even the money they initially invested. Also, if there are successful projects in a portfolio the investors are not guaranteed to get their premium, simply because of how the economic model has developed in the country.

Better access to trustworthy data, and a market with less asymmetry, could enable a safer investment climate with easier access to funding for the private sector companies. In the following part I will elaborate on an important fundament to make the value chain work: the collection systems.

6.1.5 Lack of established infrastructure and collection systems

Uncertainty regarding levels of volume for production is a considerable challenge for the private companies operating in SSA. Many companies struggle to keep their businesses running because of inconsistent flows of collected waste (Ndiso, 2019). Several respondents emphasised that their greatest challenge is to get sufficient volumes of waste, while one would think that their challenge was to sell the processed products (eg. plastic flakes) to the market. In order for the private companies to exist, they need a more constant flow of raw material, and better organising to secure collection (Coba Impact Manufacturing). A well-developed system for collection that can enable raw material at a steady level is therefore critical for production in the industry (Plastic REVolution).

It is hard to estimate the flow and the exact volumes companies have available, which makes it hard to plan future production. For some material, like paper, the volumes are also varying

greatly depending on seasons, in the rainy seasons, there is a lot more wet paper, which is hard to utilise for recycling. (Penda Papers).

There are also very inconsistent manufacturing capabilities because of issues with power in the region. All the countries of analysis have issues with power outages. In the "*doing business in 2020*" the world bank outlined that Ethiopia, Ghana and South Africa were all below the regional average on the accessibility and reliability of electricity. Insufficient levels of electricity bring down the production, and when the machines are not performing at full capacity, the overhead costs are very high (Coba Impact Manufacturing). Overall, it becomes hard for the companies to produce at the optimal output level.(Coba Impact Manufacturing)

Many private companies have direct contracts with multinationals, where they sign contracts to supply the multinationals (such as Coca Cola) with for instance plastic. The multinationals choose companies to work with based on their quality and capacity. They require constant flows delivered, which drives a further pressure on the private companies to supply a constant volume. Amara and Makris from Coba emphasised that it is high pressure to work with multinationals. Penda Papers described how the paper mills require a constant flow of recycled paper in order to operate, and that is it a considerable risk with not having steady collection levels.

There is a need for established collection systems. Provencal from RePATRN emphasises "*When you speak to anybody coming from abroad, they are used to well-established sourcing systems and sourcing networks that are formal. We don't have that in Ghana. The biggest issue we have is that we have to commit to a market and build the collection network of our own*" (Provencal J, Interview with RePATRN, 01.04.2020). Several respondents argue that lack of collection network is one of the most important reasons why private companies are struggling to operate with waste management and recycling on a larger scale. (RePATRN)

The introduction of the South African recycling model PETCO can enable the collection networks to be better in certain areas. As previously mentioned, PETCO is a partnership between plastic producers such as Coca Cola and recyclers to increase the level of recycling and better coordinate existing efforts. However, full implementation can take time.

Furthermore, this model is only for the recycling of plastic, and not all waste streams, which means there will still be a need for better collection infrastructure.

Plastic REVolution, initiated by the Norwegian company Aker Energy, is piloting on a project to transform plastic waste to biofuel that can be sold in Ghana or to the European market. Their goal is to build a model that can be replicated in other places and adopted worldwide. Existing actors such as RePATRN argues that companies like Plastic REVolution would be a good initiative because it creates a vacuum for other businesses to develop in its wake. The Plastic REVolution can be the company that buys the plastic that is collected and processed. Getting Plastic REVolution in the value chain can, therefore, incentivise other companies to open businesses and see the value in supplying the Plastic REVolution's initiative. Hence, overall more waste collected.

For the private sector companies in the industry not doing the collection themselves, it becomes a dilemma of buying raw material from the informal or the formal sector prior to processing the waste. As the current situation is, it is easier to get collected waste from the formal systems, because the flow is usually more predictable. However, some argue that it is more important to get waste collected from the informal part of the industry. The formal stream of waste is already going to landfills, which is better than nothing. Furthermore, it can eventually become a way of structuring parts of the informal sector. Solheim from the Plastic REVolution emphasises that private companies should try to get their waste from the informal sector since it will be an additional benefit for the environment (Plastic REVolution). Moreover, the integration of the informal sector with the formal sector could be an important step in increasing data, control and collection in the industry. Especially because the lack of data from the informal sector is a challenge in today's industry.

Solheim from Plastic REVolution further emphasised that the ideal solution is that some companies collect all the waste, then sort it and eventually parts of the waste goes to textiles recycling, some to chemical recycling, some to landfill, some to create energy. Provencal from RePATRN argued that beyond collecting it all, different companies should handle different waste streams in different types of material recovery facilities. Some respondents argue that the best solution would be to reduce the waste to the maximum extent as possible and offering two or three separation at source possibilities for individuals (organic, plastic, paper). Further, the recyclers would collect their efforts in an organic waste union, a plastic waste union and a paper waste union. The unions would then find the best ways to contribute

to the collection of the selected resource (RePATRN). The challenge will then be to what extent such a system can be controlled when corruption is an issue. Despite the exact solution, is it vital to connect actors and activities in the industry in order to solve the wicked problem of inadequate waste management (Närvänen et al., 2020).

The majority of the respondents emphasise a need for infrastructure to collect waste. If the government is unable to provide the services, it has to be the private sector. There is a need for large companies that buy large volumes to kickstart the entire process. Furthermore, there seems to be a need to consolidate existing players into fewer larger players that are able to scale up and build a collection network with the needed infrastructure.

6.2 Analysis of barriers on the operational level

In this part of the analysis, I will provide a more in-depth discussion into some challenges or barriers that the companies meet in daily business operations. These are primarily organizational matters, such as the workforce and internal operation choices. I will also discuss if the companies have opportunities to impact these barriers, or possibilities to navigate through them.

6.2.1 Challenges with the quality of the workforce

Professional competence

As previously discussed, increased education on all levels of societies in SSA is critical for regional human development and increased environmental performance. Moreover, it is important for developing the private sector and get the required business- and technical knowledge.

Education and technical knowledge are crucial for companies dealing with waste because it is a complex industry, and in some cases, it requires hard technical knowledge. Throughout the region, there is a lack of people with higher education, especially within higher level business expertise and in the engineering field (Engineers without borders). Technical knowledge is hard to find, especially at the middle- manager level. Most companies find managers from overseas for roles on the management level (Coba impact manufacturing).

Guthe from Penda Papers emphasised how more qualified competence is vital for companies to grow. Engineers without borders are together with NGOs working with engineering projects across SSA. They emphasise that it is a "*current wave of interest of projects within waste management*". At the same time, NGOs and local companies lack people with higher education, especially within the engineering field. One could therefore argue for better general education throughout the region. This would naturally be the goal for all industries in the region, however, there are significant challenges to enable more people to get education on a higher level. For instance, related to lack of government investments, low accessibility, gender equality, child marriage and high costs. Nevertheless, could a better working private sector enable more people to have an income, which can enable more parents to send their children to school.

Culture, common sense and trust

Amara and Makris from Coba emphasised that their most considerable challenges and risks are on the management level, related to the workforce. The quality of the workforce has proven to be a significant constraint for failure or success. "*What determines success is definitely not the market demand, or the value chain, or where you are in the value chain, it is the quality of the workforce, and the work environment in Ethiopia, that is the primary element*" (Amara. G & Makris. C, Interview Coba Impact Manufacturing, 24.03. 2020)

Several of the respondents have experienced the way of living in Europe and emphasised the challenges they meet because of differences in culture and trust. Guthe from Penda Papers further emphasises how language can be a barrier to optimal production internally. Provencal from RePARTN emphasised how hard it is to understand the differences without local presence to experience it. Further how he could barely understand or imagine how differently people could think only 6 hours away from where he grew up. "*it is absolutely mental; it is a whole other world".* This connects to Närvänen et al (2020) perspectives on solving wicked problems. They emphasised that *constituting sociocultural meanings* is vital to solve wicked problems.

Provencal from RePATRN emphasised how human resources can be a huge challenge when there are different cultures of communication and different kinds of common sense. *"When I ask my employees questions, they can be understood in a certain way, and they answer truthfully what they think is best, and it might be something completely different from what I am expecting. If I don't drill deeper, I will never understand what it really meant. So, there are small things that can be super annoying and super frustrating and makes processes unnecessary difficult".* (Provencal J, Interview with RePATRN, 01.04.2020).

The companies in the industry have many logistical processes and transactions, in the process from collectors to the collection centres to the factory where the material is processed and transported prior to selling it to the market or exporting it. There are complex control processes that are difficult to follow. Amara and Makris from Coba emphasised that they have had significant challenges with stealing, which they argue is because of lack of education and "*how people are*". These challenges have caused significant financial losses for Coba. At the same time, Guthe from Penda emphasises the value of local employment, especially in terms of understanding the context they operate in and provide valuable local knowledge.

Provencal told a story to explain the situation in rePATRN: "*Yesterday we were loading a container. I asked by WhatsApp how it's going. And the response was "We are working on it". Which makes me think okay cool, the container is there, they are loading the container, everything is going on. And when I called half an hour later, the feedback was: there is a problem with the forklift, there is a puncture in one of the wheels, so they had to take the forklift to fix the wheel, inflate the wheel and come back. In the timeline from the "we are working on it" and I called, not a single bail was loaded in the container. Their interpretation of "we are working on it" was that yes, we are doing what we should be doing. And I wanted to know to what extent the container had been filled already"."* (Provencal J, Interview with Repartn, 01.04.2020)

The issues as described above are typical for companies in Ghana; however, companies seem to solve it in different manners. According to several respondents, many companies are treating workers as a commodity, and get locals to do work that require lower levels of competence. When someone is not performing well, they will be fired and replaced. People can earn a living but are not offered any kind of security or education to improve from their employee. This way of operating becomes a challenge for the overall development and economic growth in the region. (RePATRN)

Provencal from RePATRN work to keep employees, despite their repeatedly mistakes or misunderstandings, to create an impact on their lives and the country's development. Yet, some competitors can be more productive by spending less time on education, precision and corrections. It becomes a dilemma to either choose a less efficient path but have a social impact - or run the business most easily. *"So, I think I choose the noble but incredible difficult way to attempt this and have the social impact that I am hoping to have. Not just putting money in people's pocket, but educate them to a certain extend. So that they learn do think more differently or broader than they did in the past*" (Provencal J, Interview with Repartn, 01.04.2020)

Penda Papers employ women who are left out of society, even if they might not be the most productive employees available in the market. There is a risk that other players in the market may utilize the gaps of a lower effectivity and build their model on the same activity, but with higher efficiency and lower social impact. Generally, employees in the SSA region have little working rights, compared more developed countries. Which means that the more rights employees get, the more it costs the company because there is no such "hygiene"-

factors in the society that all companies must follow (Penda Papers). However, the company can benefit from doing good to communities and contributing towards the country's development, especially in the long-term. Further, because they build stronger reputation and values in the local communities. In developed countries, companies could gain a competitive edge by employing a diverse group of people and contributing to the society. Yet, Penda Papers emphasised that the competitiveness is not necessarily strengthened in doing good, because not all businesses have the same mindset.

As some of the case companies emphasised, the quality of the workforce is the single largest constraint for failure and success, furthermore it is vital to be able to solve wicked problems (Närvänen et al., 2020) In this case, the companies told openly about the internal challenges with the workforce. Yet, in many cases, such information can be held back or hidden for investors. It can then be an example of moral hazard, because the agents (leaders) can refrain from telling the principal(investors), because they will most likely not find out about it. (Laffont & Martimort, 2009). Nevertheless, such challenges with the workforce can over time have significant consequences for companies and the financial performance. In the following part I will elaborate on other aspects that makes it challenging for the private companies to increase revenues.

6.2.2 Hard to increase revenues

As previously mentioned, there is an overall lack of investments in recycling and waste management in SSA. Moreover, it is hard for the companies to operate at a financially sustainable level. All the respondents provide information about challenges to generate profits and increase revenue stream. Nevertheless, the companies of analysis are some of the most successful companies in the region, and it seems to be correct that it is rarely possible to reach financial sustainability in the industry (Dukhan, 2014).

Pienaar from Waste Plan emphasised that in the field of recycling and waste management, there are primarily two ways to increase profits as a company: raise revenue or cut costs. To raise revenue is hard because the companies are price takers in an international market that determines the price of the raw material (Waste plan). Amara and Makris from Coba emphasises that it is a big issue that companies are completely limited by their selling prices (for flakes). Riiber Knudsen from Penda Papers also argues that the pricing of the raw

material is set by a global pricing market. All the companies can do is therefore to cut costs, or to add more value to the waste.

Low margins and cost-cutting initiatives

In order to cut costs, the companies can for instance work to become more effective. Waste plan emphasises that they are witnessing a critical financial situation for the industry. The companies they offer their services to are continually seeking for the cheapest way to get rid of their waste, while at the same time meeting the necessary standards. The industry must, therefore, always work to save costs and be more efficient.

The market environment is continuously pushing profits to the bare minimum and newcomers as well as incumbent players are struggling to survive. A lot of the smaller companies are forced to close down due to the increased pressure from the commercial sector, where they collect waste (Waste Plan). This is a significant challenge for all competitive markets, however, the difference for this market is that unmanaged waste creates a negative externality. Nevertheless, it is beneficial for all involved parties that the waste is managed in the most sustainable way. Cost-cutting and efficiency are also challenging the companies' ability to work in the most environmentally friendly way (Mike, Waste plan, 2020). The most optimal solution is therefore challenging to provide without governmental support or other incentives.

A lot of the players in the industry struggle to generate profits. Moreover, many of those who are financially sustainable emphasise that profits have eroded (Waste Plan). Amara and Makris from Coba described how the bottle recycling market has increased, which is increasing the cost of the raw material. They must pay about a double price for plastic waste now than a decade ago because new players are entering the market and offer higher prices to get more bottles. Amara and Makris further emphasises that a lot of private deals are made. When private deals are driving the market up, the prices increase, and it damages everyone in the industry.

The respondents emphasize that the industry is a rapidly changing environment, with new actors being established and taking over parts of the value chain. Mike from Waste Plan describes the overall competition in the waste industry as very aggressive. This becomes a challenge because there are players that are not necessarily operating in a sustainable manner, that are pushing the prices down.

There are also external factors affecting the company's abilities to generate more profits. Coba emphasised that Ethiopian shortage of foreign exchange makes the companies unable to import as much raw material as they want, and they are therefore obliged to buy locally, for higher costs (Coba Impact Manufacturing). Penda Papers argued that the overall cultural challenges such as issues with payments, that the suppliers rarely pay on time, leads to a lag in the value chain. Pienaar from Waste Plan emphasised that Chinas import ban on recycled plastic and unsorted paper, affected the margins for a lot of the smaller players in the industry in SSA. Chinas import ban crashed the market since paper cardboard prices impact the local recycling market, and the price (for cardboard) decreased with 60-70%. The smaller players in the industry were then unable to operate with lower margins.

Overall, there are a variety of reasons why it is especially hard to increase levels of income in the industry. There are primarily external barriers and rapid changes in the market environment which makes it significantly challenging.

Value creation initiatives

Because it is hard to generate income in the industry, the majority of the respondents are looking into various ways to add more value to their end-product. This is also called upcycling. The reason for this is because the price on the end-product is a critical factor for operating (Plastic REVolution). After all, a waste management system is expensive. Waste that can be used again or recycled will increase the value in all parts of the value chain and for all waste streams. (Plastic REVolution)

Unfortunately, in most cases the processes of upcycling rely on expensive technology. Coba emphasised that in order for them to do the entire process of recycling plastic bottles to new plastic bottles (bottle to bottle) it would require an investment of about 2,5 million euros for the smallest available machine, taking 500 kg/hour (Coba). It will therefore cost millions to recycle at an industrial scale with good quality. Coba is, therefore, looking into different ways of increasing the value of the product by for instance making monofilaments for industrial/domestic brooms and the fishing industry. Their internal calculations expect this new activity to double the value of the product. Their existing plastic flakes are selling for about $600, and monofilaments are selling for about $1100. (Coba).

Waste Plan is also looking into doing more upcycling and seeing it as a necessary thing to do going forward (Mike, Waste plan, 2020). Provencal from RePATRN argued that the best

option for them would be to do the full recycling in Ghana if the funding was available (RePATRN). Because the full process of recycling is very limited in SSA, Ghana import recycled waste to use in production while having piles of waste available in Ghana. RePATRNs goal is to do the entire process in Ghana, which can employ more locals and make another economic activity available to the country. The possibilities of upcycling can enable the companies to increase their income, and hopefully overcome some of the external barriers hindering optimal levels of profits.

Annan from Jekora emphasised that they are positioning for a second revenue stream by selling recyclables to material recovery facilities. However, the revenue streams are not high enough to sustain the business, because it is hard to sell some of the recyclables. Because it is hard and expensive to process and succeed with recycling, the industry of recycling is overall not so developed.

In European countries, energy from waste (EFW) or incinerators are making upcycling worth the expenses, because the demand for energy is high. One big challenge for large scale waste management in the SSA region is that the EFW/incinerators do not make much sense. In order to get energy out of waste, there is a need for a high calorific value, which means a waste composition that burns well. Even though plastic burns very well, the regions overall organic content is very high (figure 3), so the overall waste is too moist to be able to burn it (RePATRN). Nevertheless, it is hard to calculate and estimate the future calorific value of the waste composition, both because it requires specific numbers on population growth and the predicted changes in waste composition (Penda).

Despite the challenges and costs related to it, more upcycling seems inevitable going forward. However, based on the existing barriers will the transition phase to more upcycling be challenging for the private sector companies. Waste plan emphasised that the transition to more upcycling includes many risks, but it is most importantly representing a tremendous global opportunity. When China banned the import of recycled plastic and unsorted scrap paper, they did, in a sense, force other companies into more circular thinking, and come up with solutions. One can therefore argue that Chinas import ban also contributes positively for the industry's development in SSA (Waste plan). It is therefore not unlikely that to better regulate or monitor the global trade of waste, will have a significant impact. More upcycling will also impose another environmental aspect to the sector, since many technologies require

more energy. There are also uncertainties to the actual real environmental footprint of the changes (Waymore).

6.2.3 Lack of clear goals on value creation

Overall, there seems to be a lack of the private companies' clear goals on how they wish to create value. The involved players have different set of goals, related to environmental, financial and social performance. Some are primarily driven by the environmental perspective, others by profitability. Creating employment are driving other companies. What is unclear is the balance between operating for profitability or operating primarily for other development concerns.

Many companies are aiming for performance along several dimensions, and it can become unclear what the actual aim of the company is. Some are mainly focused on doing good for the communities, or for the country, which is great, as long as the main goal is clearly communicated. However, being impact driven can also affect how the company deal with low productivity or poor results. Nevertheless, some companies might seem to accept low levels of profitability in doing good for the society. One could argue that some companies could perform better or be more profitable if they did not excuse bad performance in doing good for the environment or social purposes. It is a risk of goal ambiguity, and in order for the companies to operate in the best possible way, clear communication on goals is vital.

The lack of clear goals might also affect investors and other relevant stakeholder. When the goals are unclear, it can result in a principal-agent-problem where the leaders (agent) goals are not necessarily aligned with the owners (principal) long-term goals. Furthermore, a problem with moral hazard, since the leadership (agents) are often working for short-term value creation to benefit the short-term profits, while the investors are often aiming for long-term value creation. The government should therefore for instance set a regulatory framework that enhance long-term thinking and sustainable investments. This could for instance be done by reducing the investment barriers for such investments or benefit these companies with tax-reductions or less expensive land space. (Andersen & Idsø, 2020) (Laffont & Martimort, 2009).

However, there is also a lack of clear goals on a governmental level, where short-term successes are beneficial for future re-elections. Today, governmental decisions on financial support seem not to reflect or consider companies environmental or social efforts in some

parts of the region. Jekora is currently seeking government support but emphasised that the social and environmental good their provide to the communities is not necessarily considered in the decision regarding who gets support and not. She emphasised that: "*The country is corrupt, it is difficult, but we are hopeful"* (Annan M, Interview with Jekora Ventures, 31.03.2020).

Sustainability or profitability

Several of the companies emphasise that they are losing money on activities they do that makes them especially sustainable. This problem exists because there are different ways of approaching waste management. It is a balance between doing business in the right way or in the most profitable way. Sustainable innovation was described as a solution to wicked problems, and a solution to the waste challenge (Hautamäki & Oksanen, 2016). Nevertheless, being sustainable and working towards success on three-dimensions in the industry seems to be a challenge and impair competitiveness.

In underfinanced societies like in SSA, private sector companies get little recognition for providing positive externalities for their community, country or region. If there are no incentives for companies to act sustainably, there is a possibility that the companies that do survive are the most effective but doing little social and environmental good. It is, therefore, vital that governments make it easier to do what is best for most people. Governments should play a role in incentivise sustainable behaviour so that the private companies that are doing good to the communities get compensated for it (Thaler & Sunstein, 2008). By doing so, the government are internalizing the positive externality the companies create.

In South Africa, the government's policies for companies to handle waste is driving the waste management and recycling industry. The government has introduced legislation including fees on non-compliance on waste management in the commercial sector. This means that big waste generators demand a waste management and recycling industry that manages waste responsibly to make them legally compliant (Waste plan). The demand for compliance can incentivise sustainable practices in the industry, without eroding income levels. A lot of the multinationals that are big waste generators must further comply with a set of rules around the world and must report on sustainability in their value chain. The increased global focus on sustainability might eventually give waste management companies handling waste sustainably a competitive advantage in SSA.

Further, there are valuable aspects of running sustainably, that might benefit the companies in the long run. The reputation sustainable led companies get in the local communities are valuable for the companies. Jekora argued that their current success is based on the mentality of their staff, that they all want to do the right thing, and are mentally inclined. Waste plan argued that their success was based on their market reputation and the formal caring environment they were building.

Running sustainably could be beneficial especially in terms of funding from international investors. Globally there are growing environmental concerns, along several dimensions (Waste Plan). Many foreign companies in all sorts of industries that operate in SSA are therefore giving more attention to environmental and social improvement to the region (Coba). However, several of the respondents are under the impression that the motivation for a majority of the big international companies is more for the image of it, to have content on webpages and in sustainability reports. Yet, many local companies are running sustainability and contributing to social aspects because they have to, and they urgently see the needs of their populations (Coba).

The growing "sustainability"-concerns can be an opportunity for private companies in SSA both related to more funding towards sustainable projects, and increased demand for recycled products globally. There are also international investors in SSA, NGOs and companies wanting to support waste management companies in order to show their customers that they care about their end-products. Internationally, especially in Europe, there is also an increased understanding of sustainable solutions as a competitive advantage. Being a sustainable company in many developed countries is also a legal compliance aspect and are, in most cases, making companies more profitable (Eccles et al., 2014). Therefore, one could argue that international investors would rather invest in companies being sustainably run also in Africa, despite possible lower margins.

There is a need for the private sector companies to have clearer goals on value creation. Moreover, for governments to incentivize value creation along several dimensions, which can enable aligned motivations for companies despite the way in which they are owned and the goals of their investors.

6.3 The future: how to navigate?

The challenges of increasing waste levels and inadequate waste management are global issues, but it is built on local problems that need to be solved locally. In contrary to other global problems such as the climate issue, it makes sense to act locally. Solheim from the Plastic REVolution emphasised that most of the plastic on Accra's beaches is waste generated from inland Accra; hence it needs to be solved in Accra. Compared to other global challenges, it makes sense to solve national problems without asking what everyone else does.

Local solutions that are fit for different local contexts is essential going forward (Godfrey & et al., 2019). The world bank argued that complicated technology is not necessarily the key, but rather to seek for local solutions (Kaza et al., 2018). In order to improve the situation, there is no need for heavy technological investments, rather to build better working societal structures, regulatory frameworks and facilitate for development in the industry.

The only actors that can fully solve the waste challenges on large-scale are government's by regulating the markets, the companies pushing the products out in the market and the customers using the products (Plastic REVolution). Since the government is not able to find or support solutions, it is the private sector that drives the conversation in Ghana and the government must follow by setting the regulatory environment to support it. (RePATRN)

Lack of collective efforts from NGOs and international companies

The Ghanaian government are publicly sharing that waste pollution is a challenge and a focus area for them. However, Provencal from RePATRN argues that there is too little incentive for the Ghanaian government to drive the initiative when so many international companies want to solve the problems or emphasise that they have the best solution for the government. Rittel & Webber (1973) argued that number of people and opinions involved is a reason why wicked problems are hard to solve.

There are many of the international organizations and companies telling the government what to do without knowing the local context well enough. Some argue that the best option would be that the government in Ghana drive the initiative and come up with solutions, and then ask for help to implement and fund it (RePATRN).

There are several organisations, NGOs and smaller projects that are working with waste management and recycling in SSA. Provencal from RePATRN argues that many organisations have smaller projects just to be able to share that they contribute towards the pressing waste challenges. Solheim from the Plastic REVolution argues that there are currently endless numbers of small solutions to the waste challenges in Ghana. Thousands of NGOs try to start initiatives and projects, but they lack the scale and industrial competence to succeed. Solheim further emphasised that there are "*Small NGOs with few chances to accomplishes anything of importance*" (Solheim.E. Interview with Plastic REVolution, 02.03.2020).

There are companies and NGOs supporting projects with the intention to improve the situation, yet the outcomes have unintended consequences. Engineers without borders are working to provide industrial competence to small-scale solutions in developing countries. They are working with local solutions, that are built on locally available material and tools, to ensure that it is possible to operate their solutions over time. They have witnessed a lot of donors and larger projects with imported solutions, that are left to the local populations without the knowledge to operate it. The projects are designed with a top-down approach, without really understanding the local context. No one in the local community can afford to buy new parts when something is broken. "*The problem in itself is not the solution they offer, but the lack of follow-up*" (Svendsen. H, Interview with Ingeniører Uten Grenser, 17.02.2020).

Different development organizations are active in Ethiopia and Ghana, such as serval UN instances, OECD, DFID, Norfund and USAID. However, the challenge is that no one wants to collectively put together big funds towards waste management in the countries. Provencal from RePATRN argues that for instance, the EU should coordinate their efforts. "*We need someone to come with a lot of money, but a lot of the smart money that can do something on the industrial scale. We are thinking too small right now, too many small initiatives*" (Provencal J, Interview with RePATRN, 01.04.2020).

Producer responsibility

The majority of the informants argues that the producers that are pushing the products out in the market have a responsibility to take a significant role to fund or organise waste management. Especially companies selling goods to areas where there are no end-of-life services. Solheim argued that *"The most obvious solution as I see it is to solve this challenge*

as we have solved other industrial issues, the polluter pays. (Solheim.E. Interview with Plastic REVolution, 02.03.2020). He further argued that it is unrealistic to use household tax income to build effective waste management systems. However, he argues that to impose a tax for producers could be the optimal solution to finance it. The government should, therefore, enforce a policy for extended producer responsibility, where the producers are responsible for collecting the waste they sell (OECD & Ministry of the Environment, 2014). Enforcing the polluter pay principle, by an extended producer responsibility will make plastic and waste more expensive, and there will eventually be less or it. Moreover, it creates funds that can be used towards waste management.

Today, producers constantly try to make their plastic better by changing the content. In reality, new types of plastic make it harder for the recyclers. The recyclers will then need to find out how the new types of plastic composition can be processed, and some are also unable to be processed. (Waste Plan). Solheim from the Plastic REVolution argues that the best option would be that the government impose all producers only to use plastic of the type that is the easiest to use again or recycle.

The large companies like Coca Cola are bragging about having projects in developing countries, but Solheim emphasises the following about the initiatives. "*if you dig deeper into what they actually do, they have one small projects in 1 of the 700 000 villages in India - which means that are not even solving the problem in that one village*". (Solheim.E. Interview with Plastic REVolution, 02.03.2020). The producers must act on a completely different scale.

Solheim from the Plastic REVolution argues that some global producers have promised to collect an equivalent amount of what they sell. However, each company cannot have their own systems, and they should rather use their industrial competence, knowledge and funding towards larger collaborative waste management systems. This connects to Närvänen et al, 2020 perspectives on how to solve the wicked problem of food waste, by *better connect actors and activities within the system*(Närvänen et al., 2020). To succeed with scale in the industry is vital.

There are also arguments that companies should rethink how they deliver their products, rather than investing in how to collect the waste they create (Jørgensen & Pedersen, 2018). Provencal from RePATRN argued that the end-solution to the challenges must be that

companies become more service-minded and focus on how they could differently provide a service rather than providing the actual product.

Waymore, argue that the long-term solution to the waste challenges is to create alternative materials that can create the same user functions as waste and other waste items, such as biodegradable plastic. Waste plan argues that people working on biodegradable plastics destroys the recycling market. He emphasised that the concept is, in theory, a good thing, but in the process of switching some of the waste streams, it is destroying the market. Further that in order for biodegradable plastic to be a solution, we need to switch everything or switch nothing (Waste plan). Whatever turns out to be the solution, governmental waste management systems or biodegradable products, the transition phase will impose considerable risks to the industry.

Governments locally, regionally and globally must create rules, regulations and policies to enable private companies better to operate efficiently on a scale. The way of doing this will vary significantly from country to country because the political picture is drastically different in the region. (Penda Papers). However, the challenges with corruption make government intervention hard. In geographical areas where the governments are unable to enforce policies and create large initiatives, the private sector is driving the conversation of waste management (RePATRN). The private sector is fundamental for creating a value chain for waste management and is also more effective and less corrupt than the government (Plastic REVolution). Yet, whether the end-solution will be an integrated waste management system, to create biodegradable packaging, to enforce extended producer responsibility or consolidate the market remains uncertain. What is clear, is that further cooperative actions to build a better working waste management system is urgently needed.

7. Concluding remarks

The private sector companies in waste management and recycling in SSA are operating in a wicked problem environment. There are countless numbers of opinions and parties involved in both creating the challenge and solving the problem. There is incomplete knowledge on several dimensions, asymmetric information and lack of knowledge sharing. To work towards solutions will impose a large economic burden on governments and the private sector companies. Lastly, the waste challenge is interconnected with other global problems.

There are significant socio-economic, cultural and political barriers for private companies operating in waste management and recycling industry in SSA. The structural barriers are making it hard to achieve profits and be financially sustainable over time. One of the primary barriers is the high costs of the system. The majority of the companies responded that their main challenges were connected to lack of existing infrastructure, lack of funding, high investment costs and high overhead costs, while also facing challenges to generate higher levels of income. More transparency on data as well as increased shared knowledge on solutions and challenges are vital to enable the development of the industry. Moreover, to allow further investments and lower risks related to the investments in the field. Challenges vary significantly from country to country, mainly depending on the political and financial situation in the country. Solutions to the problem will, therefore, vary across the region, across countries and communities.

The industry of waste management and recycling is too fragmented, with too many small-scale players operating on their own. In order to solve the wicked problem of inadequate waste management it is a need for consolidation in the market to create impact on a large scale. A more consolidated industry can allow for collective efforts to better manage logistics, implement technological solutions and get better access to funding. Arguably a solution can be to connect the existing market into a few larger players that can collect all types of waste, sort it and distribute different waste streams to different material recovery facilities. This can enable companies to become experts on their waste stream and enable higher levels of upcycling and create more value.

For a decade, governments, individuals and NGOs have been working to find solutions to avoid waste, throw less waste, reuse more and use less single-use plastic. Due to the outbreak of Covid-19, the demand for single-use plastic is increasing, and the global population look to the health-related benefits of single-use waste items. It is, therefore, now even more important to seek solutions to deal with waste and reuse and recycle as much as possible.

It is vital to have economic stability and funding available to build large scale waste management and recycling systems. Waste represents not just an environmental catastrophe, but inadequate waste management may also bring about an economic catastrophe, because of how it negatively affects public health. The handling of waste is as such not just an environmental issue, but it also represents a massive economic opportunity and an economic risk. In order to improve peoples' lives – which will require further economic growth – it is vital to get solutions to the waste challenge.

"*Good decision-making about how we manage the waste we create is one of the most important contributions humanity can make to reducing its impact on the natural world."*

Steiner & Newman, Global waste management outlook (UNEP, 2015)

8. Limitations and future reseach

An essential part of this master thesis was to experience first-hand how the waste challenge is affecting the population and private sector companies in SSA. Moreover, to better understand the context and culture the private sector companies are operating in. I had planned and booked a four-week research trip to meet with over 15 different companies and experts in Accra in Ghana, Addis Ababa in Ethiopia, Durban in South Africa and Lilongwe in Malawi. I had planned visits to waste management facilities, recycling facilities, landfills, collection centres, collection advisory and educational centres. Due to the outbreak of the Coronavirus in March 2020, I was unable to undertake the journey.

Luckily, I got the opportunity to speak to most companies over skype. Unfortunately, some of the intended companies of interest were unable to meet over skype due to a variety of different reasons, such as difficulties with internal logistics, temporary shutdowns or lousy internet connection from their home offices. I decided to use already existing external information from these companies where it was expedient.

Despite this significant change of circumstances, I did get meetings of good quality and collected more than enough data to do a thorough analysis of my problem formulation. Still, there were some companies I did not get the opportunity to meet that could have given the thesis interesting input. There were also some practical concerns which affected the number of companies I ended up interviewing. The practical concerns were related to a different culture in terms of planning, and for some scheduled interviews I was unable to get in contact.

An important limitation of this study is related to the selection of companies. Professor Albuquerque emphasised that "*Whatever is already going on, whether it is a success or a failure, is already a selection of what went through. Do not forget that many projects that never even saw the daylight, they were deemed unfeasible* (Professor Albuquerque. J, Interview Africa Long-Term finance initiative, 17.03.2020). The companies I have studied have already passed a lot of barriers and challenges to still be active in the industry. Therefore, it will be several important early-stage challenges of importance, yet not being discussed in this thesis.

An additional limitation of this master thesis is that the companies have few incentives to dig deep into their most considerable challenges or biggest headaches. It is natural that companies want to be portrayed positively. Nevertheless, I did get the feeling that the respondents were honest and openly shared information about the challenges they were facing. Some argued that they were satisfied that someone was researching into the challenges they are facing. My decision was not to name the companies anonymously, because it is in my intention that investors seeking information about field, can get familiar with these companies. Furthermore, hopefully, drive more investments to the companies.

For future research, it would be interesting to analyse a more diverse and larger selection of companies in SSA. This would enable a better understanding of regional, locational or company specific challenges. It would also interesting to look further into the entry barriers and the competition in the industry. In addition to how different ownership structures affected the value creation for different private sector companies.

To research effects and potential outcomes of different regulatory frameworks would be beneficial for governmental stakeholders. Moreover, to understand how the different policies, bans or regulation would affect the private companies, producers and individuals positively or negatively. Another thesis could be to do a comparative analysis on several wicked problems, to build on the theory and find out what solutions that are fit for different types of problems.

Since we are amid COVID-19, it would be interesting to research the future implications for the industry especially in terms of funding for larger scale infrastructure, and increased level of uncertainty in the industry.

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Appendices

Appendix 1: Interview guide

Interview guide

General introduction

- Thank you for meeting with me etc.
- Present the purpose of the study
- Ask for consent on using their company and name in my study
- Ask for consent to record
- Confirm language

Core questions about the business

- **Context they operate in**
  - What determines failure or success where you are in the value chain?
  - The context they operate in, is there recycling alternatives?
  - Their human development positives- do they employ people steadily?
  - Overall goal of the business?
- **Production**
  - How much waste do they upcycle or keep out of the system?
  - What are the main challenges in production?
  - Any barriers in the production?
  - What are their other environmental impacts? Water/power
  - Collection strategy?
- **Demand/supply**
  - What are the critical factors for supply and demand for your business?
  - What about the prices, are they fixed, or do they vary?
  - Are there market-based prices?
  - How is the demand, and how does it vary?
- **Business model**
  - How are your company funded?
  - What makes them financially sustainable at the point where they operate?
    - Or is it financially sustainable? Profitable?
  - Where they get their money? How funded? Local investors?
  - The importance of technology in the business model?
  - What are the biggest barriers in the business model?
  - Who are the funders?
    - Motivation for establishing
- **Challenges and opportunities**
  - What are barriers for the optimal flow in the value chain of waste management?
  - Where is it possible for future growth in the value chain?
  - Why have you succeeded so far?

- What are their goals going forward?
- Your thoughts about future challenges and opportunities for you as a company, anything that your company is more prone to than other companies. Or any opportunities you are well positioned to embrace?
- Where are the risks too great to handle?
- What is the role of the private sector companies?

Core questions of the business environment & political/cultural/socio-economic aspects

- **Governments/NGOs/multilaterals**
  - Overall insights on governance?
  - Stability: how does overall stability and local challenges affect the work?
  - Are the regulations supportive or destructive?
  - Any subsidies?
  - International funding?
- **Industry structures**
  - Network, how important is it?
  - Your thoughts about future challenges and opportunities for the industry?
- **Value Chain**
  - What is critical in the value chain?
  - Where is it possible to make profits?
    - As a private SME operating in sub-Saharan Africa is it better to take part in the entire value chain or parts of it?

- **How to finance a waste management system**
  - How can different players incentivise for change in the industry?
  - Do you think it is likely to see a world without plastic?
  - What are your thoughts on the end game of the industry?
  - What do you think is the future for waste management in your country? Is it possible?
- **Investment perspective**
  - Expected return on investments in the industry?
  - Risk factors, and how to minimize it?
  - Level of knowledge about the industry prior to investing?
  - Motivation for investing or getting involved in the industry?
  - What are you looking at prior to investing?
  - What is most important for the valuation?
  - How does lack of data affect it.?