INTRODUCTION

In recent years, there has been growing recognition of the danger that plastic waste has on marine life and the broader environment. Because of this, various approaches to combating the negative effects that plastics pose have been investigated and implemented. Since 2008, Rwanda, a developing country in the East African region, has placed an almost total ban on plastics. In the country, the importation, sale, and use of plastic bags is generally illegal and traffickers caught having illegal plastics are liable and can be fined or even jailed. The nation is one of more than 40 around the world that have banned, restricted or taxed the use of plastic bags, including globally influential countries like China and France, and its laws on plastics have been considered to be among the strictest in the world. Authorities in the country claim that plastics "are as bad as drugs" (Kimiko, 2017).

Most studies on Rwanda's approach to curbing the negative effects of plastics have evolved around the outcomes of the approach on Rwanda's economy and overall development. Due to this, countries all over the world have been encouraged to adopt similar policies on the use of plastics as doing so has positively impacted the country's economy and overall development (Clavel, 2014). There exists limited analysis, however, of the forces, both human and non-human, responsible for the success of the country's unique approach to minimizing the negative impacts of the use of plastics and how they influence each other. This is likely because the impacts of the use of plastics is mainly economic and environmental. Without proper knowledge of the forces responsible for the successful implementation of Rwanda's zero tolerance policy on the use of plastics and how they influence one another in doing so, groups concerned about the effects of using plastics and how to restrict them remain inadequately informed about the level of applicability of Rwanda's approach in other countries around the

world. As a consequence, concerned groups will likely propose approaches to minimizing the negative effects of using plastics that are not feasible for certain countries.

I will use the framework of actor-network theory (ANT) to examine why Rwanda's anti-plastic pollution network has been successful. The ANT framework will be used because the analysis will be centered on how a network of actors, not just technical but also social, environmental, legal, and many more can shape different approaches to solving the problem of plastic pollution. Knowledge from this study will provide a basis for explanations as to why the approaches that certain countries take to curb the negative effects of plastic wastes might not be conducive or feasible for other countries.

LITERATURE REVIEW

Scholars have examined Rwanda's approach to managing the negative effects that plastics pose. These examinations have mainly centered around studying the process behind Rwanda's implementation of a ban on the use and production of plastics in the country, and the outcomes of the implementation on Rwanda's economy and overall development.

Pritish Behuria uses the case of Rwanda's ban on plastics, together with the current state of the approach that has been taken by fellow East African countries of Kenya and Uganda to manage plastic waste, to discuss why implementation of bans on plastics can vary from country to country (Behuria, 2019). He establishes that explanations of why anti-plastic policies have been blocked in other countries should not solemnly rely on business power-based explanations, with the assumption that plastic manufacturers and the broader manufacturing sector have obstructed implementation, to explain why such policies have not been successful. Instead, variation in the implementation of such initiatives should be explained as shaped by pressures

from three levels: business power, the local environment, and the external environment. In this particular study, local pressures appear in the form of local environmental activism – which often works alongside external pressure from regional East African governments and international civil society groups and the United Nations Environment Programme (UNEP). Behuria also particularly emphasizes that the aforementioned pressure levels interact to influence the countries' implementation to a certain degree.

Mikaela Danielsson relies on sixteen interviews - and a number of documents as a complimentary source - performed in Rwanda during a two-month field study to analyze the implementation process behind Rwanda's environmental policy that involves the ban of plastic bags, and in so doing, lays out the most central actors involved and the interaction between them (Danielsson, 2017). She emphasizes that Rwanda's government and the local manufacturing industry have been the most important actors. More importantly, she stresses that the government has been the more central actor because the local manufacturing industry was too weak at the time of the implementation to influence Rwanda's final approach. She notes that alternative approaches to banning plastic bags such as collection, recycling, and taxing were considered, but in the end not chosen mainly due to lack of technical and financial resources, as well as an inadequate environmental consciousness among Rwandan citizens. She describes such factors, namely, time and resources, as contextual factors. Considering this, contextual factors such as time and resources were key to Rwanda's approach. Unlike Behuria, Danielsson notes the absence of international actors in Rwanda's approach to managing plastic waste. However, Danielsson's study does not discuss how the interaction between the actors involved accounted for the selection of Rwanda's approach to managing plastic waste.

Both scholars establish that there is a set of fundamental factors that influence what approach a given country takes towards managing the negative effects of plastics and that they (the factors) are interconnected to a certain degree. Using ANT, I will build on the work by both scholars to examine why Rwanda's anti-plastic pollution network has been successful. This will involve an analysis of the network of the main human and non-human actors involved in Rwanda's approach to managing plastic waste.

ACTOR-NETWORK THEORY

The science, technology, and society (STS) concept of ANT provides an effective framework for analyzing why Rwanda's anti-plastic pollution approach has been successful because it allows for the heterogeneous components and connections of this approach to be isolated and critically examined. In this paper, ANT will be based on the structure laid out by Michel Callon, Bruno Latour and John Law. Fundamentally, ANT attempts to simplify heterogeneous elements with heterogeneous relationships into a cohesive network of human and non-human actors defined by their relative positions within the network (Callon, 1987). As a result, ANT lays out how networks come into being, traces what associations exists, how they move, how actors matriculate into a network, how parts of a network form a whole network and how networks achieve temporary stability. Every entity is an actor-network, irreducible to either an actor or a network alone (Callon, 1987). Conversely, an actor is any source of action, regardless of its status as animate and inanimate, and at the same time, an actor-network is an "actor whose activity is networking heterogeneous elements and a network that is able to redefine and transform what is made of" (Callon, 1987). In the sense of ANT, a network is a map of the way in which actors define and distribute roles and mobilize or invent other actors to the play these roles (Law & Callon 1988). For ANT, all that matters is the associations that exist

between heterogeneous actors, and it is these associations that describe how networks come to be larger and more influential than others, how they come to be more durable through enrolling both social and material actors, and where power comes from and how it is exerted. Due to this, power, or lack thereof, is a direct result of the level of association or connectivity that exists between a set of actors, not the independent strength of the actors themselves. Callon's concept of translation provides an actual conceptualization of what is actually occurring during the development and progression of a network (Callon, 1987).

Translation is the process through which functioning actor-networks are formed by and around a primary actor. Callon lays out four phases of translation: problemization, interessement, enrolment, and mobilization (Callon, 1986). In problemization, a primary actor appears, defines the problem at hand to be addressed by the network, identifies the necessary joint actors that must be recruited, and sets itself down as the "obligatory passage point" (OPP) through which the other actors must pass to form a stable and mutually beneficial network. In interessement, the primary actor attempts to actively recruit the other actors into the network and to align their interests with the problem and OPP originally defined by the primary actor. In enrolment, the other actors that have aligned with the problem definition are allocated roles and positions within the network by the primary actor. Importantly for this paper, enrolment also demands that the other actors in the network actually accept and faithfully carry out their assigned roles as intended. Finally, in mobilization, the primary actor takes up its role as the director and spokesperson for the actor-network, which begins to function as a cohesive whole. Callon also illustrates how an actor-network defined in such a way can fracture or fail if one or more of the actors refuses or is unable to perform the role assigned to it by the primary actor (Callon, 1986). Similarly, I will use ANT to discuss why a heterogeneous actor-network has not failed.

Furthermore, Callon's concept of translation will enable me to show how Rwanda's government, as a primary actor, has been able to enforce an almost total ban on plastics by means of its unique associations with other actors involved.
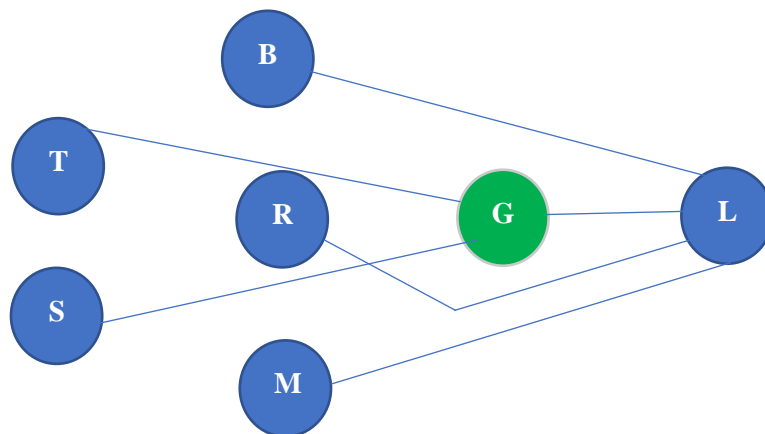
ANALYSIS OF RWANDA'S ANTI-PLASTIC NETWORK

Construction of Rwanda's anti-plastic network

The first step in understanding why Rwanda's anti-plastic actor-network has not failed is to define the heterogeneous actors that are present within the network. I have identified the central human actors based on the different groups that have been relevant to Rwanda's anti-plastic initiative based on the work of Behuria and Danielsson. These actors are defined as follows: (i) *the Rwandan government* (including environmental protection and management institutions and state law enforcement agencies), which is responsible for designing and implementing policies through which the country functions; (ii) *plastic manufacturers* that produce and sell plastics; (iii) *residents* of Rwanda that use plastics and (iv) *businesses* in Rwanda that use and sell plastics, and those that do so with alternatives to plastics. Similarly, I have identified the central non-human actors based on the non-human factors that influenced Rwanda's plastic management approach. The actors include: (v) the *time* when Rwanda's ban on plastics occurred (vi) *resources* needed to implement alternatives to Rwanda's current approach to managing plastic pollution and (vii) the *law* that was passed banning the use, production, and sale of plastic bags in the country.

Upon defining the central actors within Rwanda's anti-plastic pollution network, the next step is to analyze the various associations that could exist between the actors. I will draw these associations by tracking the network's formation through the phases of translation as laid out by

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Callon. Danielssonn's study of the procedures that the ban of plastics in Rwanda followed provides a rational basis from which these phases can be drawn. In her interviews of numerous civil servants that were directly involved in the implementation of the ban and the business parties that were affected by it, Danielssonn's findings characterized the government's approach to managing plastic pollution as repressive and also noted that other human actors such as plastic manufacturers, particularly local manufacturers, had little input in the process. Based on this study and the pivotal role that the government has played in the implementation of the process, I assume that the government of Rwanda is the primary actor around whom Rwanda's anti-plastic pollution actor-network formed through translation.

Figure 1 – Rwanda's anti-plastic actor-network. G represents government, L represents law, R represents residents, B represents businesses, M represents manufacturers, T represents time, and S represents resources.

The general form of Rwanda's anti-plastic network is shown in Figure 1, where all connections are symbolic of potential associations intended by the primary actor (shown in green) during the translational process. During problemization- the first phase of translation, the government of Rwanda, through the Rwanda Environmental Management Authority, determined

that that the nation was critically facing a problem of plastic pollution after conducting a study on the impact of plastics on the environment and other aspects of the country. Based on this problem definition, the government passed a law banning the sale, use, and production of plastic bags in the country. By doing so, the government laid out the anti-plastic network by connecting the non-human actor of law to the human actors of the residents of Rwanda, businesses, and plastic manufacturers at the OPP.

During intersegment, the government was able to recruit these other actors into the network by orienting their interests to the problem definition. Through the law, the government first recruited residents and businesses, who are the primary market for plastic bags, and then plastic manufacturers, who produce plastic bags. Residents can be considered to align with the problem definition in part because they believe that getting rid of plastics is the best approach to conserve and protect the environment they live in, and also because they don't want to face the repercussions of breaking the law that include imprisonment and monetary fines (Kimiko, 2017). Businesses can be considered to align with the problem definition because doing so protects them from the repercussions of breaking the law that include imprisonment and monetary fines. Lastly, plastic manufacturers can be considered to align with the problem definition solely because they cannot afford to break the law. Due to pressure from plastic manufacturers and businesses, the government then considered alternatives to an almost-total ban on plastic bags such as recycling and increasingly taxing them. However, the lack of technical and financial resources to carry on with the proposed alternatives disregarded them (the alternatives). Furthermore, the seriousness of the risks associated with avoiding a ban at the time of considering alternatives pushed for the ban to be implemented. Consequently, the government

recruited time and resources to carry on and implement the ban via the law and joined the network by its duty to pass and enforce it (the law).

In the ideal enrollment phase, residents of Rwanda, businesses, plastic manufacturers, the time at hand, and resources all accepted their assigned roles and formed the intended associations as in Figure 1. Considering this, plastic manufacturers stopped producing plastic bags, residents and businesses stopped using them, and the non-human actors of time and resources continued to incentivize the government to maintain the law in place. As shown in Figure 1, the human actors pass through the OPP indirectly because, while the government is a fundamental part of the network's access, it primarily associates to the human actors via the law. Similarly, the non-human actors of time and resources associate with the human actors indirectly because they incentivize the government to hold the law, which directly associates to the human actors. Through all this, the government maintains its rank as the OPP via the law and its direct association with other non-human actors at hand.

With Rwanda's anti-plastic actor- network defined, I will use the roles that each of the actors play and continue to play within the network to explain why the country's actor-network has remained intact.

Rwanda's government and its role in maintaining the country's anti-plastic actor-network

As the OPP, the government of Rwanda fundamentally initiated the country's anti-plastic approach. Considering this, to understand why the country's anti-plastic actor-network has remained intact, it is important to primarily consider the government's role within the country's anti-plastic actor-network. Based on interviews of Rwanda's government officials conducted by Danielssonn, Rwanda's anti-plastic initiative is described as one that originated "all the way up

from the top government as even the President was much engaged" (Danielssonn, 2017). To provide some context, Rwanda has been regarded as an authoritarian state by a plethora of human rights groups, and it is said that Paul Kagame, the country's president since 2000, solely guides the path the country takes (Danielsson, 2017; Seay, 2016). Considering this, it is very likely that the government was entirely united in its approach to managing plastic waste at the time of the initial implementation of the ban. Furthermore, the government and the political nature of the country has not changed ever since the ban on plastic bags was implemented. Due to this, and considering that the ban on plastic bags is still in place, it is very likely that the government remains united in its approach. This partly explains why the anti-plastic actor-network initiated by the government remains intact today. To implement its anti-plastic approach across the country, the government passed a law that prohibited the sale, use, and production of plastic bags, and the law still applies today. As I have noted, anyone caught producing, using, and selling plastic bags within the country is subject to imprisonment, monetary fines, and sometimes, public shaming. The government has largely entrusted the responsibility of enforcing this law to the national police, whose enforcement, per a New York Times article, "is easily accepted in a country with authoritarian tendencies" (Danielsson, 2017; Kimiko, 2017). To enforce the law, the police operates everywhere from villages, airports, and across all its borders (Danielsson, 2017; Kimiko, 2017). Furthermore, the police has plastic-bag vigilantes everywhere in the country that tip it off about suspected sales and use of plastics (Kimiko, 2017). In addition to using the national police to enforce its anti-plastic law, the government has used propaganda to implement the ban; anti-plastic messages have been broadcasted via national television and other media outlets owned and operated by the state, and in schools, children are taught not to use plastic bags (Danielsson, 2017; Kimiko, 2017). Furthermore, the government has

emphasized that banning plastic bags has resulted in the exceptional cleanliness of the country relative to fellow African nations (Danielsson, 2017; DW English, 2018). The residents of Rwanda take pride in their country's cleanliness, which has also been praised by the international community and associated to the boost in the country's tourism sector (Davis, 2019). Considering this, it is likely that they (the residents) adhere to the law at their own free will and free from the authority of the government. To eliminate the use of plastic bags on the side of plastic bag consumers and businesses that use plastic bags in their operations, the government has taken initiative to promote the use of alternatives to plastic bags such as paper bags and khaki handbags (Danielsson, 2017). Similarly, to eliminate the need for plastic bags on the manufacturers' end, the government encouraged manufacturers to re-orient their business model towards recycling of plastics by providing tax incentives to do so (Danielsson, 2017; Clavel, 2014). In summary, the government has kept Rwanda's anti-plastic actor-network intact mainly through using authoritarian rule and propaganda to align the human actors with its anti-plastic approach.

Because actors recruited by the government need to carry out the exact roles assigned to them by the government as the OPP for Rwanda's anti-plastic actor-network to remain intact, I will now discuss in more detail how the various actors that were recruited by the government have reacted to their assigned roles.

Response of residents and businesses

The residents of Rwanda and businesses in Rwanda have to accept the roles set for them within the anti-plastic actor-network by the government for the actor-network to remain intact. Both accept assigned roles by avoiding the use of plastic bags. Rwanda's residents have never officially protested the plastic-bag ban since its implementation in 2008 (Behuria, 2019). Due to

this, it can be considered that they have generally conformed to the plastic bag ban since its implementation. The only form of opposition that residents of Rwanda have expressed towards the ban of plastic bags has entailed occasional participation in a plastic-bag black market within the country and smuggling plastics from neighboring countries of Uganda and the Democratic Republic of Congo (Behuria, 2019; Pilgrim, 2016). However, the government is aware of the existence of the market and is continuously fighting it through sensitization of the public, continued inspection, and application of the law to those caught in the act (Behuria, 2019; Pilgrim, 2016). As I said, the general conformational response of the residents can be explained by the alleged authoritarian nature of the country. Additionally, as I already noted, the conformational response is also in part due to the value residents associate to a clean environment (Davis, 2019). Businesses have generally followed the response of residents and adopted the use of alternatives to plastic bags such as paper bags, whose use has been promoted by the government (Behuria, 2019; Danielsson, 2017). As I noted earlier, business' response to the ban could be attributed to the high cost of breaking the law. In summary, residents and businesses have kept the country's anti-plastic actor-network intact by avoiding the use of plastic bags. Both residents and businesses have done so because the consequences of breaking the law are too dire, and residents have avoided the use of plastics in part because they value a clean environment, which is a consequence of the ban of plastics.

Response of plastic manufacturers

For Rwanda's anti-plastic actor-network to hold, manufacturers have to adopt the role set for them within the actor-network by the government by shutting down production of plastics. Danielsson and Behuria note that plastic manufacturers stopped production as soon as they were required to do so by the government through the law. As I noted earlier, plastic manufacturers

can be considered to align with the government because they cannot afford to break the law. Danielsson and Behuria also note that at the time of the implementation of the ban, the local plastic manufacturing industry was too weak and disorganized to challenge the government. Considering that the ban has been in place for almost twelve years, it is likely that the industry remains weak, if not weaker than it was at the time of implementation. Therefore, manufacturers have kept the anti-plastic actor-network by

Changes in time, resources, and the law

Finally, the response of non-human actors is equally important when analyzing why Rwanda's anti-plastic actor-network has remained intact because they (non-human actors) partly make up the actor-network. As I noted earlier, the government of Rwanda chose to pass and implement a law banning the sale, use, and production of plastic bags in 2008 because it was the right decision for the progress of the nation at the time, and the country also lacked resources to pursue alternative approaches. Considering that the law is still in place, it is likely that the ban is the most conducive approach for current times. It is also most likely that the country still lacks the resources necessary to pursue alternative approaches. In summary, time, resources, and the law have kept the anti-plastic actor-network intact by staying the same since the implementation of the plastic ban.

As I have shown, the authoritarian nature of Rwanda's government has significantly helped keep the country's anti-plastic actor-network intact by enforcing that all human actors play the roles assigned to them for the anti-plastic actor-network to hold, and also by employing non-human actors that support its anti-plastic initiative. Proponents of this argument, like

Danielsson and Behuria, however, tend to overstate the role of the authoritarian nature of the government as it relates to keeping Rwanda's anti-plastic actor-network intact. They do so by disregarding the response from human actors to the anti-plastic approach that comes from free will, which is separate from the government's authority. As I have shown, residents of Rwanda adhere to the role(s) set for them by the government within the anti-plastic actor-network because their immense value for a clean environment aligns with the roles set for them by the government within the anti-plastic actor-network.

CONCLUSIONS

In this paper, I have used the sociotechnical concept of ANT to analyze why Rwanda's anti-plastic actor-network has remained intact. Through an analysis of the translational process responsible for the formation of the country's anti-plastic network, and the associations that all human and non-human actors have within the network, it is evident that the government, as the OPP, has managed to keep the network intact by using its power to pass a law that aligns all other actors with its anti-plastic goal. The government has relied on non-human actors of time and resources to uphold and implement the law, and through the law, the government has been able to align the human actors involved within the network with its anti-plastic restrictions. Furthermore, the other actors have assumed the role assigned to them by the government within the network and can be considered to be content with it. With this knowledge, the general reader will be more aware of why plastic waste management approaches employed by certain countries or regions are not conducive for other countries.

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