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Plastics Waste Metabolism in a Petro-Island State: Towards Solving a "Wicked Problem" in Trinidad and Tobago

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Abstract: Island systems have limited geographical, ecological, and social capacity to metabolize waste materials produced by the economic activities of their growing populations. Conceptualized as a 'wicked problem', the faults and weaknesses in waste management systems on islands continue to cause acute and cumulative ecological and human health impacts. Trinidad and Tobago is one such island jurisdiction grappling with this situation, particularly being a petroleum-dependent economy. Through the lens of neo-institutional theory, this case study of waste management in Trinidad and Tobago unpacks the efforts, reactions, drivers and circumstances that have led to various successes and failures but no definitive solutions over time, especially regarding plastics and packaging materials. We identify three temporal phases of policy evolution that have altered the waste metabolism trajectory to date: (1) government led patriarchal approach of traditional landfilling combined with behavioral change campaigns to reduce, reuse, and recycle, (2) to a more democratic, shared burden, public-private partnership approach combined with attempts at incentive-based regulations, (3) to the present, more private sector-led voluntary bans on production and use of plastics. This study contributes to our understanding of the institutional factors that shape the search for solutions to the wicked problem of island waste metabolism.

Keywords: plastics; Trinidad and Tobago; institutional; metabolism; waste management; islands; public-private partnerships

1. Introduction to Waste Management on Islands

Waste generation is increasingly regarded as one of the most urgent environmental issues of our contemporary era, one demanding global attention. Relative to 2.01 billion tonnes in 2016, the yearly waste generation around the globe is predicted to reach 3.4 billion tonnes in the coming 30 years, representing an increase of 70% in global waste by 2050 [1]. The plight in Small Island Developing States (SIDS) bears no exclusion. With the continuous improvement in their lifestyle and economies, consumption and waste disposal patterns have changed radically. Unlike the agrarian period, the emergence of non-bio-degradable materials in today's time is posing a challenge on island territories [2]. The average waste generation of SIDS inhabitants on a daily basis is 2.30 kg per person compared to the global average of 1.55 kg [3].

The ongoing growth of solid waste and the delayed rate of degradation of most components have been reported as the fundamental factors causing a constant rise in marine litter, notably in the form of long-lasting plastic waste, found at seas and coastal regions [4]. Statistics depict that global plastic production has grown from 1.5 million tonnes in 1950 to 348 million tonnes in 2017 [5]. Owing to its characteristics of being lightweight and non-biodegradable, plastic is hugely favored by manufacturers and consumers. However, these properties are the reasons plastic is troublesome to the marine environment, while the former ascertains its diffusion in the seas, the latter ensures its everlasting existence [6].

With waterways being the dumping ground for plastic waste and encompassing its impacts on the environment, human health, economic and aesthetic value, plastic management is a growing multi-dimensional issue [3,7]. The geographical feature of islands elevates their vulnerability to plastic debris given that dumping areas are located next to the seas or along river streams. Estimates suggest that 80% of marine waste arises from land-based activities and around 2% of the yearly plastic production find their way into the seas. Plastics have been acknowledged as a "silent killer" residing in the marine ecosystem [6].

Several studies have been well documented, bringing forward that islands are becoming the source, temporary reservoir, and final sinks of plastic waste. Back in 2010, the Indian Ocean was discovered to contain a garbage patch, the third major plastic collection spot following the North Pacific Ocean and Pacific Atlantic Gyre. With around 90% of mostly plastic wastes being dumped into the Indian Ocean, over 40 countries, both littoral and African coastal areas, are severely polluted [8]. The remoteness of islands no longer guarantees their protection against plastic debris. For example, Henderson Island in Eastern South Pacific, has been identified to possess the highest record of plastic pollution, notably, 99.8% of the total waste collected on the beach during their study [9]. A second study by [10] highlighted the substantial plastic accumulation on Cocos Island, located on the northern coast of Australia. An estimate of 238 tonnes of anthropogenic waste was reported, out of which 25% were categorized as disposable plastics.

An effective waste management system is viewed as a vital factor to promote sustainable and healthy communities, however, this notion is frequently neglected in low-income countries [1]. From the study of [11] on Seychelles Island, inadequate waste management has been identified as a fundamental driver in making uncontrolled waste disposal an environmental threat. On the other hand, others reported that many countries are finding themselves in a dilemma whereby they can no longer control the amount of waste being generated through their waste management systems. Consequently, large plastics and microplastics eventually land into rivers and seas [12].

Considering the Waste Framework directive under the aegis of the European Standard, islands are required to have proper waste management systems meeting the main objectives of (i) reducing waste generation, (ii) landfill disposal, (iii) reusing and recycling, and (iv) valorization of energy. Nonetheless, island systems around the globe, ranging from Hawaii and the Caribbean area to the Canary Islands, Cyprus, and the Azores, waste management is a problematic sector [13]. Waste generation coupled with tourism association in islands is emerging as an acute environmental burden. Inundated by the sheer capacity of tourism waste generation, waste management in islands is further exacerbated. Several researchers summarised the adverse impacts of the tourism industry in island settings. Waste from tourism has nearly doubled the regional generation rate. Moreover, exposing the community to new cultures and lifestyles, an influence on the consumption and disposal paradigm is being observed [14–16].

A multitude of studies has highlighted the different constraints leading to the mismanagement of wastes in islands around the world. These include frequent problems like inadequate governmental support, lack of long-term planning and insufficiency in skilled personnel, amongst others [17]. Others reported that despite initiatives to reduce waste production, recycling was still at an embryonic stage in several island communities [18]. The lack of markets or markets of sufficient size for recycled materials is also a barrier [19]. Recent studies have identified similar contributing elements to the

difficulty of managing wastes: New studies indicated issues of weak governance, shortcomings in formal procedures, land-use competition, and absence of efficient technologies [20]. The cost of operating waste disposal facilities and waste transportation is often challenging for highly indebted island governments [21]. Lack of waste disposal sites and improper landfill planning and construction, owing to the small size and isolated characteristics of islands were mentioned in [22].

2. Island Waste Metabolism Is a *'Wicked Problem'* for Policy-Makers

The demarcation line between "tame" and "wicked" problems was first introduced by Rittel in 1973 [23], where the term "wicked" was used to characterize challenges that were misleading or difficult to detect. They are often affected by the presence of knotty political and social aspects, with such aspects often evolving over time. Wicked problems affect whole systems, which therefore brings forth another problem of framing since the problem can be defined from the different viewpoints of various stakeholders [23,24]. Rittel proposed that the key characteristics of wicked problems include (i) the identification of wicked problems relies on the diversity of opinions of stakeholders, (ii) wicked problems entail no right or wrong, true or false solutions, (iii) since wicked problems have multiple inputs, there are hence a myriad of solutions, (iv) given that each problem is distinct, solutions are also unique and previously identified solutions cannot be applied to new problems, (v) every identified wicked problem leads to another wicked problem [25,26].

Island waste management challenges remain common and the impacts are heightened due to their locations and environmental sensitivity making the situation complicated [3]. Variations in socio-economic and geophysical characteristics across different islands constrain the ability to deploy standardized or scaled solutions to waste streams [27]. In Caribbean countries, variations in the volume of waste, socio-economic standing of communities and traditional waste handling practices all contribute to different national waste management strategies [28].

Given the complex and multifaceted challenge of island waste management, we postulate that it can be framed as a 'wicked problem'. Many of the premises of what characterizes a 'wicked problem' in the field of public policy [29] are notable in the island waste management discourse. These characteristics include (1) wicked problems actually being comprised of a number of overlapping problems where solution sets for one overlap often intensify the magnitude of other overlaps, and (2) wicked problems entangling numerous diverse stakeholders making communication, process coherence toward solutions and negotiations very difficult.

2.1. Tackling Such a Wicked Problem

The literature has decidedly veered towards the premise of 'coping' with or mitigating wicked problems and less so towards ultimate solutions. Three veins of studies look at tackling wicked problems. First is one that is now widely elaborated, deriving from [30] in the design thinking and systems approaches to social planning. This suggests understanding the components and relationships within problem contexts so as to work towards better outcomes. Evolving from this approach has been, for example, the 'integrated systems design' such as Elia and Margherita (2018) which emphasize collective approaches to problem resolution and curating relevant tools and analytical guidelines towards such. This vein of studies tends towards reductionist and mechanistic searches for more favorable problem outcomes. Second, are those studies that promote interdisciplinarity and innovation through collaborative frameworks as the way forward. Here, the value of the eventual coping approach to the 'wicked' problem under investigation becomes less deterministic and more probabilistic. Third, are a growing cohort of studies that are concerned with the underlying motives and determinants of the decisions of actors that are consequential to the problem at hand and its future evolution. Encountered are studies interested in 'management' of problems by leveraging underlying 'carrots and sticks'. [31] for example examines power differentials among actors as the premise for problem-solving, suggesting either authoritative, collaborative or competitive coping strategies. Several others apply psychological frameworks to shed light on actors' motives [32].

2.2. Analysis Through the Neo-Institutional Lens

It is primarily in this third vein of approaches that we introduce neo-institutional theory as an appropriate framework for unpacking and understanding the underlying nature, motivators, and determinants of 'wicked' problems such as island waste metabolism. According to [33],

> "Institutions are social structures that have attained a high degree of resilience. [They] are composed of cultural-cognitive, normative, and regulative elements that, together with associated activities and resources, provide stability and meaning to social life. Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines, and artifacts. Institutions operate at different levels of jurisdiction, from the world system to localized interpersonal relationships. Institutions by definition connote stability but are subject to change processes, both incremental and discontinuous."

Institutional theory, therefore, provides a workable framework to analyze the dynamics of actors, stakeholders, and situations in the operating environment. Past studies such as [34] suggest the main institutional complexities related to waste management include weakened regulations and policies, lack of public awareness and uncontrolled waste disposal techniques, but relevance to island context is to date unverified. The application of neo-institutional theory, therefore, describes waste management in terms of policy decisions and actions over time, driven by three fundamental institution forces.

First are the coercive or regulatory forces that empower institutions with the authority to sanction and to set pertinent rules, laws, and regulations, as well as the roles and responsibilities of the involved agencies. Although waste management regulations are enacted in numerous island nations, even basic challenges in enforcement mean that illegal dumping and waste burning, for example, are everyday practices [21,35]. Coupled coercive forces is the influence of the political agenda and commitment to various politically favored solutions. [36] points out that island waste legislation remains archaic and largely unconsolidated, lacking in defined roles and responsibilities, predominantly concentrated on "end of life responses" [2].

Second are normative drivers that involve pressures to take actions that are widely derived from shared beliefs of appropriate behavior, often promulgated by well-coordinated and established actors in society. At the forefront of these are typically community and environmental activist groups, as well as professional associations and business alliances [37]. The increasing professionalization of the waste management sector has been a pivotal factor in raising the profile and importance of waste metabolism on the political and social agenda. Also, importance has been the increasing expertise and capabilities of non-governmental organizations [37].

Third are cultural or cognitive drivers that focus on persistent changes in conceptual beliefs, mental models, and interpretations of shared meanings that societies go through and lead to significant policy changes. This perspective also stresses the importance of achieving change that is internalized by society and culturally supported in order for it to be satisfying and sustainable in the long run. Central to how prevailing societal culture influences waste management is changing norms, attitudes, beliefs, and perspectives across key stakeholders. Recent surveys in island contexts suggest growing awareness and concern about waste issues including reducing volumes and proper disposal [35,36].

Waste management actors both shape and navigate the institutional drivers in the operating environment including norms, rules, and expectations that define what constitutes legitimate behavior. These actors are, therefore, considered to be legitimacy seeking and susceptible to the institutional drivers identified. The legitimacy building actions that actors take can be in different forms, just as these actors are motivated differently by the prevailing institutional drivers. These can include actions geared towards accruing moral, cognitive and/or strategic legitimacy.

The institutional environment and the strategic maneuvers of actors including government, the business sector, and civil society, all shape the evolution of island waste metabolism. The institutional context and the maneuverability of actors are also shaped by the unique limited and constrained context of island geography, resources, and development trajectories [37]. Figure 1 is an illustrative

summary of the conceptual framework through which we analyze the case study of Trinidad and Tobago in order to better understand the roles of institutional drivers and actors in waste, particularly plastics, metabolism to date, therefore providing insights pertinent to further disentangling of this wicked problem.

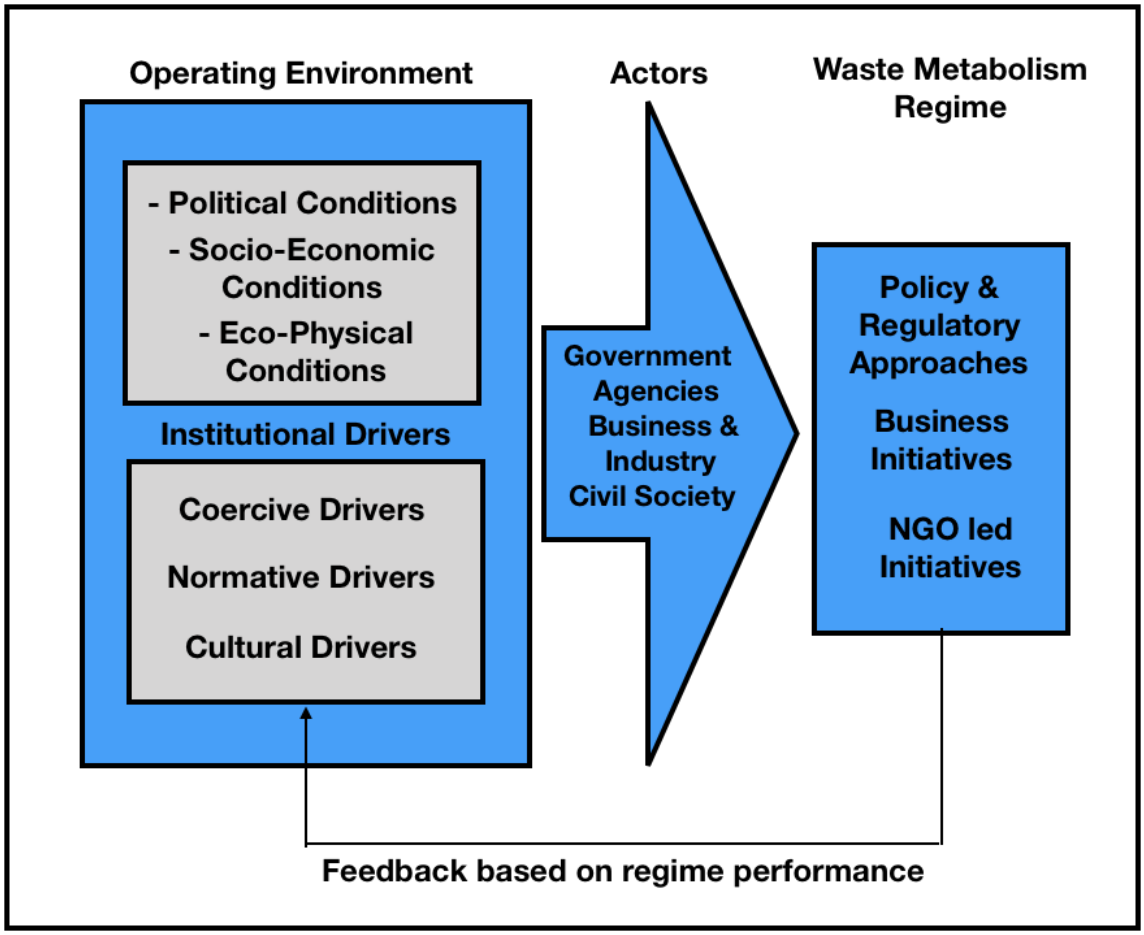

Figure 1. The Institutional Framework in which island waste metabolism exists.

3. Methods

The study is designed as a single explanatory case study research design [38,39] focused on Trinidad and Tobago given the nature of the research objective which is to understand the institutional drivers for waste management policy decisions and management actions over the last decades [39].

Multiple data collection tools and materials will be applied to triangulate and validate primary and secondary data collected from different sources. These include archival data collection and qualitative interviews. Secondary information was collected from public sources including internet and websites (organization websites, newspapers) as well as requests from government and corporate entities for annual reports, publications and communications materials such as quarterly newsletters. Official government archives were also consulted rendering items including Annual National Budgets and breakdowns for public agencies, Public Service Investment Portfolios with allocations to new government projects and national statistical data. Secondary information was important to compliment interviews during the research process but also for content analysis to identify general themes to further explore in interviews [38].

In order to identify interviewees, an initial listing of the key organizations involved with waste metabolism in Trinidad and Tobago was established. The list was constructed through reviews

of the secondary information acquired, government reports and newspaper reports (The study approach including identifying key organizations involved in waste management and key informants was facilitated by two study researchers who worked in the Trinidad and Tobago environmental sector.). At least two representatives of each organization were identified as potential informants and requests for interviews were made. For each organization, the target informants were (i) the chief executive or highest-ranked officer involved in waste regulations and (ii) the organizations' technical or operations lead with direct responsibility for waste-related regulatory or operational activities. During this initial round of interviews, where informants identified additional potential informants, these recommendations were evaluated by the research team and a second round of informants from this snowball approach were interviewed [40].

A semi-structured interview approach was adopted for this study [38], whereby a specific interview guide with similar questions was applied to each purposeful informant. The actual wording of the questions was adjusted to suit specific informants, however, the same general lines of inquiry were pursued for all informants [41]. This enabled comparability within and between different informants across the waste metabolism value chain. In face-to-face or online conference call format, interviews lasted approximately thirty minutes.

The proposed data analysis process draws heavily from the constant comparative method which enabled the ongoing analysis and interpretation during the process of data collection itself, between primary and secondary information. The inductive analytical approach of pattern matching and taxonomy coding allowed substantive concepts and themes to emerge primarily from the narratives after which we ascertained which, if any, were associated with the institutional drivers, actors, and actions, operating environment and regulatory or non-governmental waste management decisions and directions [42].

While interview methods are noted for their relative strengths including the ability to focus directly on case study topics, they may also be compromised due to researcher bias, response bias, and inaccurate accounts from informants due to poor recall [42]. To address these weaknesses, we triangulated information from interviews with secondary information. Threats to reliability were reduced in the study design by using semi-structured questionnaires. This approach allowed enough flexibility to capture the story but enough structure to build consistency and ensure quality. Reliability was also reinforced by interviews undertaken by the researchers themselves. Internal validity can be challenged in single case studies. Here it was minimized by triangulation of data sources and the use of multiple respondents at multiple organizational levels.

4. Results and Analysis

4.1. Case Study of Island Waste Metabolism in Trinidad and Tobago

4.1.1. The Current Situation

The magnitude of the waste challenge is illustrated by the most recent waste characterization conducted in 2010 [43]. It identified the different types of waste as follows:

On a national level, with the exception of organic material, plastics dominate the waste-landscape, as a percentage of total waste, particularly in Trinidad (see Figure 2). Notwithstanding this, plastic waste constitutes at least a fifth of total waste on both islands. As it relates to volume, the waste characterization study in 2010 indicated that 700,000 tonnes had been delivered to landfills in Trinidad for the year of the study, while approximately 17,228 had been delivered to the landfill site in Tobago [44]. More recent data pertaining to the character of waste is not available. Figures 3 and 4 illustrate the waste characterization for Trinidad and Tobago respectively, for the year 2010.

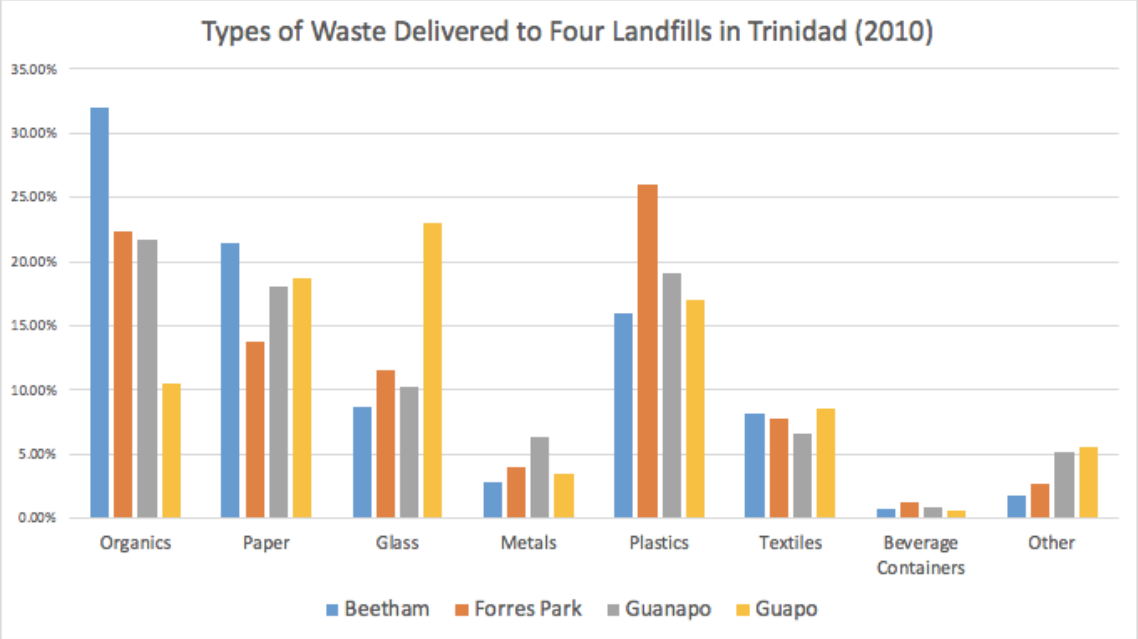

Figure 2. Waste characterization in Trinidad and Tobago for the year 2010. Source: National Waste Recycling Policy, Government of the Republic of Trinidad and Tobago [43].

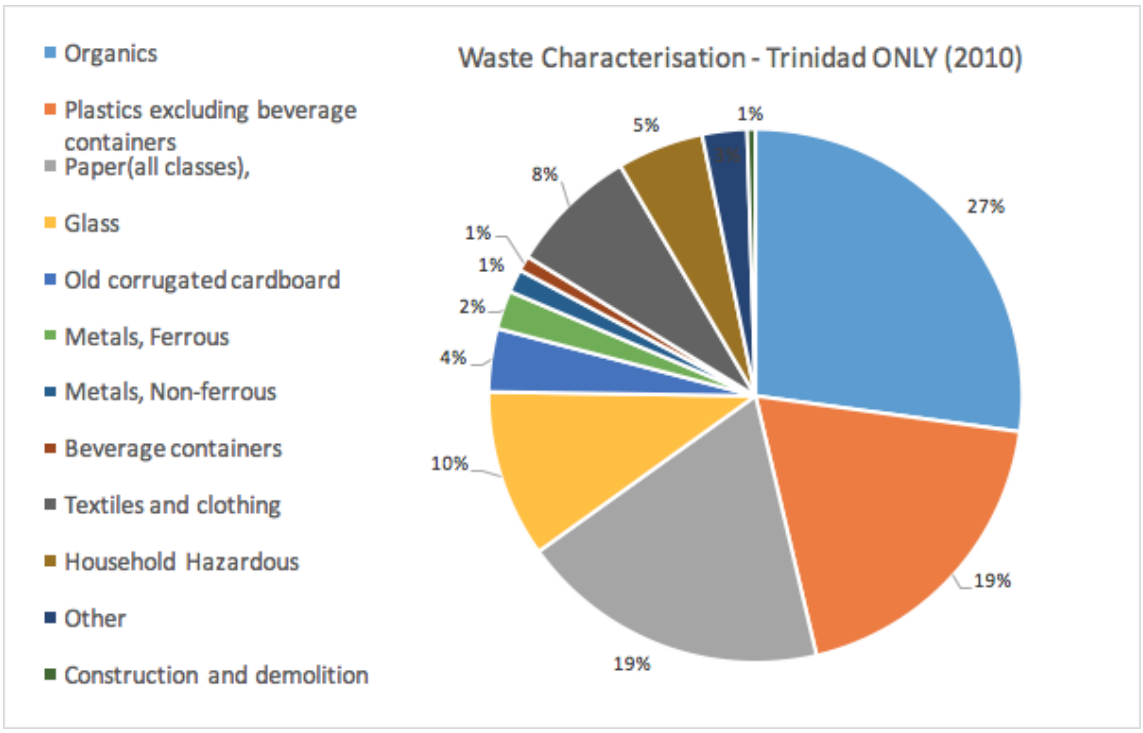

Figure 3. Waste Characterization for the island of Trinidad only, in 2010.

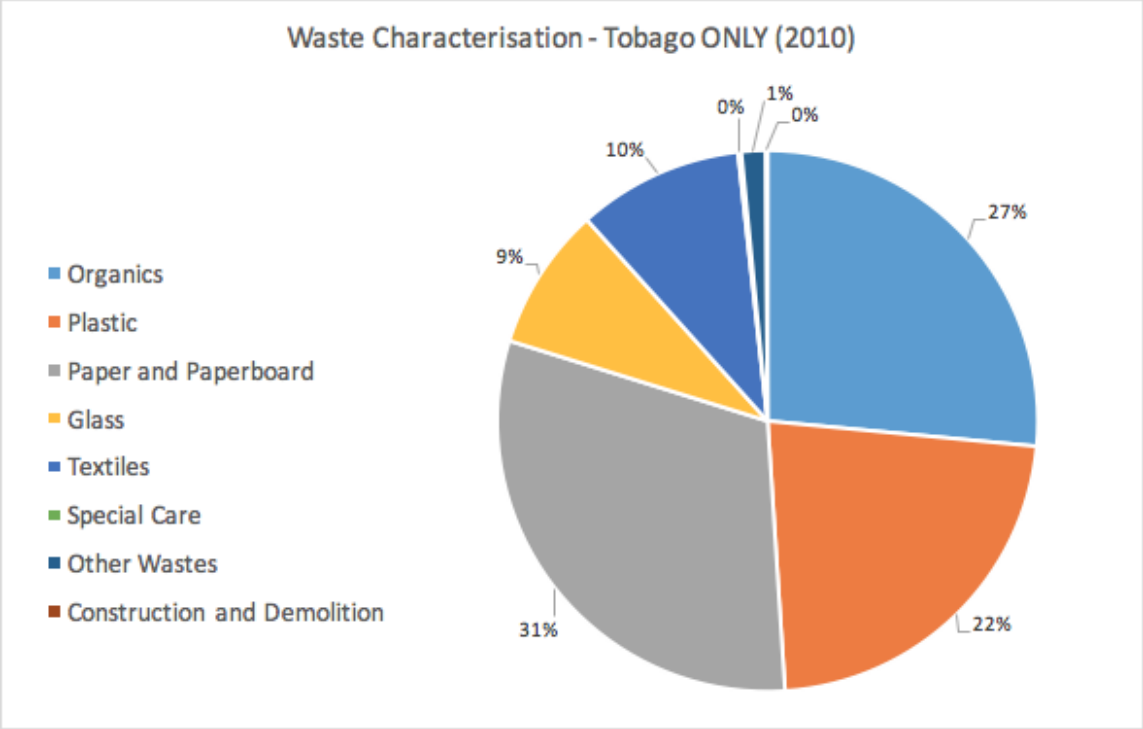

Figure 4. Waste characterization for the island of Tobago only, in 2010.

In terms of expenditure on solid waste management in Trinidad and Tobago, over the course of the last 10 years, Government of Trinidad & Tobago (GORTT) allocations have fluctuated but have decreased overall, from a high of Trinidad & Tobago dollars (TTD) $8.7 million in 2010 to TTD $6.67 million in 2020 (See Figure 5). No expenditure was reported as being allocated to solid waste management for 2015. That aside, in light of recent attempts to improve recycling locally, particularly through the establishment of a Waste Recycling Management Authority (which will initially be housed under the Solid Waste Management Company of Trinidad and Tobago (SWMCOL)), funding allocations have increased in recent times. In fact, in 2019 TTD $1 million was allocated to a "Public Sector Recycling Programme". Similarly, in the 2020 allocation, TTD $5 million was set aside for the upgrade of recovery and recycling facilities, plant and equipment" [45].

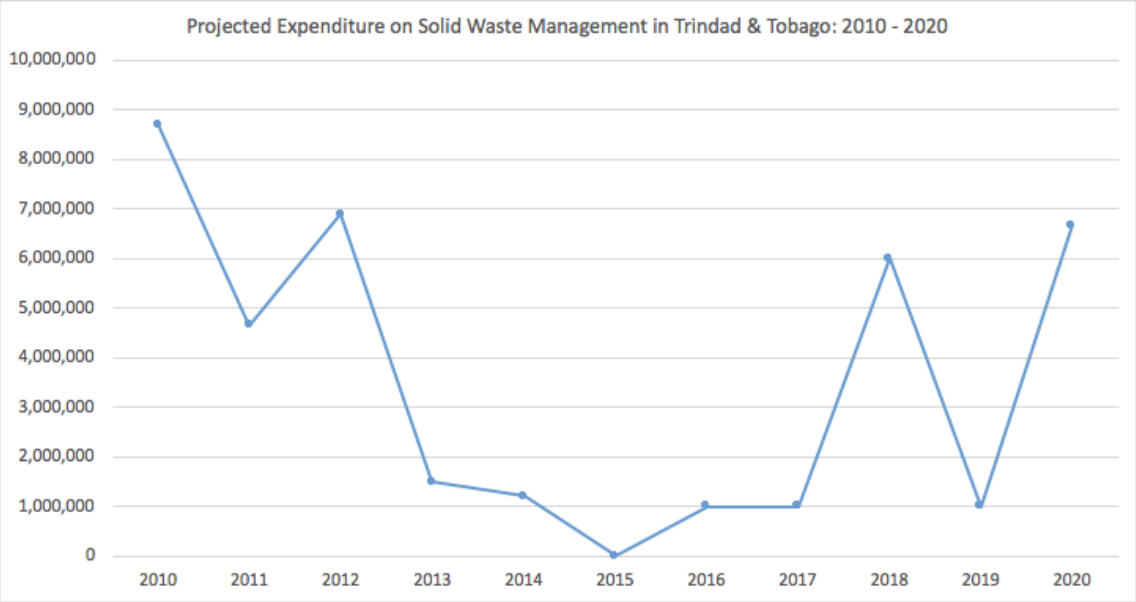

Figure 5. Projected expenditure on solid waste management 2010–2020 (compiled by authors).

4.1.2. The Policy Environment

In modern times, the country's waste management policy landscape has been characterized by an Integrated Solid Waste and Resource Management Policy, National Waste Recycling Policy, and a National Environment Policy. Notably, the National Environment Policy "recognizes major drivers of solid waste generation to be unsustainable consumption patterns and the inefficient use of resources in the production of goods and services" [46]. The need for behavioral change in order to transform the manner in which goods and services are produced and consumed is therefore underscored. However, the theory or model of change employed often involves educational campaigns that follow an approval process very similar to the one mentioned earlier with respect to policy. Some twenty years ago, a National Beverage Container Bill was drafted but to date, has not been approved and passed by Parliament, even as it has cropped up for debate from time to time. The Bill would, among other things, set up bottle (plastic and glass) deposit-return mechanisms and promote producer responsibility among manufacturers. As recently as 2019, the Minister responsible for the Environment identified the passage of this bill as a prime concern.

All these policy instruments find relevance and place in the overarching context of the National Development Strategy of Trinidad and Tobago 2016–2030 (Vision 2030) which promises to strengthen national environmental governance through the: "development of a comprehensive and well-coordinated system to address the many interconnected environmental issues, including: natural resource management (terrestrial ecosystems and forests, biodiversity, water resources and marine ecosystems and resources), waste management (waste disposal, solid waste, electronic waste and hazardous waste), pollution and chemicals management (air pollution, ozone depletion, water pollution, land pollution, marine pollution), built environment management and climate change" [47].

In light of the need for more up to date data to support decision making, in 2019, the SWMCOL issued a public request for proposals for the following:

i. A comprehensive solid waste quantification and characterization study at three (3) landfills
ii. A comprehensive waste centroid study for Trinidad
iii. An assessment of all current public and private waste separation at source and recovery and recycling programs existing throughout Trinidad and Tobago [48].

While steps are being taken to address the lack of data about waste, a further significant challenge with respect to enhancing waste management is related to governance. The introduction of systems to facilitate the recycling of plastics and other materials is in large part dependent upon the reform and strengthening of the institutional framework, established to manage and regulate waste collection and disposal.

4.2. Key Actors

Policy implementation is distributed (or fragmented) across several institutions as shown in Figure 6. SWMCOL is responsible for the "management and control of all wastes severally or jointly with any other company, statutory authority or persons in Trinidad and Tobago" [49]. In 1983, the organization's remit surrounded the operation and management of three landfills. However, in 2003, SWMCOL's mandate was expanded "to include the preservation and upgrade of the environment" which extended to the provision of services such as General and Special Waste Collection, Fecal Waste Disposal, Portable Sanitation Product Rentals and Recycling [49]. Though initially a department of SWMCOL, the Community-Based Environmental Protection and Enhancement Programme (CEPEP), which currently operates as a separate publicly owned company that provides unemployment relief for unskilled labor through the provision of services, focused on "environmental protection, enhancement, and beautification" [50]. However, CEPEP (among other services) also offers waste and dead animal removal services. Additionally, in conjunction with the Office for Disaster Preparedness and Management (ODPM), CEPEP offers clean up services after natural disasters [51].

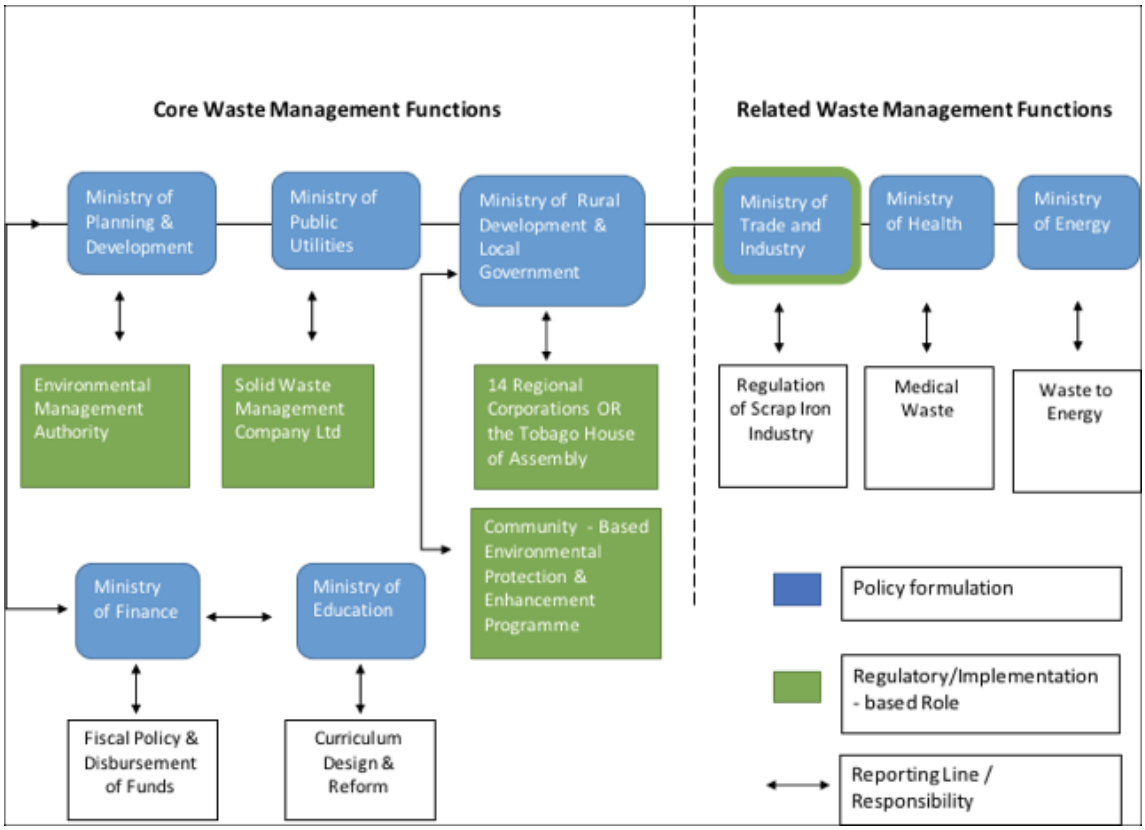

Figure 6. The key institutional actors and relationships.

It should, therefore, be noted that SWMCOL is not responsible for all matters related to waste. The Ministry of Health is responsible for medical waste while the Ministry of Trade and Industry is responsible for the regulation of the scrap metal industry. Additionally, local government authorities

are responsible for waste collection and delivery to landfill sites. The Environmental Management Authority (EMA) is tasked, inter alia, with the development and implementation of policies (including the National Environment Policy) and programs for the effective management and wise use of the environment, with the promotion of public awareness and the development of national standards related to the environment [52]. The Act also mandates the organization to "make recommendations for the rationalization of all governmental entities performing environmental functions" [52]. While the EMA has been central to drafting most of the waste management policies currently enacted, it is not directly responsible for implementation.

4.3. Interactions and Outcomes Regarding Plastic Wastes

While these institutional arrangements reasonably serviced municipal, commercial, and industrial waste management including hazardous waste management, no significant efforts were made around waste recycling, particularly for plastics. The only long-standing waste recycling effort in the country was glass bottles whereby the major bottlers voluntarily provided a few cents per returned beer bottle, and this has been the norm since the 1970s. By the early 2000's with the insertion of the newly established EMA in the policy mix, and growing concerns around major flooding events in urban and suburban areas that disrupted business, commerce, and quality of life, fresh interest in waste management grew as the public and authorities began noting the vast volumes of plastic bottles and debris clogging waterways, drains, pipes, and culverts, and also washed out to the nearshore beaches. Interest in reducing and recycling plastics surged.

It should be noted that several attempts have been made by local government authorities to partner with other institutions, including the EMA, in order to boost efforts at recycling at the municipal level within Trinidad and Tobago. For example, the Port of City Corporation partnered with the EMA's recycling initiative known as the 'iCare' initiative in order to launch a 'curbside' recycling program within the nation's capital city [53]. Additionally, in several regional corporations, there have been a number of discrete in-house projects aimed at recycling and reusing tyres, inclusive of a collaborative project with the University of the West Indies focused on researching ways in which recycled rubber produced from automotive and truck scrap tyres (also known as crumb rubber) could be used for road works [49].

Still, however, there were hiccups, especially with the Beverage Container Bill which remained unsupported by major political interests within the manufacturing sector. It is notable that, for example, during this period of concerns with plastics recycling, the manufacture of plastic bottles for water and beverages surged. Manufacturers of plastic products assumed leadership positions in the local Manufacturers Association and Chambers of Commerce, even winning prestigious national awards including the Prime Minister's Exporter of the Year Award and Manufacturer of the Year Award. One particularly problematic optic was the awarding of the Green Business Award to the 'largest, most modern and eco-efficient' commercial bottled water interest in the country. Legislation to enforce recycling was stymied by political and business interests but blamed on the 'complexity and lack of clarity of the policy'. In this environment, with urgency to act, the government and the non-governmental sectors sought to collaborate on solutions.

One of the most ambitious initiatives taken up by the non-governmental sector in partnership with SWMCOL was the Plastikeep Initiative, launched around 2010 by the Greenlight Network. This was a plastic waste recovery project geared toward increasing "public awareness of the proper management of plastic waste, encouraging community participation and building recycling capacity in Trinidad". The project emphasized specifically on community education and the recovery of unwanted or discarded plastics from households. Via this project, Type 1 plastics, also known as Polyethylene Terephthalate (PET) were collected and sent to a SWMCOL Beverage Container Processing Facility, processed into flakes and exported. According to the Greenlight Network (GLN), "other types of plastic not directly processed by SWMCOL were sorted by type and color and baled for export" [54].

Notwithstanding the above, diseconomies of scale restrict the ability of NGOs like GLN, along with other small businesses from making investments in machinery that would allow them to engage in these activities on a commercial scale. In addition to this, the material collected was often co-mingled and contaminated, resulting in a labor-intensive sorting of materials for recycling. Moreover, there was, and still does not exist a legislative or regulatory framework that incentivizes the return or sorting of plastics at the level of the end-user. The GLN was therefore dependent upon on multiple iterations of government financing through the Green Fund (which is the national accumulation of a Green Fund Levy of 0.3% on gross income paid quarterly by companies and business partnerships) to sustain its operations. Indeed, in spite of receiving some support from the private sector, when public funding ceased in 2016 the organization found itself in debt and largely unable to continue.

After almost a decade of effort, Plastikeep was officially closed in 2019 and its collection bins were handed over to the EMA as a component of their Recyclable Solid Waste Collection Project, also referred to as the "iCare" project. iCare, which stands for "Community, Awareness, Recycle, Everyday" is also funded via the aforementioned Green Fund and aims to "create heightened public awareness on the benefits of recycling and the adverse effects of poor waste management." [55]. While it is a positive development that some of the services that were being offered in the past by GLN via Plastikeep are now being offered by the EMA through its iCare program, it should be noted that the eventual demise of a "bottom-up", community-based approach to plastics recovery and recycling has been replaced by a more "top-down", government-operated and funded alternative.

The waste management landscape appears to now be at another inflection point in its progress. Until recently, the business and manufacturing sectors have been very cautious in outwardly supporting some aspects of waste management legislation including the Beverage Container Bill which could essentially place producer responsibility (and cost) back on them. While there has been some evidence of corporate proactivity on waste management initiatives, often as part of the corporate social responsibility portfolio or on direct request of the EMA, this pales in comparison to the political lobbying, pressure, and negotiations to hold back such legislation as the Beverage Container Bill. However, public mood and market perceptions are evolving to become more conscious of these issues and strategically, there may be pressure on business and manufacturing interests to exhibit proactive voluntary efforts, so as to head off the recent government declarations of plastics and Styrofoam bans and finally the passing of the Beverage Container Act. For example, in 2018 the Massy Group, the largest Caribbean regional conglomerate, headquartered in Trinidad and Tobago, adopted a voluntary ban on single-use plastic bags within all of its supermarket and retail store chains [56,57]. The CEO noted,

> "As a responsible, leading retailer we are determined to play a role in the reduction of waste. Along with citizens of every Caribbean country in which we operate, we are collectively accountable for actions which impact the future of the Caribbean. We started this journey by procuring bags made of biodegradable plastic, but it is imperative that we take a stand to reduce our overall consumption of plastic, which is why we introduced a campaign to help end 'double bagging'. Our focus is now on encouraging customers to bring their reusable bags, with the intention to phase out the demand for plastic bags."

5. Discussion

5.1. An Emergent Evolutionary Model of Island Waste Metabolism

Trinidad and Tobago's current approach to waste management can be described as a "top-down" or state-centric model that makes use of traditional land-filling. Reducing and recycling waste has always been a central message but has not received as much focus as disposal and treatment. If the twin-island nation is to transition to an approach that is more democratic in nature and utilizes public-private partnerships along with incentive-based regulations that seek to allow non-government agencies to participate in plastics recovery and recycling, simplification of the current approach to governance as it relates to waste management may be necessary. At present, there is a lack of appropriate or

adequate incentives for the private sector or even citizens to participate in the recovery of plastics. In addition, while avenues for public-private partnership exists, a simplified policy landscape would make such ventures easier to pursue. Figure 7 summarizes the institutional evolution of waste in Trinidad and Tobago.

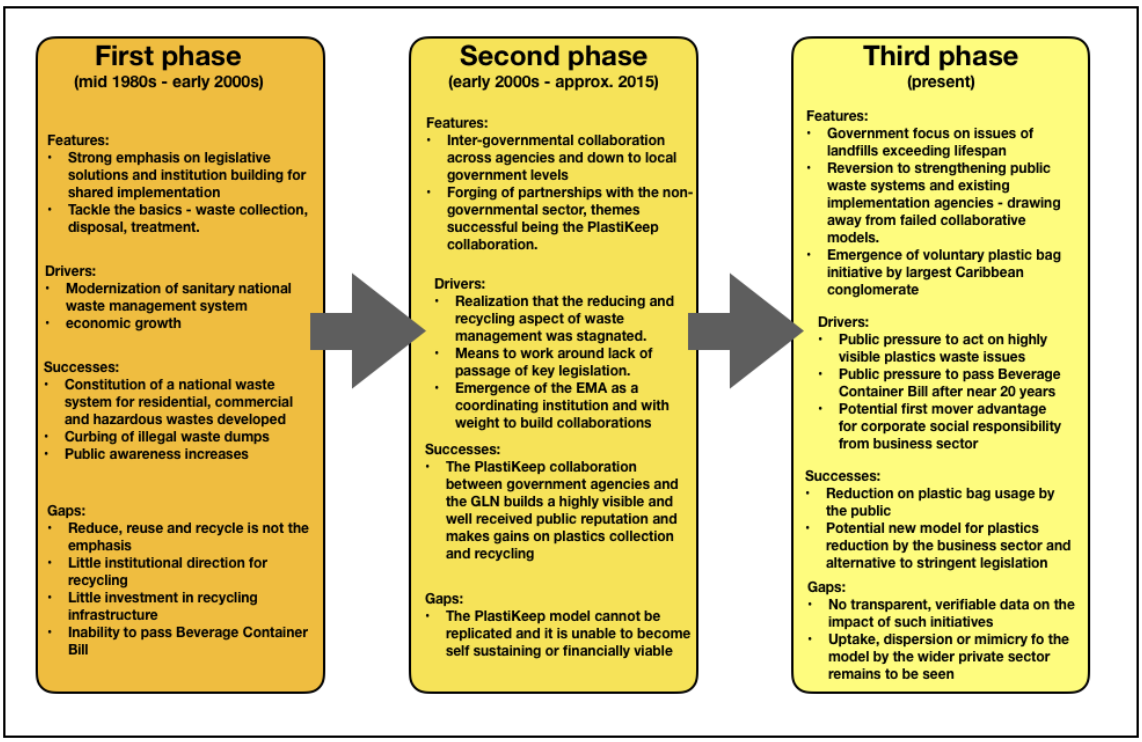

Figure 7. Summary of the institutional evolution of waste, particularly plastics, metabolism in Trinidad & Tobago.

We identified three temporal phases of policy evolution that have altered the waste metabolism trajectory to date: (1) government led patriarchal approach of traditional landfilling combined with behavioral change campaigns to reduce, reuse and recycle, (2) to a more democratic, shared burden, public-private partnership approach combined with attempts at incentive-based regulations, (3) to the present, more private sector-led voluntary bans on production and use of plastics. The latter initiatives now have a positive feedback effect on the government to promote such interventions. The figure below illustrates the three phases proposed.

In the first phase, which is approximated to the late 1980s to the late 1990s, almost sole emphasis was placed on legislative declarations, regulations, and the building of institutions to implement the legislated intents. Coercive pressure was derived from the central government and targeted not only the general public but perhaps more decisively, local and municipal governments. Implementation was shared through mandates in accordance with the respective legislation. One prime piece of legislation that was designed to promote recycling, especially of beverage containers (plastics and glass) has been a 'political football' for near twenty years, with background opposition by major business and manufacturing interests. In public forums, however, both the business sector and government have voiced support for getting the Bill passed but bemoan its 'considerable complexity' and the need to simplify in order to properly implement. The business sector coalesced around an unsaid position of resistance to the Bill, exerting normative group pressure on government through political means, essentially diluting coercive pressures on the business sector and redirecting attention to the inefficiencies in the local government waste management system.

By the early to the mid-2000s, the institutional landscape, public views, and cultural norms were changing. The EMA was now fully functional and overseeing broad policy direction including waste management that was being implemented by SWMCOL and others. There was increasing environmental education and awareness of the public strengthening cognitive pressure on polluters generally. This, coupled with increasing flood events at least partially attributed to refuse clogged drains as well as reports of government attention related to the saturation of existing managed landfills on the island. The context of these conditions and pressures gave rise to a more informed and energized environmental advocacy sector interested in moving beyond the slow-moving government bureaucracy. This ushered in a second phase of sharing the administrative burden of waste management with non-governmental partners through collaborative partnerships. [58] suggests that this is often a natural progression of 'problem-solving', as evidence that the problem faced is indeed a wicked one. It is also pointed out that this route of dealing with the problem through stakeholder collaboration with stakeholders with whom power is dispersed is particularly relevant when at least part of the challenge is the behavioral change among stakeholders or the public. Partnerships, joint ventures, whole of (or joined up) government, international treaties and information campaigns to influence lifestyle choices are all variations on this strategy. More collaborations and larger ones revolved around making progress on reducing and recycling waste. The Plastikeep collaboration between the government and the non-governmental sector was the largest and for nearly a decade, the most successful effort. However, the model was never profitable, as was intended, nor was it even self-sustaining as a business model. It could not attain financial viability without 'crutches' of government aid and financial assistance. That was not the intent and by 2018 it was shuttered by government despite the gains made in collecting and recycling plastics, setting up a national bin system and putting a dent in public behavior with respect to plastics collection for recycling by the public.

The public and the business sector watched on with interest at the increasingly visible successes of the Plastikeep partnership in collecting and recycling plastics. As the finances behind the success were not as visible, it was shocking to most when the government effectively pulled out. By this time, however, the public thought they were seeing a solution in motion and would start being more conscious of their own plastics usage as well as the waste management practices and reputation of the business and manufacturing sectors. The latter would pick up on the increasing coercive pressures from those that mattered to their bottom lines—the consumer public. Growing public comments and the increasingly negative press after flooding events that revealed photos of massive heaps of plastics clogging waterways questioned the legitimacy of business stalwarts as responsible societal actors. The increasing media reports of marine fauna with plastics in and on their bodies reinforced motivation by the business sector including business associations, to change the narrative, if not also their practices and waste management performance. The abundant goodwill that the public seemed to have with the Plastikeep partnership was also an incentive for businesses to take action. This is where we propose that Trinidad and Tobago are entering the third phase in the waste management evolution—voluntary corporate responsibility. The initiatives of Massy Group described above, provide the early prototype of such an evolution in corporate strategy, even as it starts with addressing only plastic bag usage.

The initiative is arguably driven by several factors, not the least of gauging the swirling institutional forces. Factors include the failure of the Plastikeep partnership placing the government in a position again to have to pursue the Beverage Container Bill among other regulatory approaches for waste management. A voluntary effort by such a large conglomerate could dissuade the government that pushing the legislation, which is already an uphill battle with the business sector, may not be a necessary fight. It can also be a new prong in the effort of corporate social and environmental responsibility that can potentially increase brand and corporate reputation value while contributing to a front-burner environmental problem that is in the public eye.

5.2. Learning from the Institutional Evolution Model Observed

If private sector firms and community-based groups are to become more involved in plastics recovery and recycling, the current policy landscape requires clarity and simplification. Not only is there no singular guiding policy that seeks to incentivize the collection and recycling of plastics, but at present, a number of ministries and state agencies have related responsibilities which could make collaboration unnecessarily complex. Stakeholders wishing to engage in collaborative projects with the government first need to engage in research to ascertain the appropriate agencies to be approached in order secure the required permissions and agree upon the terms of cooperation (possibly via a Memorandum of Understanding) before project execution can commence.

In practice, therefore, state agencies must consider how to incentivize the private sector and civil society to participate or even initiate policy dialogues on matters related to waste management governance. Funding has proven to be a limiting factor to NGOs to invest in infrastructure and/or in educational material and campaigns related to improving waste management. It should be noted that while the attempt to provide such a facility via the Green Fund in Trinidad and Tobago is laudable, funding mechanisms of this nature should ultimately encourage financial self-sustainability of NGOs and facilitate the participation of the private sector (particularly as beneficiaries of financial and technical resources). In addition, funding mechanisms should also support long-term partnerships between the public sector and non-governmental organizations (including private firms) on programs that aim to enhance waste management governance. Certainly, if plastics metabolism and wider waste management are to be strengthened within island environments, policy and funding mechanisms that support long term partnerships across different sectors will be required to facilitate joint policy planning and implementation as well as large-scale execution of recycling and waste management initiatives.

While there are a number of policies that relate to waste management governance in Trinidad and Tobago, there is an inadequate comprehensive framework that effectively provides guidance for public, private, or civil society stakeholders willing to enhance the efficient waste collection, disposal, and treatment on the island. Certainly, the absence of a clear framework also makes the formation of strong partnerships between the public and private sectors more difficult. This is noteworthy, as partnerships between private, public, and civil society stakeholders are critical to reforming the current top-down approach to policy formulation within the twin-island republic. To add to this, an enabling policy environment is necessary to promote the participation of the private sector and civil society in the development of programs that actively engage and encourage members of the public to decrease their ecological footprints, especially as it relates to waste.

Programs aiming to introduce practical measures or infrastructure that improves the ability of the population to enhance the efficacy of waste collection and treatment (inclusive of recycling) are likely to be equally as difficult in the absence of clear policy support and guidance. Indeed, the ultimate collapse of the Plastikeep program that was piloted by GLN following the cessation of funding from the State, may be symptomatic of a larger problem related to waste management governance. In the case of the Plastikeep, not only was the project almost entirely dependent on continuous support from the GORTT but perhaps, more importantly, there were no legislative or policy regulations that would have allowed the organization to continue the initiative or introduce a similar project in a commercially viable manner. The absence of policies to support such activities makes bottom-up approaches to waste-management, on the part of individuals, the private sector or civil society, largely untenable.

6. Conclusions

In 2015, the Caribbean group of countries, including many SIDS met in Trinidad and Tobago to chart out a prioritization program for the 17 Sustainable Development Goals (SDGs) promulgated by the United Nations for attainment by 2030. Notably, SDG 12, which focuses on "responsible consumption and production" was absent from the prioritization. Furthermore, the 10 Year Framework Plan (10YFP) for implementing SDG 12 for SIDS and in accordance with the SAMOA Pathway has thus far not provided any tangible policy drivers. The lack of progress at the macro-level of the SDG

Agenda may also be traced to some of the policy inertia due to structural issues identified through this case study.

Notwithstanding the above, while we are unable to answer the question that follows fully within this paper, the evidence presented does raise a larger question of whether or not waste management represents a wicked problem or whether it is simply a symptom of a wicked system of unsustainable production and consumption. Moreover, the paper reviews the unique case of Trinidad and Tobago, which is home to modest but emerging industries that produce consumer goods for local and export markets, and also have the impact of making waste minimization more complex. The additional challenge of effectively processing and minimizing waste from imported and heavily packaged consumer goods make the top-down approach reviewed within the case study more problematic. Indeed, the top-down and fragmented approach to waste management governance within the twin-island surely lends some justification for our characterization of this policy challenge as a 'wicked problem.

The results of our study show that even in small island states, devolution of waste management has the potential to deliver more effective development dividends. Waste management and particularly plastics waste management requires community-level behavioral change and no matter what level of centralized control is exerted, there can be "leakage" in the system given the scale of the challenge. Public-private partnerships may provide a useful opportunity for change but there remains an ongoing concern about linking waste management to the broader development agenda for SIDS.

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