China’s Battle against Marine Plastic Pollution at the Local Level: A Case Study of Sanya City, Hainan Province

Mandy Meng Fang
Assistant Professor, School of Law, City University of Hong Kong, Hong Kong

Introduction*

Recent decades have experienced exponential growth in the use of plastics and inadequate management of the resulting waste, leading to the accumulation of plastic wastes in the marine environment globally.¹ Even in the most remote parts of the Arctic and Antarctic Oceans and in every marine habitat, the existence of plastics has been recognized.² The high societal penetration of plastics is primarily attributable to the material’s versatility, durability, high strength-to-weight ratio, and low cost.³ However, many plastics are hazardous because they either contain chemical additives and plasticizers or absorb hazardous chemicals.⁴ The rapidly unfolding plastic

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¹ The author is grateful to four anonymous reviewers for their helpful comments. All errors remain her own. E-mail: mengfang@cityu.edu.hk


pollution crisis poses significant challenges to the environment, human health, and economy. As one of the world’s largest producers and consumers of plastics, China is highly vulnerable to the detrimental impacts of mismanaged plastic wastes, while also uniquely positioned to play a pivotal role in battling plastic pollution. Plastic accounted for an overwhelmingly large share of floating debris, beach debris, and submarine debris in China—93 percent, 76 percent, and 83 percent, respectively. China’s efforts to tackle plastic pollution date back to the late 1990s when the central government banned the production of plastic foam tableware and later restricted the production, sale, and use of ultra-thin plastic bags. However, the effectiveness of enforcing these
early-stage plastic bans and restrictions in China turned out to be at best modest, if not disappointing.\textsuperscript{11} It was not until recent years, especially after China's imposition of an import ban on solid waste, that plastic pollution governance became a rising issue on the agenda of the Chinese government.\textsuperscript{12} China's regulatory efforts have been oriented towards a more holistic governance approach that controls the life cycle of plastics from the stage of production and usage to disposal.\textsuperscript{13}

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\textsuperscript{11} One of the major reasons for the ineffectiveness of China's early-stage plastic restriction is the weak enforcement, particularly in farmers' markets, small stores and rural areas. See, “The Effectiveness of Plastic Restriction Diminished after the First Two Years and the Return of Super-Thin Plastic Bags,” Gov.CN, 1 June 2009, available online: <http://www.gov.cn/jrzg/2010-06/01/content_1618320.htm>.

\textsuperscript{12} The Implementation Plan for Prohibiting the Entry of Foreign Garbage and Advancing the Reform of the Solid Waste Import Administration System” [禁止洋垃圾入境推进固体废物进口管理制度改革实施方案] issued by the General Office of the State Council on 18 July 2017, available online: <http://www.gov.cn/zhengce/content/2017-07/27/content_5213738.htm>. The ban took effect in January 2018 and plastic wastes were included in the Catalogue of Prohibited Solid Waste Imports in the Plan.

More than merely prohibiting or restricting the production and consumption of highly-environmentally damaging plastic products, China's new governance approach calls for more systemic efforts in reusing, recycling, and end-of-life treatment of plastics.\textsuperscript{14} In addition to the Ministry of Ecology and Environment, many other Chinese central ministries and departments are responsible for alleviating plastic pollution under their respective jurisdiction.\textsuperscript{15} As a key component of circular economy development, governing plastics throughout the life cycle has been incorporated into China's 2030 Carbon Peaking Action Plan.\textsuperscript{16}

The proliferation of China's centrally designed plastic policies raises an important question concerning its interpretation and implementation at the local level. The significant authority and influence China's local leadership have in executing centrally formulated policies are well-documented.\textsuperscript{17} Like many other environmental problems, plastic pollution has frequently been dealt with by governments at the sub-national level, in particular with municipalities as environmental policy implementers. Cities, such as Beijing, Shanghai, Shenzhen (Guangdong Province), and Guangzhou (Guangdong

\textsuperscript{14} See “The Development Plan on Circular Economy During the 14th FYP,” Id.
\textsuperscript{15} Id. Some plastic policies are in fact sectoral policies and thus fall under the jurisdiction of traditional sectoral ministries.
Province) have rapidly followed the central guidance and enacted various policy measures to tackle plastic pollution.\textsuperscript{18}

While an expanding body of literature discusses the centralized policy instruments adopted to tackle marine plastic pollution in China, a thorough overview of local actions from the legal and regulatory perspectives remains scant.\textsuperscript{19} This article aims to fill in the gap by using Sanya City in Hainan Province as a case study to critically assess the local government’s capacity to formulate and implement environmental laws and policies to address marine plastic pollution. Sanya is an appropriate research choice as leaders’ efforts to establish it as a ‘model city’ for ecological civilization and to achieve the ambitious ‘zero waste’ goal offer critical insight into the opportunities and challenges on the road ahead for the country. Sanya’s governance practices can have important implications for local environmental governance of marine plastic pollution underway in China and many other parts of the world. The Sanya case raises a new set of interesting questions: Why is the local environmental governance level vital for preventing and controlling marine plastic pollution? What are the institutional arrangements, instruments, and strategies adopted by the


Sanya government to tackle marine plastic pollution? How should the successes, limitations, and challenges of Sanya's local governance approach be assessed?

This article begins with a discussion of the importance of local environmental governance in tackling marine plastic pollution in China. Aside from illustrating how China's central-local relations in environmental politics shapes the role of local authorities in environmental governance, this part also highlights several characteristics of marine plastic pollution and the related policies that can reinforce the significance of local actions. The article then presents Sanya's legal and regulatory framework in governing marine plastic pollution, based on government policy documents and reports and available secondary sources. It also provides a critique of the strengths and weaknesses of Sanya's plastic governance approaches. The article concludes with recommended improvements on local environmental governance of marine plastic pollution.

**Marine Plastic Pollution and Local Environmental Governance**

Marine plastic pollution presents a multi-faceted challenge that has environmental, economic, technical, and behavioral dimensions across multiple jurisdictions. Governance arrangements to prevent and control plastic pollution at international and national levels, in contrast to local actions, have received overwhelming attention in recent years. There are three reasons why locally-led governance approaches can play a vitally important part in reining in marine plastic pollution, particularly in countries as vast and diverse as China.

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First, local authorities can exercise substantial autonomy in policy implementation and regulatory enforcement and have long been important agents in China’s environmental governance, which is featured with a decentralized structure.\(^2^2\) Despite a new wave of recentralization in China’s environmental governance during President Xi’s rule,\(^2^3\) environmental protection responsibilities are largely decentralized.\(^2^4\) Particularly when it comes to implementing mandatory environmental policies, central regulators simply lack the capacity to oversee polluting activities across the country.\(^2^5\) According to China’s Environmental Law, local governments are responsible for environmental governance in their jurisdiction.\(^2^6\) Similarly, the application of territorial responsibility in plastic waste treatment has been repeatedly underscored by the central government.\(^2^7\) Local authorities have the ability to adapt environmental policies to local physical and socio-economic circumstances and engage more closely with the public and other non-State actors in fulfilling environmental targets. This explains why local-level environmental model city programs can create best practices and raise the standard in terms of urban environmental governance.\(^2^8\)

Second, despite of the global extent, marine plastic pollution has easily identified local causes, as land-based plastic waste inputs constitute the main cause of marine plastic pollution.\(^2^9\) Throughout different stages along the

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\(^2^6\) See Article 6 of the Environmental Protection Law of the People’s Republic of China [中华人民共和国环境保护法], revised and passed by the 8th Meeting of the 12th Standing Committee to the National People’s Congress on 24 April 2014.


plastic pollution pathway, aside from production that can take place in a different locality, the consumption and post-consumption stage, including recycling, reuse, treatment, and clean-up of plastic wastes, will most likely be locally based. For instance, tailoring waste management infrastructure and practices to local conditions is instrumental in reducing and preventing the leak of plastic wastes into the ocean.\footnote{See J.E. Mathis et al., “Reducing ocean plastic pollution: Locally led initiatives catalysing change in South and Southeast Asia,” \textit{Marine Policy} 143 (2022): 105127.} As stressed in a recent press conference held by the Ministry of Ecology and Environment (MEE), local governments, especially those in the coastal regions, should strengthen the governance of marine plastic waste and microplastic pollution, and establish a long-term waste treatment system.\footnote{“The Coastal Regions Are Exploring the New Governance Model of Marine Plastic Pollution,” NDRC, 26 July 2022, available online: <https://www.ndrc.gov.cn/xwdt/ztzl/slwrzlxzdx/202207/t20220726_1331381.html?code=&state=123>.} Therefore, local governance responses can have a substantial impact on addressing marine plastic pollution.

Third, the perennial problems underlying global environmental crises such as climate change pose enormous obstacles to local policy-making, namely, time lag, less than visible or not-so-easily quantifiable policy outcomes, trade-offs against economic growth, and organizational challenges.\footnote{S. Eaton and G. Kostka, “Authoritarian environmentalism undermined local leaders? Time horizons and environmental policy implementation in China,” \textit{China Quarterly} 218 (2014): 359–380, p. 368.} Nevertheless, these barriers to local actions appear either non-existent or only partially applicable in the case of marine plastic pollution. First, the yields of plastic policies applied throughout the whole life cycle of plastics do not take that long to realize. On the contrary, many policy measures, either undertaken at the source of pollution or dealing with plastic wastes at the end-stage can produce results in a relatively short time period, if not immediately. Second, the outcomes of plastic policies are not hard to measure or identify as plastics or plastic waste prevention and control projects can generate unambiguous and visible results. Third, tackling plastic pollution does not always involve stark trade-offs against economic growth, except when the local economy depends on the traditional plastic industry. In Sanya’s case, the limited local manufacturing capacity in single-use plastics shapes an enabling environment for the shift towards non-plastic substitutes and degradable plastics.\footnote{The manufacturing capacity of traditional plastic products in Hainan Province is not high, ranking below more than ten provinces in China in 2020. See “The Analysis of China’s Plastic Industry Current and Future Development,” Industry Information Website, 1 April 2021.}
Fourth, organizational challenges posed by the need to cooperate among different functional departments across multiple jurisdictions could emerge for policy implementation at the stage of plastic pollution source prevention and reduction. However, the treatment of plastic waste does not necessarily demand inter-jurisdictional collaboration as it is the local waste management capacity that plays a key role. Therefore, local policy-making in addressing marine plastic pollution faces less deeply embedded obstacles.

Sanya’s Governance approaches in Tackling Marine Plastic Pollution

Marine Plastic Pollution in Sanya

Located at the southern tip of Hainan Island, Sanya consists of four administrative districts—Haitang, Jiyang, Tianya, and Yazhou—with a 1,920 km² land territory and a long coastline spanning 263 km. One of the most popular tourist destinations in China, Sanya boasts outstanding sea views and tropical forests that attract more than 20 million tourists annually. Tourism, which contributes approximately Renminbi (RMB) 58 billion in revenue and accounts for nearly 86 percent of the city’s total gross domestic product (GDP), has become the key growth engine of Sanya’s economy. The heavy reliance of Sanya’s economy on tourism renders the protection of the natural environment particularly salient as environmental deterioration will dent its tourist appeal and impede economic growth.

Nevertheless, Sanya’s booming tourism industry and deficient local capacity in waste management led to a staggering rate of plastic waste accumulation in the marine environment. As reported, nearly 86 percent of waste found on Sanya’s beaches are plastics, which confirms land-based waste inputs as the primary source of marine plastic pollution in the region. Without preventing and controlling plastic waste generated on land, slowing down or reversing the degradation of Sanya’s marine ecosystem is simply impossible. Besides

35 “Sanya Received 23.96 Million Tourists in 2019,” Zhiyan Insights, 10 March 2020.
36 Id.
37 Id.
creating environmental and health-related hazards, a polluted marine environment will severely cripple Sanya’s local economy, particularly tourism.

The prevention and control of marine plastic pollution has emerged as a policy priority in Sanya since the designation of the city as China’s first ‘Zero Waste City’ demonstration site and Hainan Province as “National Pilot for Ecological Civilization.” The selection of Sanya as the pilot for the Zero Waste City program is a recognition of the city’s economic and social capacity and local government’s political willingness to manage solid wastes, including plastics, in an environmentally sustainable manner. Against this background, the political salience of mitigating plastic pollution and setting a good example as a model city for other Chinese cities is elevated in Sanya. Meanwhile, the high interdependence of economic growth and marine environmental protection also means less entrenched local interests in Sanya that prioritize GDP growth over protecting environmental quality. Therefore, Sanya becomes an


40 According to the State Council, demonstration sites for the “Zero Waste City” program should have the capability and relevant past experience in treating wastes. Factors such as the developmental level, industrial structure, and the local government’s environmental performance in the past should be considered. See “The Work Plan on Building the Demonstration Site for ‘Zero Waste City’ [关于印发“无废城市”建设试点工作方案] issued by the State Council on 29 December 2018, available online: <http://www.gov.cn/zhengce/content/2019-01/21/content_5359620.htm>.

41 Local protectionism often is referred to as the predominant reason for weak implementation of environmental laws in China since government officials are more interested in economic growth. When there is a (short-term) trade-off between GDP growth and environmental protection, the latter will be given less priority since it is seen as a limit on
interesting case to study given its high political, economic, and environmental stakes in reining in marine plastic pollution.

**Sanya’s Governance Approaches in Tackling Marine Plastic Pollution**

In recent years, Sanya’s local government has exhibited an increasing determination and ambition to tackle plastic pollution and improve the ecological quality in the city. The government has formulated and implemented a proliferating body of regulations and policies to intervene at different stages along the marine plastic pollution pathway. These policy measures can be divided into three categories based on the specific stage at which these measures are undertaken:

- **Beginning stage**—prevention and reduction of plastic production and consumption at source
- **Mid stage**—management (sorting, recycling, reuse, and treatment) of plastic waste
- **End stage**—clean-up of plastic waste

The design and implementation of policy measures to deal with plastic pollution at each stage tend to differ, although some measures could be used throughout all the stages to achieve plastic pollution reduction.

### Prevention and Reduction of Plastic Production and Consumption at Source

The primary regulatory tool used by Sanya to prevent and reduce plastic production and consumption at its source is the plastic ban,\(^{42}\) in line with China’s first provincial legislation banning the production, sale, and usage of 19 kinds of plastic products enacted in Hainan Province.\(^{43}\) To guide and facilitate the

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\(^{43}\) See “The Regulation on Prohibiting Single-Use Plastic Products in the Hainan Special Economic Zone” [海南经济特区禁止一次性不可降解塑料制品规定] passed by the 16th Meeting of the Standing Committee to the Hainan Provincial People’s Congress on 31 December 2019 and took effect on 1 December 2020, available online: <http://www.gov.cn/xinwen/2020-02/10/content_5476880.html>. The banned products include single-use sheets and bags containing non-biodegradable materials, such as polyethylene (PE), polypropylene (PP), polystyrene (PS), polyvinyl chloride (PVC), ethylene-vinyl acetate (EVA) and polyethylene terephthalate (PET) and single-use tableware containing non-biodegradable materials, such as PE, PP, PS, PVC and PET. The list of banned
implementation of the plastic ban, the government authorities in Sanya formulated an elaborated plan in which the scope, responsibility, and time frame of the ban were set. Given that the implementation and enforcement of the plastic ban falls upon a range of different government bureaus and agencies, the bureaucratic structure will fragment easily. Against this background, the Sanya Municipal Party Committee and government established the “Leading Group on Plastic Ban,” consisting of officials from 23 municipal government agencies and headed by the vice-mayor. As an interdepartmental coordination committee, the Leading Group can facilitate joint problem-solving and address disagreements between departments as the leader of a working group retains the authority to make decisions. Otherwise, a plurality of decision-making agencies can jeopardize the much-needed coordination efforts in policy implementation. Coordination and cooperation among multiple government departments and stakeholders are particularly vital to deal with plastic pollution with diffuse sources that challenge effective policy implementation.

To supplement and increase the operationality of the implementation plan on the plastic ban, the Sanya government issued additional policies, which further specify the responsibilities and targets for relevant governmental bureaus

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44 As the most important guiding document, the Plan on Implementing the Holistic Ban of the Production, Sale and Use of Single-Use Non-Degradable Plastic Products in Sanya Municipality [三亚市全面禁止生产，销售和使用一次性不可降解塑料制品实施方案] was jointly issued by the Sanya Municipal Party Committee and Government on 3 November 2019.

45 Id. The formation of “leading groups” as informal bodies to deal with specific issues has been common at both the central and sub-national levels in China. Normally, leading groups have the mandate to advise the body that appointed them on specific strategies and policies and coordinate implementation of those strategies and policies. See F. Teng and P. Wang, “The evolution of climate governance in China: Drivers, features, and effectiveness,” Environmental Politics 30, no. S1 (2021): 141–161, p. 144.

46 Setting up leading groups to address environmental problems is not uncommon in China. Placing local political leaders in the driving seat has proven to lead to more efficient policy coordination. For relevant discussion, see G. Kostka and A. Mol, “Implementation and participation in China’s local environmental politics: Challenges and innovations,” Journal of Environmental Planning and Policy 15, no. 1 (2013): 3–16.

and agencies.\textsuperscript{48} The implementation plan for the ‘Zero Waste City’ program lists several places as key areas to strengthening the enforcement of the plastic ban, such as farmers’ markets, hotels, and tourist spots that traditionally have consumed a substantial volume of plastics.\textsuperscript{49} The joint law enforcement team formed by officials from the Sanya Municipal Administration for Market Regulation and Bureau of Law Enforcement conducted frequent inspections shortly after the enactment of the plastic ban.\textsuperscript{50} In 2021, the enforcement authorities investigated 310 cases pertaining to violations of the plastic ban and imposed fines of \textcurrency{RMB 336,800}.\textsuperscript{51} In a more recent inspection, the enforcement team identified twelve stores and six small-sized retailers using single-use non-degradable plastic products and filed cases for investigation.\textsuperscript{52}

To strengthen the accountability of government agencies, a highly detailed assessment measure has been formulated and implemented to evaluate the actual enforcement of the plastic ban.\textsuperscript{53} The evaluation methods consist of document checks and on-site inspections. The former focuses on the accuracy and completeness of the submitted documents, while the latter investigates


\textsuperscript{50} “Plastic Ban Law Enforcement Took Place in Sanya, the Removal of Single-Use Non-Degradable Products from Supermarkets,” Yunnan.cn, 1 December 2020, available online: <http://society.yunnan.cn/system/2020/12/01/03153303.shtml>.


\textsuperscript{52} This round of enforcement action took place 238 times and covered 462 business sites. See “12 Stores in Sanya Were Investigated for Allegedly Using Single-Use Non-Degradable Plastic Products and Investigated,” Hinews, 21 July 2022, available online: <http://www.hinews.cn/news/system/2022/07/21/032999020.shtml>.

\textsuperscript{53} “The Assessment Plan of Implementing the Total Ban on the Production, Sale and Use of Single-Use Undegradable Plastics (for Trial Implementation)” [三亚市全面禁止生产销售使用一次性不可降解塑料制品工作实施情况考核办法] issued by the Sanya Municipal Bureau of Ecology and Environment on 22 March 2022, available online: <http://www.sanya.gov.cn/sthzsite/zjgfbx/202203/7dfc5b654303419c90e226f386bf0c9c.shtml>.
the actual performance in enforcing the plastic ban.\textsuperscript{54} The assessment measure also lays out detailed requirements and scoring criteria for different actors, including governments at municipal and lower levels, government-affiliated institutions, and private entities across almost every sector of the economy.\textsuperscript{55} For instance, the Bureau of Ecology and Environment was put in charge of designing the action plan and setting the specific tasks of banning certain types of plastics, which was to be completed by 2021.\textsuperscript{56} Reducing the use of disposable plastics in key areas such as farmers’ markets, hotels, and tourist spots was assigned to the Bureau of Commerce and the Bureau of Tourism, Culture, Radio, Television, and Sports, with no specified time frame.\textsuperscript{57} The formulation of precise predefined hard targets and performance indicators is arguably what local officials are accustomed to in China’s environmental governance.\textsuperscript{58}

Besides precisely defining the responsibility of various governmental agencies in implementing and enforcing the plastic ban, the introduction of third-party monitoring and supervision to strengthen compliance in Sanya is noteworthy.\textsuperscript{59} Third parties are those entities or personnel with the professional capacity to assess environmental conditions and are not associated with any government agency or private enterprise.\textsuperscript{60} There is a growing trend for local governments in China to appoint third parties to provide independent environmental assessment and play a complementary role in the enforcement of environmental protection law and regulation.\textsuperscript{61}

\textsuperscript{54} Id.
\textsuperscript{55} Id.
\textsuperscript{56} Id.
\textsuperscript{57} Id. Enforcing the plastic ban in farmers’ markets, hotels, and tourist spots is arguably more challenging as these areas have traditionally been large consumers of single-use plastic products.
\textsuperscript{58} As identified by Shin, the more concrete and short term the targets and metrics, the better because local officials are concerned their performance might not be evaluated with accuracy in the absence of specified targets. See K. Shin, “Environmental policy innovations in China: A critical analysis from a low-carbon city,” \textit{Environmental Politics} 27, no. 5 (2018): 830–851, p. 840.
\textsuperscript{59} See “The Assessment Plan of Implementing the Total Ban on the Production, Sale and Use of Single-Use Undegradable Plastics (for Trial Implementation), see n. 53 above.
\textsuperscript{60} See “The Opinion on Further Improving the Environmental Protection “Three-Stage Simultaneous” Requirements in Project Construction and Supervision of Self-Certification in Project Completion Work System” [关于进一步完善建设项目环境保护“三同时”及竣工环境保护自主验收监管工作机制的意见] issued by the MEE on 23 August 2021, available online: <https://www.mee.gov.cn/xxgk2018/xxgk /xxgk03/202108/t20210824_860298.html>.
\textsuperscript{61} Id.
For instance, the Sanya government has entrusted third parties to initiate investigations openly and/or secretively to assess the performance of government agencies on a quarterly and annual basis. Information and evidence of plastic pollution problems are gathered during the field investigation processes. The third-party assessment carries a heavy weight (80 percent) in the final score in order to avoid inter-agency corruption and ensure fairness. Government agencies that score high in the assessment will receive monetary rewards and medals, those falling below the standard will have to provide written submissions specifying the reasons for failure, corrective measures, and pertinent time frames. Poor performance in two consecutive quarters or one year can negatively affect the responsible government agency in the annual cadre evaluation, which is inarguably politically salient. With hard targets in place, prohibiting plastic production and consumption is no longer a soft guidance target that does not have clear consequences for substandard performance. Weightages accorded to environmental criteria in assessing the performance of local authorities show an upward trend.

While enforcing the plastic ban has had the effect of reducing plastic production and consumption at the source, the production and promotion of environmentally friendly alternatives, such as reusable and degradable plastics and non-plastic products made from cloth, paper, and bamboo, have gained more traction. However, the price of alternatives remains considerably higher than non-degradable plastics, which places a heavy burden on end-users. In response, the Sanya government has provided alternative bags for free in residential and commercial communities, farmers’ markets, and tourist sites. Meanwhile, ensuring the availability and affordability of alternatives has surfaced as a policy priority in Sanya. In the 14th Five-Year Plan (FYP), Sanya policy-makers list the development of biodegradable plastics as an

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62 See “The Assessment Plan of Implementing the Total Ban on the Production, Sale and Use of Single-Use Undegradable Plastics (for Trial Implementation),” n. 53 above.
63 The rest (20 percent) of the final score is based on the assessment given by the Assessment Panel, which consists of two members from the Leading Group on Plastic Ban. Id.
64 Id.
65 Id.
66 For instance, bio-degradable plastic bags cost almost five times more than traditional ones. The high price of alternatives to environmentally harmful plastic bags was brought to the government meeting for deliberation. See “The Sanya Municipal Bureau of Ecology and Environment’s Reply to the 88th Proposal in the 7th Meeting of the 7th Political Consultative Conference of Sanya Municipality,” Sanya Municipal Bureau of Ecology and Environment, 4 November 2021, available online: <http://www.sanya.gov.cn/sthjsite/hygq/202111/611571fbb7d41ebc37b2b871e69fab.shtml?viewport_type=pc>.
67 Id.
industry-based solution to plastic pollution. Incentive mechanisms such as tax rebates and direct funds are available to attract research and development (R&D) institutes and investors, both domestic and foreign, in the biodegradable plastic industry. Since the market size of degradable plastic products is projected to increase, Sanya’s move will align plastic pollution governance more closely with economic objectives. Faced with the rapidly rising cost of raw materials for the manufacture of biodegradable plastics since 2021, the government has provided subsidies and orchestrated large-scale purchases to lower prices. With the expansion of biodegradable manufacturing capacity, the rising market demand is likely to be met and the price gap with conventional plastic products narrowed.

In just more than one year since the enactment of the plastic ban in Sanya, progress has already emerged. The replacement of banned plastic products with degradable alternatives took place rapidly in supermarkets, government offices, tourist sites, hotels, and hospitals. As a result, the annual consumption of single-use non-degradable plastic bags and plastic cutlery was reduced by more than 8,000 tons in Sanya. In the agricultural sector, the local production of single-use non-degradable mulch was reduced by 10 percent, and the consumption of super-thin film (smaller than 0.01 mm in thickness) was

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68 “The Outline for the 14th Five-Year Plan for Economic and Social Development and Long-Range Objectives Through to the Year 2035 in Sanya Municipality” [三亚市国民经济和社会发展第十四个五年规划和二零三五远景目标纲要] issued by the Sanya Development and Reform Commission on 22 June 2021, available online: <http://www.sanya.gov.cn/sanyasite/gmjjsx/202106/t16b2be4b3f499ca086a89dfd94b2s.shtml>.

69 See “The Outline for the 14th Five-Year Plan for High-Tech Industry in Sanya Municipality” [三亚市高新技术产业园“十四五”发展规划] issued by the Sanya Government in November 2021, available online: <http://www.sanya.gov.cn/sanyasite/szfjxj/202203/19f0b05beda6d83bb5738ed968a48/files/g76e0389d4443d6933cc084ac96.doc>.

70 It is estimated that the total domestic demand for degradable plastic products will reach 4.2 million tons and RMB 83 billion by 2025, which is more than nine times higher than that of 2018. See F. Wang, "Two National Standards of Degradable Plastics Took Effect on 1 June, the Industry Demand and Capacity Are Yet to Fully Grow," National Business Daily, 28 May 2022, available online: <https://m.nbd.com.cn/articles/2022-05-28/230089.html>.


lowered by around 90 percent. Nevertheless, the ‘hard-to-abate’ sectors such as e-commerce and delivery still present obstacles to fully enforcing the plastic ban.

Management of Plastic Wastes—Sorting, Recycling, Reuse, and Treatment

Given the enormous challenge of reducing the production and consumption of all forms of plastics, it is important to manage plastic waste before it accumulates in the environment. As a complex undertaking, improving plastic waste management involves a series of undertakings, such as collecting waste, sorting different types of waste, operating recycling schemes and flows, and treating unrecycled waste. As primary inputs to marine plastic pollution, land-based plastic waste can be highly diffuse, which might be subject to different policies with diverse sets of rules and thus challenging to regulate.

The current regulatory framework in Sanya pursuant to managing plastic waste remains fragmented as no specific regulation or policy addresses this problem with an integrated approach. Sanya’s management of plastic waste is largely scattered throughout government policies addressing various sorts of waste. Additionally, the development of policy responses to the management of plastic waste at different stages so far has been quite uneven in Sanya. As discussed below, Sanya’s governance of plastic waste sorting and collection has achieved some progress over the past years, while its recycling, reuse, and treatment capacity remain limited.

First, the Sanya government has sought to establish a sophisticated household garbage sorting system, covering garbage delivery, collection, transportation, and disposal in Sanya’s urban and rural communities. Citizens are mandated to classify garbage into four categories: recyclables, kitchen waste, hazardous waste, and residual waste. Measures taken to encourage citizens

74 Id., p. 36.
77 See Andrady, n. 29 above, p. 1597.
79 Plastic waste, including plastic bottles, styrofoam, and hard plastic belong to the category of recyclable waste. Id.
to comply with the sorting requirements include scaling up the installation of classification bins in the community, stationing volunteers to give instructions, and using artificial intelligence (AI) and facial recognition to monitor behavior.\textsuperscript{80} The use of AI is expected to assume an increasingly important role, such as in assisting the public in correctly sorting out various forms of wastes and supplementing the traditional enforcement mechanisms.\textsuperscript{81}

Nevertheless, a large number of short-term residents in Sanya, some of whom may lack a strong sense of community responsibility, add to the difficulty of mandating waste sorting among the public.\textsuperscript{82} Against this background, some districts in Sanya have deployed fiscal incentives to reward citizens for properly sorting various categories of garbage, which has been well-received.\textsuperscript{83}

In rural areas, the pervasive use of single-use, non-biodegradable mulch film presents a particularly thorny task for plastic waste management. The Sanya government has set up collection facilities and assigned inspection teams to guide farmers on the disposal of used film.\textsuperscript{84} As of June 2020, eight collection facilities had been built, and the proper disposal rate of used agricultural film

\textsuperscript{80} Id.

\textsuperscript{81} As envisioned by the Sanya government, AI and big data could also be used to promote the management of solid wastes in an information-savvy manner, which facilitates the sharing of information among different sectors and departments. See “The Implementation Plan of Building Sanya “Zero-Waste City” (2021–2025),” n. 39 above, p. 7.

\textsuperscript{82} As reported, the enforcement team of the National People’s Congress Standing Committee instigated a spot check in Sanya in 2021 and identified the lack of compliance with the waste sorting obligation in some communities. See “The Study of Solid Waste Pollution Prevention and Control in Hainan: Where Has Our Household Garbage Gone?,” Hainan Daily, 18 June 2021, available online: <https://hainan.sina.cn/news/hnyw/2021-06-18/detail-ikqcfncar71912.d.html?pos=345>.

\textsuperscript{83} For instance, Tianya district in Sanya started early on to use a fiscal rewarding scheme to allow local citizens to trade credits they receive from properly disposing of certain recyclable products, including plastics for rice, cooking oil, laundry detergent or other basic commodities. After a few months, the sorting and recycling rate of plastic wastes grew to nearly 65 percent in the district. See “Sanya’s Pilot Programs in Promoting the Waste Sorting with Big Data,” Sina, 20 October 2020, available online: <https://finance.sina.com.cn/tech/2020-10-20/doc-iiznctkc660380.shtml>. Similar schemes have been applied to rural communities. For example, in some Sanya villages, a bin of recyclable waste equals approximately 800 credits, which can be used to purchase commodities such as rice or cooking oil. See “The Promotion of Rural Waste Sorting System in Point Program to Clean Up the Village in Sanya Tianya District,” Wangyi News, 1 June 2022, available online: <https://www.i63.com/dy/article/H8Q2TJD905346jX.html>.

\textsuperscript{84} “Sanya: Creating Green Life and Rejecting White Pollution,” Pengpai News, 17 July 2020, available online: <https://www.thepaper.cn/newsDetail_forward_831476>.
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reached more than 87 percent in Sanya, higher than the national target of 75 percent.\textsuperscript{85}

Second, what follows the stage of collecting and sorting plastic waste is recycling and reuse. Despite the local government starting to install recycling facilities for various forms of recyclable waste during the 2010s, Sanya’s capacity remains weak due to substandard recycling and reuse infrastructure and technology.\textsuperscript{86} In Sanya’s 14th FYP on Renewable Resource Recycling System, the policy-makers adopt a circular economy perspective and underscore the imperative to follow an international standard in recycling with clear targets and government supervision.\textsuperscript{87} The Hainan provincial government also plans to develop Sanya as one of the regional distributional centers for recyclable resources.\textsuperscript{88} Nevertheless, it seems too early to fully evaluate the effectiveness of Sanya’s efforts to improve the rate of recycling and reuse of plastic waste.

Third, the existence of non-recyclable or hard-to-recycle plastics makes end-of-life treatment crucial. Sanya’s ‘Zero Waste City’ initiative provides guidelines on how to carry out resource utilization and harmless treatment of plastics to reduce the leakage of plastic waste into the environment.\textsuperscript{89} One of the key strategies is to replace landfills with technologically sophisticated incinerators to process plastic waste to generate heat, electricity, and hot water without generating environmentally harmful gases.\textsuperscript{90} Nevertheless, the lack of proper separation between degradable and non-degradable plastics during

\textsuperscript{85} Id.
\textsuperscript{89} Plastic pollution prevention and control constitutes a key component in “The Implementation Plan of Sanya ‘Zero-Waste City’ Building (2021–2025),” see n. 39 above.
\textsuperscript{90} Id. Although plastic landfill could be considered as a form of carbon sequestration if done responsibly, its impact on the environment can be negative considering the contamination of air, land, and aquifers through release of damaging components. See J. Lange, “Managing plastic waste: Sorting, recycling, disposal, and product redesign,” ACS Sustainable Chemistry Engineering 9 (2021): 15722, 15731.
the sorting stage can undermine the efficacy of waste treatment practices. Instead of incineration, degradable plastics need a specific treatment process in order to minimize the negative environmental impacts. Considering the interconnectedness of waste sorting, recycling, and treatment, it is important to strengthen capacity-building on all fronts to maximize the efficacy of managing plastic pollution.

The management of plastic waste in Sanya traditionally has been dominated by regulatory instruments, in contrast to market-oriented mechanisms such as deposit-refund schemes and extended producer responsibility, the use of which is much more limited. As initially planned, Sanya would experiment with a deposit-refund scheme to increase the recycling rate, and its experience would later be promoted to the rest of the country. However, the eventual absence of the deposit-refund scheme from the local plastic pollution legislation can be attributed to strong opposition from large companies, such as Coca Cola and some local retailers and companies. So far in Sanya, the deposit-refund system has only been applied within a limited scope, covering agricultural mulch films and pesticide packing materials. Whether and when market-based mechanisms will be promoted at a large-scale in Sanya remains unknown, despite such mechanisms potentially being less administratively burdensome and more cost-effective in maneuvering market dynamics to shape consumer and producers’ behavior.

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93 “The Deposit-Refund System as Typically Adopted for Plastic Bottles Facilitates the New Environmental Protection Journey,” Huanqiu, 10 October 2019, available online: <https://city.huanqiu.com/article/9CaKrnKnclj>.


95 See “The Implementation Plan,” n. 39 above.

Clean-up of Plastic Waste

The pervasiveness of ‘white pollution’ induced by the accumulation of plastic wastes in rivers, farmlands, beaches, the ocean, and other places requires clean-up activities. Given Sanya’s geographic landscape, cleaning up plastic waste needs to happen in a multi-pronged manner. However, plastic waste clean-up in Sanya has not received systematic policy-making or strict targets. Nevertheless, the increasingly active engagement of different stakeholders in cleaning up plastic wastes shows promising signs.

On the policy front, two government policy measures in dealing with marine plastic waste clean-up are notable. One is the selection of Sanya as the pilot for the Marine Sanitation System in 2020, which has propelled the local government to develop a land-sea integrated system, under which marine plastic waste can be collected, salvaged, transported, and disposed of on land.97 However, the scope of the Sanitation System is rather limited, leaving estuaries, coastal ports, piers, and tidal flats that are highly susceptible to the accumulation of plastic waste ungoverned. The other important policy instrument in Sanya’s toolkit for removing plastic waste is the use of the river chief system, lake chief system, and bay chief system, which can govern riverine inputs of waste.98 Officials appointed as river chiefs are responsible for preventing, controlling, and reducing the discharge of plastic items and pollution in general. Given the considerable volume of marine plastic pollution derived from watercourses, managing plastic waste in rivers before they flow into the ocean is vital.99

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International collaboration between Sanya and different organizations and foreign cities to explore effective plastic pollution governance approaches has experienced steady growth in recent years. A majority of those activities focus on cleaning up plastic waste from the environment. For instance, Sanya became the first Chinese city to join the WWF Plastic Smart Cities Initiative, pledging to eliminate plastic pollution by 2030.100 Several local districts, such as Wuzhizhou Island, Haitang District, and Tenghai Community were chosen as pilot programs in which public participation in beach clean-ups and plastic disposal was forcefully promoted.101 Another example is Sanya's engagement in the ‘No Plastic Ocean Initiative’, which is part of the European Union’s ‘Rethinking Plastics’ Program.102 Under the Initiative, Yazhou Central Fishing Port and Yufeng Fisherman Professional Cooperative in Sanya were chosen as demonstration sites. Furthermore, Sanya became one of the pilot cities in China to develop bilateral projects with Norway to reduce plastic and microplastic pollution.103 One of the key areas for collaboration is to improve Sanya’s technological capacity of tracking and detecting marine waste in the ocean, which contributes to the creation of an evidence-based understanding.104

Mobilizing the public to participate in plastic waste clean-up activities can reduce pollution and raise their awareness of the detrimental impact of mismanaged plastics on the environment, which is a crucial yet largely underinvested sector in China.105 The public, as primary consumers of plastics, can change their consumption practices or even influence the decision-making of companies to enhance industrial responsibility.106 Government authorities, together with environmental non-governmental organizations (NGOs), such

103 “Sino-Norway Cooperation—the Signing of Memorandum on Collaborative Capacity Building in Managing Marine Plastic and Microplastic” (Basel Convention Regional Centre for Asia and the Pacific, 26 October 2020).
104 Id.
as the China Environmental Protection Foundation and Blue Ribbon, have executed outreach campaigns to engage the public to improve their understanding of plastic pollution.\textsuperscript{107} More than 800 public events oriented towards the plastic ban and marine environmental protection were held in 2020, which substantially increased the visibility of plastic pollution as an environmental and health-threatening problem.\textsuperscript{108} As a result, the number of citizens participating in awareness-raising and beach clean-up activities rose rapidly from over 12,000 in 2019 to more than 50,000 in 2020.\textsuperscript{109} In some rural communities, such as Xi Island and Wuzhizhou Island, educational sites for marine environmental protection have been set up to help local residents to overcome plastic illiteracy and strengthen community support for plastic removal and clean-up actions.\textsuperscript{110}

Another easily overlooked category of plastic waste is derelict fishing gear, which can have profoundly adverse effects on the environment that require urgent local interventions.\textsuperscript{111} Given that collecting, carrying, and delivering derelict fishing gear is time-consuming, it is useful to deploy incentive mechanisms to garner widespread support from residents. A rising number of \textit{ad hoc} activities have been led by local authorities, in some cases in partnership with business groups and environmental associations, to encourage local fishers to collect fishing gear from the ocean.\textsuperscript{112} One private enterprise, the Corona beer company, has established an initiative to subsidize fishers in Sanya to collect and bring back marine debris to port.\textsuperscript{113}

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\textsuperscript{109} Id.


\textsuperscript{113} “Corona Recycles Marine Debris,” Social Beta, 22 March 2022, available online: <https://socialbeta.com/c/10734>.
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Reflections and Recommendations

A review of Sanya’s regulatory approaches and enforcement mechanisms to mitigate marine plastic pollution reveals that its regulatory emphasis overall reflects policy priorities at the national level to ban the production and use of certain types of single-use plastic products, but with a higher degree of stringency (e.g., the scope of the ban and the time frame). Sanya’s regulatory and institutional initiatives, notably the crafting of implementation rules and the creation of the Leading Group on Plastic Ban, can bring certainty and overcome barriers induced by bureaucratic fragmentation. By setting binding targets pursuant to the plastic ban for government agencies and instituting various compliance mechanisms, such as frequent inspections and third-party assessment, the Sanya government has spurred stronger enforcement at the local level to prohibit single-use non-degradable plastics. Despite relatively weak manufacturing capacity in Sanya, the government has increasingly perceived the degradable plastic industry as both a solution to plastic pollution and a new growth engine for the local economy. More policy support is expected in the coming years to attract investment and R&D in this area. Meanwhile, an increasingly wider scope of non-government actors, such as environmental NGOs, private businesses, and the public, have participated in the prevention and control of marine plastic pollution. This contributes to raising citizens’ environmental awareness and shaping their behavior to be more environmentally accountable, which is crucial to fostering a long-term strategy against plastic pollution. Furthermore, Sanya’s active participation in international collaboration with foreign countries and organizations can facilitate the exchange of good plastic governance practices and capacity-building.

Nevertheless, Sanya’s plastic governance approaches still have several notable deficiencies that limit the effectiveness of its environmental efforts. First, the scope of the plastic ban in Sanya remains too narrow to effectively rein in plastic pollution. Reducing certain types of plastic pollutants such as plastic bags and cutlery is a relatively easy governance task compared to reducing other sources of plastic pollution, such as textiles, tires, and food packaging, in which the industry stakes can be higher and political interests greater. Second, the regulatory framework in managing plastic waste in Sanya is highly fragmented and unevenly developed, and the institutional capacity remains weak. While policy development in plastic waste sorting and collection has

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experienced steady growth over the past years in Sanya, the recycling, reuse, and end-of-life treatment of plastic waste still lag. Third, the Sanya government’s reliance on heavy-handed regulatory approaches and the limited use of market-based mechanisms can be less productive in reducing plastic pollution, especially from a long-term perspective. Whether market-oriented schemes such as the deposit-refund system as recently planned by Sanya’s policy-makers will fully roll out is unknown. Fourth, although an increasingly diverse range of new actors have entered the regulatory landscape to tackle marine plastic pollution in Sanya, the government remains dominant, and the role of non-government actors is restricted. Without the engagement of private stakeholders throughout the entire plastic value chain, it is nearly impossible to address such a multifaceted environmental challenge.

In light of the existing problems in Sanya’s regulatory and policy framework of addressing plastic pollution, the following recommendations for improving Sanya’s local capacity in tackling marine plastic pollution are made. First, the list of banned plastic products should be progressively adjusted to cover those with a high pollution impact despite deeply embedded industrial interests. Based on local circumstances, constraints, and capabilities, implementation and enforcement authorities can design a reasonably ambitious timetable for a gradually expanded plastic ban. Second, more targeted policy support for the management of plastic waste, in particular during the recycling and treatment stages, is much needed in Sanya. Both the development of physical infrastructure, such as technologically advanced recycling facilities, and increased public awareness are indispensable. Third, Sanya should experiment more actively with different forms of market-based approaches to internalize the social and environmental costs of marine plastic pollution. It is important to maximize the cost-effectiveness and efficacy of relying on market dynamics to shape consumer and producer behavior to be more environmentally responsible. Sanya’s experiences with market-oriented approaches can be promoted nationwide or at an even larger scale. Fourth, the Sanya government should encourage broader public participation, in particular from citizens and private businesses, throughout all the stages of the plastic life cycle. As a complex and multidimensional challenge, marine plastic pollution cannot be addressed without action across multiple sectors and the engagement of stakeholders throughout the whole plastic value chain. The promising trend of new actors

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115 This is a common phenomenon in many countries as research shows that national governments used regulatory instruments 3.5 times more frequently than economic instruments. See Z. Diana et al., “The evolving global plastics policy landscape an inventory and effectiveness review,” Environmental Science & Policy 134 (2022): 34–45, p. 38.
entering the regulatory landscape to tackle marine plastic pollution in Sanya reinforces the need to balance the distribution of regulatory power between government agencies and non-government actors.

**Conclusion**

Facing the rapidly unfolding marine plastic pollution crisis, the Chinese central government has enacted an increasing number of regulations and policies to tackle the environmental problem at different stages. Amid a new wave of recentralization in China's environmental governance, the local government's capacity to formulate and implement environmental policies for addressing marine plastic pollution remains vitally important. Given China's size and geographical differences, a unified approach across all provinces and municipalities in mitigating plastic pollution might be infeasible or even counterproductive. The diffuse sources of marine plastic pollution, as identified largely at the local level, render local implementation a decisive factor in the ultimate success or failure of plastic pollution policies.

As one of the first cities in China to implement a strict plastic ban, Sanya is an interesting case study in terms of its evolving governance approaches in marine plastic pollution abatement. A critique of the strengths and limitations of Sanya's regulatory capacity in addressing marine plastic pollution yields important implications for local-level environmental governance underway in China and many other parts of the world. On the one hand, Sanya's first-mover attempts in developing implementation mechanisms, accountability regimes, and institutional arrangements to tackle plastic pollution have yielded positive results, including a considerable decline in the consumption of single-use plastic products. A wider range of non-governmental actors, such as NGOs, and private companies have entered the regulatory landscape and assumed an increasingly instrumental role of addressing plastic pollution throughout the product life cycle. The public's environmental awareness has steadily increased thanks to frequent outreach activities and campaigns.

On the other hand, it may be too early to predict when (or even whether) Sanya can successfully become a model city in reining in plastic pollution and achieving its zero-waste goal. Despite the progress achieved by Sanya so far, its governance approaches exhibit notable deficiencies, as discussed above. Whether Sanya authorities will be able to further expand the plastic ban and restrictions to meaningfully control the sources of plastic pollution and engage multiple stakeholders throughout the plastic product life cycle to sustainably manage plastic waste remains to be seen.
As clearly demonstrated in Sanya’s case, the penetration of plastic products in modern life and the diffuse sources of marine plastic pollution preclude a ‘silver bullet’ or single approach that can effectively or sufficiently resolve this complex environmental and societal challenge. A holistic and complementary approach consisting of a mix of policy interventions throughout all stages of the plastic life cycle is urgently needed. When progress at the international level remains slow, national and local governments must step up and play a more progressive role in reining in marine plastic pollution.