



Addressing Marine Litter in Cambodia:

A National Source Inventory (NSI) Approach

Working Paper

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This National Source Inventory report identifies sources of available data and knowledge related to marine litter in Cambodia, to inform evidence-based planning to address plastic pollution and marine litter at national level, in line with regional and global frameworks. This document includes information up to end of 2022.

The National Source Inventory report was developed by Fauna & Flora International (FFI) and COBSEA, with valuable input from the Ministry of Environment of Cambodia.

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The **SEA circular** project – Reducing marine litter by addressing the management of the plastic value chain in South-East Asia is implemented by the UNEP Regional Office for Asia and the Pacific and the Coordinating Body on the Seas of East Asia (COBSEA), with funding support from the Government of Sweden. SEA circular aims to reduce and prevent plastic pollution and its impacts by working with governments, businesses, civil society, academia, and international partners. The initiative promotes market-based solutions and enabling policies to transform plastic value-chain management, strengthens the science base for informed decision making, creates outreach and awareness. The project leverages COBSEA’s regional mechanism to tackle the transboundary challenge of marine litter in a harmonized manner.

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The **Coordinating Body on the Seas of East Asia (COBSEA)** is a regional intergovernmental mechanism and one of 18 Regional Seas programmes. It is the decision-making body for the East Asian Seas Action Plan, bringing together nine countries – Cambodia, China, Indonesia, Republic of Korea, Malaysia, the Philippines, Thailand, Singapore and Viet Nam – in protection and sustainable development of the marine and coastal environment. COBSEA focuses on marine pollution, ecosystem-based marine and coastal planning and management, and ocean governance. The COBSEA Secretariat is hosted by Thailand in Bangkok and administered by the UNEP Ecosystems Division.

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Established over a century ago, **Fauna & Flora International (FFI)** is the world’s oldest international wildlife conservation organisation. FFI’s focus is on protecting biodiversity, which underpins healthy ecosystems and is critical for the life-support systems that humans and all other species rely on. FFI has been working on marine plastics since 2009, and was the first biodiversity conservation organisation to address the emerging threat from microplastics in our oceans. The Coastal & Marine Conservation Programme (CMCP) is part of FFI’s programme of work in Cambodia. The CMCP supports the RGC to protect coastal and marine biodiversity, sustainably manage fisheries resources and improve livelihoods of local fishers and communities. Over the past 10 years, the CMCP has focused on building community, government and local partner capacity for biodiversity conservation and the design and management of an MPA network, whilst tackling key threats such as illegal fishing and most recently, plastic pollution.

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List of Abbreviations

3R	Reduce, Reuse, Recycle
ALDFG	Abandoned, Lost or otherwise Discarded Fishing Gear
ASEAN	Association of Southeast Asian Nations
CE	Circular Economy
COBSEA	Coordinating Body on the Seas of East Asia
COMPED	Cambodia Education and Waste Management Organization
DGE	Department of Green Economy
EPR	Extended Producer Responsibility
EPS	Expanded Polystyrene products
FFI	Fauna & Flora International
GGGI	Global Ghost Gear Initiative
GIZ	Gesellschaft für Internationale Zusammenarbeit
GSSD	General Secretariat for Sustainable Development
HH/HHs	Household/s
IGES	Institute for Global Environmental Strategies
IUNCSDB	International UN Comtrade Statistics Database
JICA	Japanese International Cooperation Agency
JAIF	Japan-ASEAN Integration Fund
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
ML	Marine Litter
MoE	Ministry of Environment
MoWRAM	Ministry of Water Resources and Meteorology
MUPs	Multiple-Use Plastic products
NAP	National Action Plan
NACSD	National Committee for Sustainable Development
NESAP	National Environment Strategy and Action Plan
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
NSI	National Source Inventory
PADI	Professional Association of Diving Instructors
PDoe	Provincial Department of Environment
PVC	Plastic Value Chain
RAP MALI	Regional Action Plan on Marine Litter
RGC	Royal Government of Cambodia
RS	Rectangular Strategy
SBC	Social Behaviour Change
SDG	Sustainable Development Goals
SUP	Single Use Plastic
SWM	Solid Waste Management
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USD	United States Dollar
WaCT	Waste Wise Cities Tool
WFD	Waste Flow Diagram
WtE	Waste to Energy

1. Executive Summary

The National Source Inventory (NSI) report is intended to collect available data in Cambodia on plastic products lifecycle and flows, waste generation, composition and disposal flows, and results arising from monitoring of freshwater and wastewater, coastal and marine environments. The main goal is to provide a basis for identification and prioritization of actions to reduce and prevent marine litter, identifying gaps, establishing baselines for possible interventions, and better tracking results.

Following the main structure proposed by the United Nations Environment Programme (UNEP), the approach is based on four key pillars, grouping data related to:

1. Plastic import, production and consumption;
2. Waste statistics;
3. Monitoring of freshwater and wastewater; &
4. Monitoring of coastal and marine water.

The analysis of 37 source documents and five national strategic plans, in addition to a national consultation to coordinate action and track results on marine litter-related activities in Cambodia in May 2022, provided the following key findings:

- Most studies included in source documents were Solid Waste Management (SWM)-related (including waste generation and composition) in cities such as Phnom Penh, Siem Reap, Sihanoukville, Battambang and Kampot, often with the aim to support the improvement of SWM systems in these urban areas. Methodologies used are not clearly comparable, making it more difficult and less reliable to calculate national estimates using available data.
- Analysis of all source documents reveals a big discrepancy in spatial or geographical focus of current research efforts on plastic pollution in Cambodia, with cities and urban areas receiving most of the attention compared to remote and rural settings (including coastal and island sites). Remote and rural areas, especially those situated near or along rivers, streams and

lakes, are lagging behind in research focus even though plastic pollution in these areas is becoming ever more rampant and worrisome. (1,2) The lack of data in rural areas is one of the key challenges to establish clear national baselines.

- Very limited data and knowledge on national plastic products import, production and consumption are currently available, although general consumption is reported to be quickly increasing at national level.
- Waste statistics from different source documents highlight overall trends of increasing waste generation, increasing plastic consumption, improving collection services that are limited to urban environment. The recycling sector, being mainly based on informal economic operators and activities, can't provide accountable and solid data to clearly define the amount of waste being recycled.
- There are no regular and consistent monitoring programmes to assess quantity and type of plastic pollution in water bodies; specific one-off research activities performed in target geographic areas provide current available knowledge, but these are not comparable to define a clear national baseline on marine litter.

Following a policy review and the analysis of current and/or drafted national strategic guidelines relevant to marine litter and plastic pollution, a series of institutional, knowledge and technical gaps are listed below:

- Unclear and overlapping mandates at institutional level over waste management and monitoring;
- Limited capacity, financial and technical resources at national and sub-national level to implement and improve SWM plans, awareness campaigns, recycling, monitoring;
- Weak data management, from collection to analysis, comparison and capacity to inform policy-making processes;
- Lack of standardized monitoring methodologies for SWM systems and plans in urban, rural, island contexts, that are consistent and can align with water-bodies monitoring programmes;

- Overall knowledge gaps along the Plastic Value Chain (PVC), including statistics on production, import and consumption, recycling, illegal disposal, leakage into the environment;
- Lack of research focused on microplastics in water bodies, and impact of plastics pollution on biodiversity, ecosystems, livelihood activities and human health at local and national level.

In order to provide an evidence base to inform decision-making and development of strategies and policies for tackling marine litter at a country level, the report provides a snapshot of the current status of knowledge at national level. The NSI report should support the process of developing a National Action Plan on marine litter by providing a set of recommendations formulated based on findings from the analysis of source documents.

- a. Enforce and implement the MoE's mandate at national and sub-national level to monitor, check and evaluate waste management;

- b. Improve technical capacity at government level to manage, analyze and use different data sets to reduce marine litter;
- c. Consistently apply a harmonized methodology for monitoring of waste generation, composition, collection and leakage to ensure collection of nationally representative data;
- d. Engage informal sector to assess waste recycling rates in different areas;
- e. Create and implement a harmonized monitoring programme on marine litter;
- f. Define a clear inventory and register of raw plastic and plastic products import and production;
- g. Include clear Social Behavioural Change (SBC) components in monitoring and evaluation of SWM projects to collect outcomes, progress and measure changes;
- h. Strengthen stakeholder's coordination to help achieve the evidence-based goals, targets, and indicators for tackling marine litter and plastic pollution.

2. Introduction

UNEP defines marine litter as “any persistent, manufactured or processed solid material discarded into the sea or rivers or on beaches; brought indirectly to the sea with rivers, sewage, storm water or winds; or discarded or lost at sea.(3)” Marine litter is rapidly becoming an urgent global issue as presented by the recent United Nations Environment Assembly resolution to end plastic pollution and forge an international binding agreement by 2024.(4)

South-East Asia is witnessing a high amount of waste entering the oceans mainly due to rapid population growth, insufficient solid waste management systems and systemic barriers. (5) The transboundary nature of marine litter issue calls for regional and multi-stakeholder actions to coordinate interventions, harmonize monitoring and methodologies, and prioritize a whole plastic lifecycle approach.

The Coordinating Body on the Seas of East-Asia (COBSEA) and the Association of Southeast Asian Nations (ASEAN) are attempting to improve coherence, coordination and synergies between existing mechanisms, and to enhance cooperation and governance to better address marine litter and microplastic challenges at local, national, regional and global levels through the application of regional frameworks of actions.(3) In Cambodia, the efforts include leading the development of a National Action Plan (NAP) on marine litter to drive and shape future policies

and actions that align with existing national strategies.

COBSEA Regional Action Plan on Marine Litter (RAP MALI) is supporting the development of robust monitoring and assessment of marine litter in participating countries to support the tracking and evaluation of science-based policy and management interventions. In order to further the development of the upcoming NAP in Cambodia, this National Source Inventory (NSI) report analyses available data, statistics and figures with the aim to help identify baselines and relevant targets.

This report includes an introduction to the NSI approach and its connection with the whole plastic value chain. Following that, it presents the methodology of analysis of available data through a corpus of selected source documents from governmental institutions, development partners, academic institutions, NGOs.

Available data are analyzed and presented along the four main NSI Pillars, highlighting main trends, patterns and identifiable gaps to be addressed in developing the NAP. Additionally, the report analyses existing national policies and strategic plans and their relevance to marine-litter issue, and suggests gaps to better align national marine litter strategy with existing one.

3. What is a National Source Inventory (NSI)?

National Source Inventory is a pilot approach developed by UNEP to collect available data within a selected country on plastic products lifecycle and flows, waste generation, composition and disposal flows, and results arising from monitoring of freshwater and wastewater, coastal and marine environments. An NSI encompasses available data from selected SDG targets and relevant stakeholders, thus gathering evidence to identify sources of marine litter and microplastics leaking into the environment, waterways and coastal seas.

The main purpose of such an approach is to provide a basis for identification and prioritization of actions to reduce and prevent marine litter, identifying gaps, establishing baselines for possible interventions, and better tracking results.

Within the process of developing a NAP on marine litter, the NSI approach is crucial to set priorities and plan effective strategic actions at national level, as illustrated in Figure 1 below.



Figure 1. National Source Inventory structure (6)

Marine litter action planning includes assessing a scientific base, collecting and organizing data to select the right strategic approach that builds on existing regional frameworks and aligns with national strategic plans. In developing a NAP on marine litter and specific regulations or policies to address marine plastic pollution along the full value chain, the NSI can provide a clear snapshot of existing knowledge and data gaps to be addressed, as well as a platform of shared knowledge to enable more cohesive and coordinated actions among all stakeholders.

3.1 Circular plastic value chain and NSI

The four pillars of the National Source Inventory structure (Figure 1) encompass: i) the plastic value chain (PVC) (i.e., from the lifecycle of plastics through import, production and use); ii) flows of plastic products once becoming waste to identify leakage hotspots; iii) monitoring of fresh and wastewater, and iv) coastal and marine

water to assess accumulation, quantity and composition of marine litter.

Such structure can support the development of policies and interventions that aim at shifting from a linear (Figure 2) to a circular plastic value chain (Figure 3), assessing where plastics are disposed of or leaked into the environment, and supporting the establishment of clear baselines for recycling to close the circular loop.

The linear flow of plastic through the PVC (Figure 2) is currently one of the primary sources of CO₂ emissions and environmental pollution.(7) The current business-as-usual management model at global level, where an approximate 41% of the plastic is either disposed of in landfills or leaked directly into the environment and only 14% is sent to recycling, is considered to triple the amount of plastic leakage into the ocean by 2040, and to increase plastic stocks in the marine environment by four times.(8)

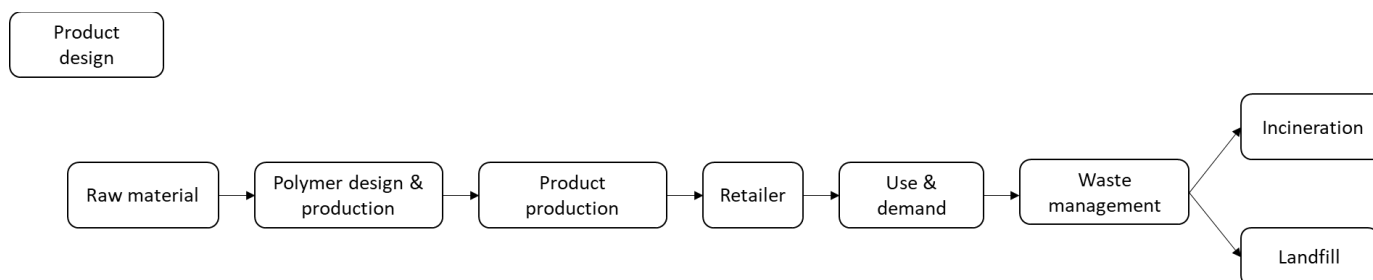


Figure 2. Linear plastic value chain (7)

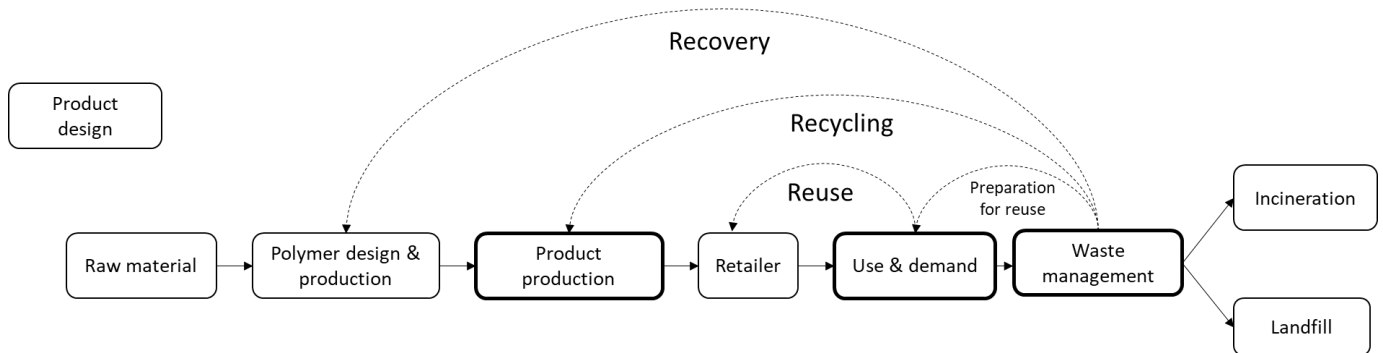


Figure 3. Linear to circular plastic value chain (7)

The circular plastic economy is gaining momentum at global level as a viable alternative to the present linear system, wherein plastic undergoes the three-stage lifecycle of “produce, use and dispose ” (Johansen et al, 2022). The chief purpose of the circular plastic economy is to reduce the volume of plastic waste entering the environment while striving for maximum reuse and recycling of plastic back into the system (Calleja, 2019; European Commission, 2018; Johansen et al, 2022).

However, various challenges exist in Cambodia along the value chain at national level to shift from a linear to a circular system, as clearly identified in the *Circular Economy Strategy and Action Plan* developed by the Cambodian Department (DGE) of Green Economy, the Secretariat General for Sustainable Development (GSSD) and the National Council for Sustainable Development (NCSDD) (9):

- **Raw material and design:** underdeveloped recycling market for raw materials, limited standards and manufacturing capacity.
- **Production and distribution:** no Extended Producer Responsibility (EPR) regulations or economic incentives for alternative materials for disposable items.
- **Consumption, Reuse and Repair:** limited consumers awareness on reduce, reuse and recycling (3-Rs) practices, limited regulation on Single-Use Plastics products (SUPs) use, and limited incentives to reduce waste generation and separation.
- **Collection:** limited fee collection from the public, limited public financing, unclear

performance requirements, and limited economic incentives for private service providers.

- **Recycling:** no waste separation at source, irregular and insufficient supply of feedstocks from private SWM companies, high costs of recycling operations vs. economic advantage of disposing in landfills, low technical capacity and equipment, underdeveloped markets for recycled products.
- **Residual Waste Management:** high costs for Waste to Energy (WtE) operations, no waste sorting, irregular and insufficient supply of feed waste,

These challenges underscore the need for changes in all the value-chain steps (i.e., design, production, use and end-of-life). The transition to the circular model should follow a holistic approach through careful mapping of implications along each step, stakeholder involvement and collaboration (7). On the consumers’ side, reducing plastic consumption and demand could avoid nearly one-third of projected plastic waste generation through elimination, reuse, and new delivery models. (8)

In order to effectively address steps in the plastic value chain in Cambodia, and subsequent marine litter presence, knowledge and information are needed to build evidence base and develop feasible and targeted measures.

3.2 Policy review

The review of existing policies and regulatory frameworks is crucial to define priority areas of

intervention, as well as to provide recommendations for implementation. As presented in Figure 1, policy review pillar is complementary to the NSI of available knowledge to inform a NAP.

The review includes identification of policies directly and indirectly referring to marine litter, identification of responsible entities and status of enforcement at national and sub-national level. In addition, different gap analysis previously conducted by national and international stakeholders support the identification of similar trends and needs in different geographical areas, thus allowing for a better understanding of current marine litter management

3.3 Legislation and Advocacy

Following the Policy Review, national strategic documents and guidelines can address policy gaps and support implementation of measures responding to identified needs. The development of a NAP needs to align and position measures within a broader legislative context that includes socio-economic and environmental perspectives.

This specific block supporting the NSI development identifies government actors to be engaged and coordinated, as well as specific areas of intervention to be coordinated within and across ministries, national institutions, and development partners.

4. Analysis Rationale / Methodology

4.1 Stakeholder analysis

In recent years, different projects and actions have been implemented by various development actors in Cambodia to support the national government to understand, analyze and tackle the marine litter problem, by also considering the main regional frameworks of action to harmonize and coordinate efforts against plastic pollution in South-East Asia (see Table 1 below). Development partners and NGOs are leading efforts in collecting evidence, with a main focus on Solid Waste Management (SWM). Governmental bodies actively participate in providing information and producing national or local strategic documents in close cooperation with the most important stakeholders.

The Royal Kingdom of Cambodia appoints Ministry of Environment (MoE) as the focal point to provide data to the International System on specific SDG Indicators (10):

- 6.3.2 Proportion of bodies of water with good ambient water quality
- 12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement
- 12.4.2 Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
- 12.5.1 National recycling rate, tons of material recycled

The National Institute of Statistics is also responsible as a focal point to provide data on the following indicators:

- 6.3.1 Proportion of domestic and industrial wastewater flows safely treated
- 11.6.1 Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities
- 14.1.1 (a) Index of coastal eutrophication; and (b) plastic debris density

To date, however, no official data on the listed SDG indicators are available within the United Nation (UN) Stats system as part of the country's profile. (11)

International and local stakeholders, on the other hand, focus most efforts on assessing local, national or regional situation and providing recommendations to public authorities at a different level for further improvement, as captured in their published reports.

In more recent years, development partners, NGOs and researchers' actions expanded their focus from SWM to the whole plastic value chain, including consumption, disposal, leakage into the environment and collection of evidence of increasing pollution in marine environment. That being said, little data are available at present and mostly focused on scoping research and/or assessment in select areas, with development partners like Fauna & Flora International (FFI) and

The World Bank being among the first in conducting specific work on marine litter.

More efforts are urgently needed to define, structure and implement a clear and harmonized data collection strategy on solid waste management, collection, leakage and pollution of riverways and coastal areas. (12)

Annex II list current efforts deployed by international development partners to tackle marine litter and/or the plastic problem at national level in Cambodia.

Technical consultation to engage key stakeholders in developing the NSI

To discuss the state of marine litter in Cambodia, available data and gaps, existing policies/regulations and gaps, barriers/challenges to implementation, and key priority action areas for marine litter planning, a virtual technical consultation, entitled “*Technical Consultation on National Action Plan (NAP) to coordinate action and track results on Marine Litter-related activities in Cambodia*” was conducted on May 26th 2022. Stakeholder engagement for this activity utilized an existing network of national coordination group established in 2020 and currently spearheaded by FFI – Cambodia, in which relevant stakeholders and partners are invited to attend virtual quarterly meeting for discussion and update.

In total, 30 stakeholders and partners from government, development sector, academia and private sectors were invited to participate in the first consultation. However, only 15 of them were able to attend on the day. Attendees were comprised of two MoE representatives as COBSEA Focal Points in Cambodia, four Non-Governmental Organizations staff, eight UN agencies and development partners staff and one research institution staff. Invited and attended participants are listed in Annex 1.

Key Topics presented and discussed in the consultation included:

1. Analysis of current marine litter situation in Cambodia, previously developed by Fauna & Flora International (FFI) - Cambodia (2020);

2. Introduction to the NSI approach to addressing marine litter, and how the involvement of national and international stakeholders could support the NSI development to build national evidence and inform the country’s NAP;
3. Possible alignment of the NAP development process with existing efforts led by various key actors, including government, local and/or international stakeholders, so as to avoid duplication issue; &
4. Relevance and importance of a national marine-litter monitoring programme and its development process.

Two key discussion outcomes emerging from the consultation included:

1. The need to review what most-up-to-date waste-management figures and statistics are available, with the emphasis being put at urban level, that can be integrated into existing data to help realize nationally representative data; &
2. How the proposed NAP can be aligned with Cambodia’s existing strategic plans to foster government buy-in and collaboration.

Specifically, the discussion on waste-management data raised not only the issue of different methodologies being used to collect data, but also the need to have one harmonized methodology and approach to ensure consistency of data collected and provide clear and representative baselines to support the setting of targets (e.g., SUP reduction, plastic cycle) in the NAP. For example, the use of the GIZ-developed Waste Flow Diagram (WFD) tool that has been adopted by a few intergovernmental agencies (i.e., UNEP and UN-Habitat) for data collection could support the assessment of (urban) plastic leakages into the environment, which also aligns with indicator 11.61 (“*Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities*”). Lastly, the focus on the NSI approach also helped to call forth the need to consider availability of data on raw plastics and products imports into Cambodia, positioning it as a critical starting

point to understand current rates and patterns of plastic use and consumption in the country.

A second national technical consultation will ensue, following the first, to present findings of the NSI report, review recommendations, and further define elements to be embedded in the NAP as well as steps for development, approval and implementation of the Plan by responsible government agencies.

4.2 Source documents – data processing and analysis

A total of 37 documents were sourced as data for review and analysis in this NSI report. Given the paucity of available data and research publication on marine litter in Cambodia to date, all the documents collected here represented accessible sources through different platforms including open-access web libraries, development organization databases, and online ministerial libraries.

The documents included published or drafted reports starting from the year 2011 to account for significant socio-economic changes (e.g., rapid urbanization, population and economic growth) in Cambodia over the last decades, which continue to define the country's increasing waste-generation trends and quickly changing consumer behaviours. (12)

Sourced documents were grouped according to their type or category for analysis. A total of seven categories were proposed based on all the documents.

- **National reports (n=1, 3%)** include an extensive report from the Ministry of Environment collecting data, status and challenges related to different working sectors, including Solid Waste and Waste Water Management;
- **Policy guidelines (n=3, 8%)** include strategic papers developed by government authorities that analyzed and addressed specific issues at national and local level, provided baseline data, identified challenges and proposing Strategic Objectives, planned actions and specific targets pertaining to Solid Waste and Urban Solid Waste Management;
- **Online databases (n=2, 5%)** include available statistics or data stored on online websites,

related to global import of plastic products in Cambodia, and underwater marine debris;

- **NGO reports (n=9, 24%)** include documents developed by charities and non-profit organizations mostly as part of project activities to analyze or tackle specific issues, including marine litter in Cambodia, use and consumption of plastic bags, recycling in urban environment;
- **Regional reports (n=2, 5%)** include documents focusing on wide topics analyzing the regional situation and existing frameworks on circular economy and plastic pollution monitoring capacity, comparing national policies and strategies to identify similarities, gaps and proposing applicable best practices
- **Research papers (n=6, 16%)** include documents developed by research-focused institutions analyzing specific waste-related issues, such as recycling potential, SWM challenges, plastic pollution in riverways, through primary and secondary data collection, and providing gap analysis and/or recommendations; &
- **Development partner's reports (n=14, 38%)** include documents developed by international organizations within the scope of specific projects or supporting the Cambodian government identifying gaps and challenges along the waste/plastic value chain, providing new sets of data and information.

Overall, development partner and NGO reports represent the biggest share of all source documents (38% and 24%, respectively). In contrast, national reports represent the smallest proportion of the documents. This overview suggests that development partner and NGOs, operating in collaboration with ministries' departments, provincial and/or municipal authorities, occupy a leading role in the overall effort of understanding, analyzing and collecting data relevant to marine litter in Cambodia, compared to the government-led efforts mainly focused on Pillar 2 of the NSI.

Research activities led by universities and citizen-science groups, albeit few, serve as an important source of data on SWM and plastic litter issues that can be integrated into national statistics and databases.

Source documents present a wide variety of figures and data to be organized along the 4 Pillars and proposed subcategories of the NSI structure. Considering the similar focus on specific SW statistics from available source documents, there's a consistent amount of data for subcategories as "waste generation", "waste composition", "waste collection". However, the different scopes, nature, collection periods and, above all, data collection methodologies applied to get the results suggested to compare figures extracted from different sources without attempting to define averages or estimations on a wider scale.

For each subcategory, when available, data have been organized in tables with a clear indication of each source's period and methodology, to allow a direct comparison without necessarily merging them. For the same reasons, a clear separation among nation-wide statistics or estimation, and different target contexts (urban, rural, island) was taken into consideration.

4.3 Spatial Distribution of Existing Data

Geographical target areas of research and data collection in Cambodia are scattered and not evenly distributed. Existing documents can provide a different level of understanding for each focus sector (consumption behaviours, waste generation, recycling, etc.) based on local contexts and geographical area investigated. Most analyzed studies in this report focused predominantly on urban areas (see Table 2), but the fact that the wider part of the population – 60.6% - still lives in rural areas where waste services are lacking, suggests a careful approach in terms of data comparison and gaps identification on a national scale. (12,13) Therefore, part of the analysis is focusing on where data have been collected and which geographical areas the proposed sub-categories are covered. Understanding spatial distribution of currently available data is highly relevant for mapping out knowledge gap across different settings (i.e., urban, rural, island) with their own socio-economic and geographical constraints. It is also pertinent for determining representative and realistically achievable baselines for data collection across these settings.

4.4 Proposed sub-categories within NSI pillars & their relevance

Having nationally representative data is key to providing evidence for national baselines for the different steps of the plastic value chain in order to mitigate and reduce the amount and impact of marine litter

To help organize and analyze data collected from all the source documents, a total of 20 sub-categories were proposed within the four pillars of the NSI structure. These sub-categories were compiled based on elements listed in relevant SDG indicators and those in the linear and circular PVC models, so as to identify appropriate clusters of available data to create evidence base for setting clear targets in the short, medium and long terms in the NAP.

Pillar 1 – Production, use, lifecycle

Relevant sub-categories proposed in this pillar are: i) plastic production, ii) plastic import, and iii) consumption behaviours.

Local production and import statistics can provide a baseline of plastic products entering the full value chain in Cambodia and an estimation of consumption patterns based on market demand. Moreover, existing studies on plastic use or consumption behaviours and their drivers can offer insights to guide the development and implementation of awareness and education-focused strategies and campaigns.

In that same vein, it is vital to acknowledge that different consumer/user groups (i.e., segregated by age, gender, income, occupation, geography, etc.) are likely influenced by different drivers and needs related to specific products, and would therefore require targeted communication strategies to motivate less consumption of plastic.

Additionally, to assess the feasibility of transition of the plastic value chain from a linear to a circular approach, it is important to consider the amount of recycled raw materials used to produce new plastic items in Cambodia, which are extremely limited to date. Small companies are able to produce reusable bags made of recycled plastic waste (15), and a plastic bag recycling company in Battambang is able to

process up to 60 tons/month (10.2% of the estimated monthly amount of plastic waste generated in the same town) to produce new bags. (14) The identification of barriers and challenges to recycling could support targeted measures to foster and increase recycling capacity in country.

Pillar 2 – Waste statistics

Relevant sub-categories proposed in this pillar are: i) waste generation, ii) waste composition, iii) waste collection, iv) disposal, v) recycling rate (type, revenue, in-country vs. out-of-country), and vi) cost & fee

On the whole, the sub-categories correspond to the driving SDG Indicator 11.6.1 - *Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities*. The main points to be analyzed are: i) waste generation, ii) collection, and iii) disposal (including “illegal” practices).

In addition, information on waste categorization are crucial for identifying the types of waste (including plastics) entering the waste cycle in different local contexts, which reflects the SDG indicator 12.5.1 (*“National recycling rate, tons of recycled material”*). Lastly, data on waste collection rate and coverage across different local settings, operation cost and service fees, and willingness to use and pay for service are essential for engaging HHs and businesses in the local SWM system, as well as for understanding remaining gaps (e.g., policies enforcement, failed fee payment, lack of funding to ensure long-term operation of local SWM system).

Pillar 3 & 4 – Monitoring of freshwater/wastewater and marine/coastal water

Relevant sub-categories proposed in these two pillars are: i) litter quantity, ii) litter composition, iii) brand audit, iv) accumulation sites/hotspots, & v) leakage pathways.

Pillar 3 and 4, *Monitoring of freshwater and wastewater* and *Monitoring of coastal and marine water* respectively, connect to different SDG indicators, but considering overlapping habitats and methodologies for monitoring the proposed sub-categories were grouped together. In fact, the upstream-downstream link between freshwater and marine/coastal water needs to be

fully acknowledged, and that marine litter pathways can be said to begin from leakages into freshwater or wastewater (upstream) to marine and coastal water (downstream). In terms of methodologies, monitoring of these two water bodies can differ because of the fast-moving waters, higher presence of sediments and suspended material, and different biodiversity in freshwater ecosystems. (16)

SDG indicators relevant to these two pillars include: indicator 6.3.1 (*“Proportion of wastewater safely treated”*), indicator 6.3.2 (*“Proportion of bodies of water with good ambient”*), and indicator 14.1.1.b (*“Floating plastic debris density”*).

Annex III provides a summary of document types, category definition, publication ownership, areas of relevance to marine litter and/or plastic according to the four NSI pillars, relevant SDG Indicator.

5. Findings

In this section, findings are presented according to main research focus(es) of source documents along the four NSI pillars in order to highlight current knowledge and data availability as well as remaining gaps (e.g., data, technical, capacity, policy, etc.) within the NSI structure.

As shown in Table 2 above, most of the existing source documents were conducted in selected provinces or cities to meet particular research focus and needs, using different research methods and tools. Scope of studies were not always clearly defined in some of the documents, and in some cases the data collected to calculate estimates were secondary (i.e., using previous data, figures or statistics) rather than primary (i.e., data collected firsthand from the field). It is therefore difficult and less reliable to calculate national estimates using available data.

As shown in Figure 4, most studies in source documents were SWM-related (including waste generation and composition) in cities such as Phnom Penh, Siem Reap, Sihanoukville, Battambang and Kampot, often with the aim to support the improvement of SWM systems in these urban areas. Only one study examined

coastal island context (i.e., Koh Rong archipelago).

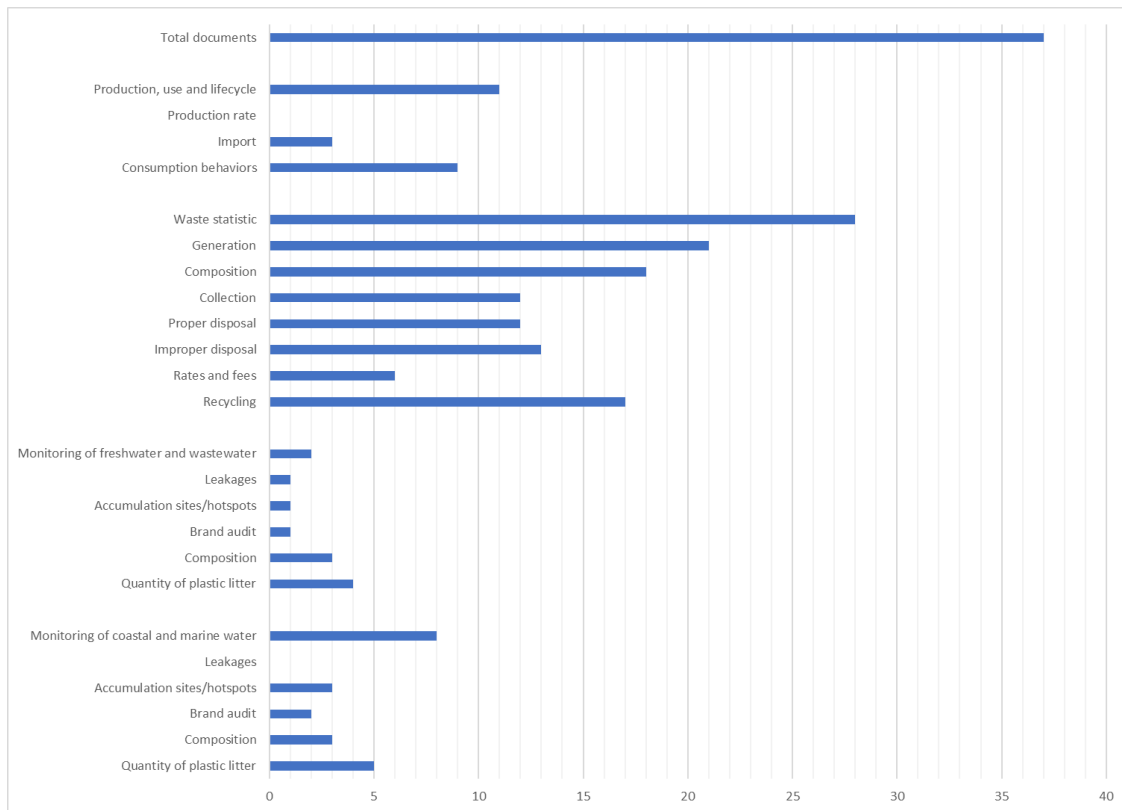


Figure 4. Available data per sub-category in each pillar

It is important to note that although some of the studies attempted to provide a national estimation of waste generation and composition, much of the focus was in urban contexts (be it big city or provincial centers). There was limited focus and effort on generating empirical evidence to enable a full understanding of (plastic) waste generation and management in rural and/or remote areas of Cambodia, including, but not limited to, reliable estimation of waste generation and identification of waste compositions.

To obtain clear, nationally representative baselines, all available data from source documents were grouped according to the proposed sub-categories in each NSI pillar, taking in account geographical coverage, data collection year, used methodology and approach. The data set are then analyzed to identify trends or patterns and gaps.

5.1 Pillar 1 – Production, use and lifecycle

Of all the source documents analyzed (n=37), five reports investigated use and lifecycle of plastics in urban settings and coastal island communities. Three reports (UNDP-owned) broadly explored consumption behaviours or use drivers of specific plastic products such as plastic bags, straws and plastic foam products, in Cambodia as a whole. Two other NGO reports (FFI-owned) further examined and identified key drivers of plastic consumption in coastal/marine island communities to include long-standing consumption habit, food and water needs influenced by geographical remoteness and limited infrastructure, and economic activities driven by tourism and fishing sectors.

Overall, the consumption of different plastic products is increasing in Cambodia (figure 5). In looking at this increase, it is useful to note the different behaviours that were found to relate to

geographical areas and social groups, as identified in each of these studies. For instance, in urban areas plastic bags were found to be the most common product for carrying goods or street food on motorbikes, and were often discarded after a single use. (17)

Youth groups (with unspecified age range in the source report) in urban settings were found to be more inclined to consume a high number of small plastic bags and food containers from street food and lifestyle purchases at local markets or modern retail venues. On the supply side, retailers, shop owners and/or suppliers rely more on bigger and stronger bags for transportation and storage, although increasingly small bags are being used to satisfy customers' preference. (17)

In island communities, the most used SUPs are plastic bags, food packaging (mostly Styrofoam), plastic packaging (including those used for transporting goods to the archipelagos). The island communities were also found to rely heavily on bottled water as the main source of drinking water due to easy access, preference for drinking cold water, and perception that bottled water is more hygienic and thus safer to drink.

This identified increase of plastic consumption is in line with data from the International UN Comtrade Statistics Database (IUNCSD), which is currently the only available data source for the country's plastic import. The IUNCSD data shows that the monetary value of plastic products imports from other countries into Cambodia rose exponentially from USD 25,505,589 in 2000 to USD 1,155,002,643.42 in 2021 (Figure 6).

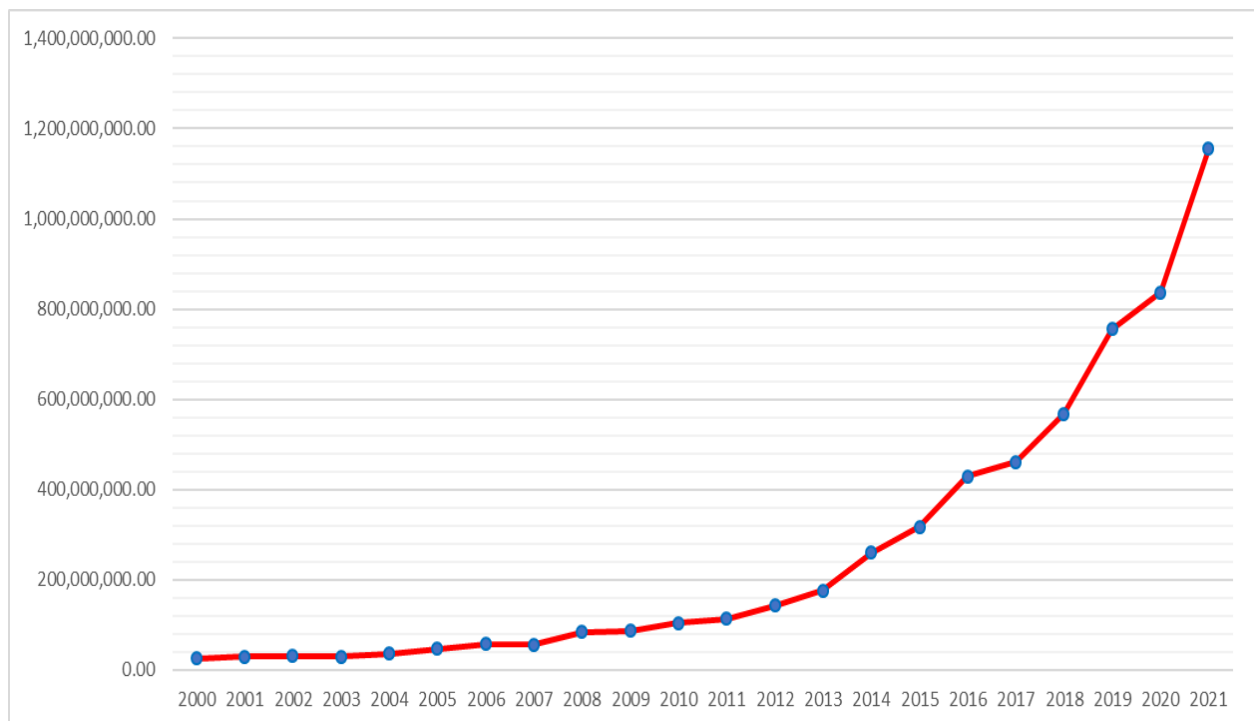


Figure 5. Cambodia Plastic products global import in USD, from 2000 to 2021 - UN Comtrade (18)

These figures suggest both a higher consumption and reliance on plastic products at national level, which confirm findings from the above-mentioned reports on use and consumption drivers across the country, particularly those in coastal and inland communities.

5.2 Pillar 2 – Waste statistics

This pillar includes a larger range of information and data, both quantitative and qualitative, compared to the other ones. Methodologies and periods of data collection differ, causing widespread uncertainty over some of the statistics and estimations considered.

A 2018 UNDP report suggests a national baseline of SW generation estimating in 2017 a yearly

to forecast the amount or quantity of waste generated within the country,

In Table 3, one research paper, one regional report, one development partner report and one

production of 3 million tons/year of Municipal Solid Waste, of 16 million ton/year of commercial and industrial waste, and of 15 million tons/year of construction and development waste. (12) Due to the lack of data and the impossibility to compare results from different methodologies, this baseline estimation is based on available data on waste generation in Cambodia and internationally combined in an estimation model

policy guideline document, from 2015 to 2021, present different estimations of waste generation at national level.

Source documents	Solid Waste Generation	Data collection methodology or source
Parliamentary Institute of Cambodia - 2015	6.82 tons/year	JICA 2005 study, assessing a per capita generation of 0.478 kg/day in Phnom Penh. The 2008 Census provides a 14.000.000 population figure
IGES – 2019 (19)	4.09 million tons/year	Data from “National Waste Management Strategy and Action Plan of Cambodia” assessing a per capita generation of 0.73 kg/day
UNDP – 2018 (12)	3 mil tons/year (MSW) nation - 16 mil tons C&I (Commercial and Industrial) - 15 mil tons C&D (Construction and Demolition)	Estimation model combining available data from different Cambodian cities and international studies
RGC – 2021 (20)	3 mil tons/year (MSW)	Unknown

Table 1. Solid Waste Generation estimates at national level

The following tables present different figures collected in the period from 2011 until 2021 at city and province-level contexts. Available data include waste generation, composition, collection and recycling rate.

Table 4 shows data collected in 2011 by the Department of Environmental Pollution Control of the MoE, based on waste disposal monitoring at various provincial dumpsites across the country, as reported by Sathy S. (21). The methodology of waste generation data collection is not specified.

No.	Town and province	Waste generation Tons/year ⁴	% of waste disposed into landfill/dump site
1	Takhmao, Kandal Province	42,340	34
2	Preyveng, Preyveng Province	6,278	32
3	Siem Reap, Siem Reap Province	47,450	85
4	Svay Rieng, Svay Rieng Province	767	75
5	Sihanouk, Sihanouk Province ⁵	40,150	73
6	Kampong Cham, Kampong Cham Province	12,775	71
7	Chbamon, Kampong Speu Province	7,191	67
8	Battambang, Battambang Province	29,200	63
9	Senmonorom, Mondul Kiri Province	2,373	62
10	Kep, Kep Province	3,176	57
11	Steung Sen, Kampong Thom Province	11,607	36
12	Samrong, Odormeanchey Province	2,190	33
13	Kratie, Kratie Province	7,300	28
14	Kampong Chhnang, Kampong Chhnang Province	9,855	26

⁴ The original source is presenting tons/day data. Figures presented here are calculated as (original daily data)*365

⁵ The correct name of the province is Preah Sihanouk

15	Khemarak Phoumin, Koh Kong Province	5,475	20
16	Daun Keo, Takeo Province	4,745	15
17	Pursat, Pursat Province	12,994	14
18	Kampot, Kampot Province	10,220	7
19	Serey Sophorn, Banteay Meanchey Province	61,320	6
20	Preah Vihear, Preah Vihear Province	3,504	6
21	Pailin, Pailin Province	2,920	0
TOTAL		323,828	39

Table 2. Waste Generation and Disposal into dump sites by towns - Department of Environmental Pollution Control (MoE), 2011

Table 5 shows data collected by UNEP, IGES and the MoE in 2017 to prepare the *National Waste Management Strategy and Action Plan for Cambodia*⁶ (22), including waste generation, collection, recycling and illegal dumping (waste not collected nor recycled) by province.

No.	Province	Estimated waste volume	Amount of waste collected		Illegal dumping of solid waste		Amount of waste recycled	
		T/year	T/year	%	T/year	%	T/year	%
1	Phnom Penh	1,007,400	839,500	83	117,530	11.7	50,370	5
2	Kandal	379,600	205,495	54	155,125	40.9	18,980	5
3	Takeo	59,427	29,066	49	14,002	23.6	16,358	27.5
4	Kep	13,505	9,125	68	2,555	18.9	1,825	13.5
5	Kampot	304,410	120,450	40	105,120	34.5	78,840	25.9
6	Sihanoukville	46,063	43,800	95	1,825	4.0	438	1
7	Koh Kong	28,321	22,269	79	4,146	14.6	1,905	6.7
8	Kpg. Speu	15,446	10,048	65	1,770	11.5	3,628	23.5
9	Kpg. Chhnang	79,471	49,070	62	11,767	14.8	18,633	23.5
10	Pursat	4,365	3,149	72	1,051	24.1	164	3.8
11	Battambang	42,940	36,828	86	4,380	10.2	1,731	4
12	Pailin	32,850	22,630	69	5,475	16.7	4,745	14.4
13	B. Meanchey	142,532	91,615	64	28,287	19.9	22,630	15.9
14	O. Meanchey	4,764	3,266	69	1,497	31.4	0	0
15	Preah Vihear	4,745	4,380	92	182	3.9	182.5	3.9
16	Siem Reap	527,811	319,740	61	194,910	36.9	13,161	2.5
17	Kpg. Thom	223,380	115,705	52	74,095	33.2	33,580	15
18	Kpg. Cham	578,890	308,060	53	258,420	44.6	12,410	2.1
19	TbongKhmum	214,002	110,350	52	102,484	47.9	1,167	0.6
20	Kratie	54,866	27,250	50	10,139	18.5	17,476	31.9
21	Stung Treng	18,980	12,410	65	6,570	34.6	0	0
22	Ratanakiri	30,660	18,980	62	10,110	33	1,569	5.1
23	Mondulkiri	4,781	3,540	74	866.875	18.1	373	7.8
24	SvayRieng	20,239	8,654	43	9,143.25	45.2	2,441	12.1
25	Prey Veng	250,755	155,850	62	73,000	29.1	21,900	8.7
TOTAL		4,090,209	2,571,235	62.9%	1,194,456	29.2%	324,512	7.9%

Table 3. Municipal Solid Waste (MSW) collection, illegal dumping and recycling rates in Cambodia, MoE 2015

The difference between these figures is evident, although all figures shown here point to a steady increase in waste generation in all provinces, together with improved waste collection services. At the same time, it also reveals the difficult challenge of comparing sets of data collected across different times periods using different methodologies, which in some cases were unmentioned or unspecified.

⁶ Draft document

Table 6 shows available figures from multiple source documents in urban environments, including methodology used. This table also includes waste composition.

Source documents	Methodology	Solid Waste Generation – Tons/day	Waste composition %				Collection rate %	Recycling	
			Organic	Plastic	Paper	Other		Quantity – Tons/day	Rate %
UN ESCAP (2011) Solid Waste Management Baseline Survey – Kep (23)	7 consecutive days in 3 communes 120 randomly selected HHs in “low” and “high” income categories 28 shops, 6 offices, 1 market, 3 restaurants included	17 0.5 kg/person/day	74	17	3	16	36	0.625	3.6
COMPED – Waste Survey research 2011 Phnom Penh	Unknown		70	6	5	19			
COMPED – Waste Survey research 2011 Battambang	Unknown		71	10	2	17			
COMPED – Waste Survey research 2011 Siem Reap	Unknown		54	11	6	29			
COMPED – Waste Survey research 2011 Kampong Cham (24)	Unknown		60	12	5	23			
Seng, B., Fujiwara, T. (2016) Phnom Penh City (25)	1 week period (2014) based in Dangkor landfill Waste sampled from collection trucks representing each district of Phnom Penh 250-300 kg of waste sorted from each truck after quartering	1,726.94	54	21	10	15	82.1	20.2	1.1
IGES (2017) Battambang (26)	Unknown	130						13.5	10.4 %
IGES (2018) Phnom Penh (27)	From K. Seng (2015)		54	21	10	15	83		
Seng, B.; Fujiwara, T.; Seng, B., (2018). Phnom Penh (28)	1-week periods in rainy and dry season 9 zones Waste collected in the morning by randomly selected trucks representing each zone and		65	21	7	16			

	sorted at Dangkor landfill, 200-300 kg each truck after quartering								
Michaels T., Ravaz J., Sensamras P. (2015) Battambang (29)	Average estimation from reports dated 2011 and 2017	130	70	15	/	15	78		12
The World Bank (2020) Sihanoukville (30)	Data estimated by Provincial Department of Environment	315 (municipality) 80 (rest of province) 20 (islands)	56.5	19	10	14.5	73		
UN-Habitat – Sihanoukville – 2020 (31)	Waste-Wise Cities Tool (WaCT) 8 days period, 9 survey areas, 90 HHs from 3 income groups (low-middle-high)	366 tons/day	51	31	6	12	90	5.4 tons/day	4
UN-Habitat – Kep – 2020 (31)	2 hotels, 2 restaurants, 2 schools, 2 offices, 1 supermarket, 1 market, 1 hospital per survey area	25 tons/day	62	23	5	10	58	0.75	3

Table 4. Solid Waste Generation, composition, collection and recycling rates at urban level in different cities and periods

Table 7 presents findings from the only NGO report (FFI, 2022) focusing on waste generation, composition and collection in island communities, more specifically in Koh Touch and Mpaë Bai villages.

Source documents	Methodology	Solid Waste Generation – Tons/day	Waste composition %				Collection rate %	Recycling	
			Organic	Plastic	Paper	Other		Quantity – Tons/day	Rate %
Fauna & Flora International (2021) Koh Rong Archipelago (32)	UNEP (2009) 8 days period 2 villages 37 HHs selected with convenience sampling method 25 businesses selected with convenience sampling method Randomized waste reduction for characterization	2.2 (during COVID)	56	26.5	/	17.5	21.7	/	/

Table 5. Example of solid waste generation, composition, collection and recycling rates at island community level (KRA) - FFI, 2021

Table 8 presents findings from a research paper (Smith et al., 2018) investigating waste statistics in a rural context, focusing on a remote community in Koh Dambang island, Stung Treng province.

Source documents	Methodology	Solid Waste Generation – kg/per capita/day	Waste composition %				Collection rate %	Recycling	
			Organic	Plastic	Paper	Other		Quantity – Tons/day	Rate %
Smith et al (2018) Koh Dambang (33)	Interviews and direct observation 9 HHS	0.4 – 1	54	13	27	6	0	/	/

Table 6. Example of solid waste generation, composition, collection and recycling rates at rural community level (Koh Dambang) - Smith et al. 2018

As previously mentioned, these existing figures are not comparable due to different methodologies used, but it is possible to highlight trends and patterns, especially at urban level.

Solid waste generation in cities ranges from 0.5 to 1.3 kg/day/per capita, while in rural and island communities remains lower from 0.4 to 1 kg/day/per capita; however, earlier studies and estimations suggested a daily per capita waste production of 0.487 kg in 2005 in Phnom Penh (21), which is now considerably higher in the same or similar urban areas.

Nation-wide, waste collection rate is estimated to be around 62% of total waste generation; however, the 2018 UNPD report on Solid Waste Management in Cambodia suggests much lower figures considering that 80% of the total population is estimated to be living in rural areas where collection services are absent. (12) This estimation reflects those of the studies by FFI and Smith *et al.* in island and rural environments, both of which highlighting very limited or absent collection services. (32,33,43)

Moreover, although waste collection rates in urban areas are growing, only a very limited amount is recycled. The majority of the waste is disposed of across 76 landfills (most of which are controlled or uncontrolled dumpsites). To date, only three sanitary-engineered landfills in the entire country are planned for establishment. (12, 22)

While the waste composition studies analyzed here differ in methodology, sample sizes, collection points, and survey duration, the general observation of data seems to suggest a decreasing pattern of urban organic waste over time in light of an increase plastic waste, as the waste itself now represents 20 to 30 % of all domestic waste—a notably high figure,

considering how light weight plastic is. Again, this affirms the growing import statistics and consumption rates of plastic products at national level, as shown in the data from the IUNCSD earlier.

Also, important to note is that island communities reported in Table 7 record a significant plastic waste percentage that is in line with urban statistics. The fact that data collection took place during COVID19 outbreak, when the archipelago saw little to no presence of tourists, further underscore the high plastic consumption and waste generation in these locations. As shown in previous research, the island communities have a higher reliance on plastic products, in large part because of the inadequate or absent infrastructures to help them meet their daily food and water needs. (5)

Nearly half (n=17, 47%) of all source documents studied the recycling sector in Cambodia, assessing the amount and types of products being recycled. Because Cambodia lacks proper, large-scale recycling facilities, the majority of recyclable waste ends up being exported via informal waste sectors to neighboring countries of Thailand and Vietnam. As pointed out in a few of the source documents, recyclable waste materials collected from HHS, waste collection points and landfills are stored together for export without any record of how much recyclable waste actually comes from each of these source points. This in turn makes it impossible to understand the real amount and type of recyclable waste being generated and collected at each of the solid waste value chain (e.g., HHS, collection points, and dumpsites/landfills).

Relevant government or national data on recycling are those compiled by the Ministry of Environment to develop the National Solid Waste Management Strategy and Action Plan 2017-

2030 and the 4th State of Environment, and are based on the 2015 inventory data collected by Provincial Departments of Environment (PDoE). (22, 47) Based on these data, it is estimated that nationally around 10.4% of municipal solid waste is sent to recycling. However, findings from the 2019 WaCT survey by UN-Habitat in Sihanoukville and Kep suggests much lower figures, respectively at 4% and 3% of total municipal waste generated. (31)

Statistics on recyclable wastes at freshwater and marine island communities are virtually absent to date. However, according to four NGOs reports in Koh Pou, Koh Rong, Koh Sdach and the rural community of Koh Dambang, there was willingness among HHs interviewed to engage in proper disposal alternatives if there were available and accessible, including high willingness to participate in waste recycling in some cases. (32, 33, 43, 53)

Uncollected waste & improper disposal

A total of 10 source documents (27%) provided estimation on the amount of improper disposal and/or uncollected waste, using the WaCT and the Waste Flow Diagram (WFD) for their study

Finally, according to a UNDP report on the enforcement and implementation of Sub-Decree n. 168 on the management of plastic bags, there appears to be a reduction of 50% of plastic bags used in supermarket due to the imposed fee, and the difficulties for smaller retailers and family shops to implement such fee. (34)

Taken together, all this statistical information can form a useful basis to not only gauge the rate of waste generation and recycling as well as its composition, but also assess the level of public awareness toward a specific SUP product, the progress of specific policies implementation (Sub-Decree n. 168), and the possible space to further enforce EPR and improve product design, plastic alternatives and fee-paying and/or SUP-ban policies.

methods. Open burning and illegal dumping were found to be the two most dominant disposal methods, as shown in Table 9 below.

Source documents	Geographical target area	Uncollected Solid Waste		Improper disposal %		
		Ton/day	%	Burned	Open dumping	
					In land	In water
RGC – National Waste Management Strategy and Action Plan 2017-2030 (22)	Nation	3,272.5	24.9%			
RGC - Policy on Urban Solid Waste Management 2020-2030 – 2021 (35)	Nation	2,739.7	33%			
Godlove C., Pak K. (2020) Kep Province - The Asia Foundation (36)	Kep	25	50%			
IGES (2017) Battambang (26)	Battambang			1.6%		
Phnom Penh Waste Management Strategy and Action Plan 2018-2035 (37)	Phnom Penh	322	11.4%			
The World Bank (2020) Sihanoukville (30)	Sihanoukville	95	30%	24%		
UN-Habitat – Sihanoukville – 2020 (31)	Sihanoukville	38	10%	1.6% ⁷	51.0%	12.7%
UN-Habitat – Kep – 2020 (31)	Kep	11	42%	34.7% ⁸	24.7%	17.3%
Smith et al (2018) Koh Dambang (33)	Koh Dambang		100%	46%	54%	
Fauna & Flora International (2021) Koh Rong Archipelago (32)	Koh Touch Koh Rong Sanloem	0.24 ⁹	28% 52%			

⁷ Percentage of improper disposal are referred to plastic waste only. The estimation of uncollected plastic waste is based on the average waste composition defined by the same survey

⁸ As above

⁹ Sum of the 2 villages

Table 7. Uncollected waste and improper waste disposal

Data on amount of land-based waste leakage into the environment are needed to better understand the amounts of litter entering waterways that will eventually end up in coastal and marine waters. While such data are absent, recent research by Haberstroh et al. (2) suggests that in the rainy season, a daily leakage of plastic waste from the capital Phnom Penh into the Mekong can equal 42% of its total plastic waste generated. The suggested figures stand in contrast with those

summarized in Table 6 and 9 earlier, which give a lower estimation. Once again, this further reinforces the need to have one standardized methodology to be used to produce national data and estimation that are consistent and representative.

5.3 Pillar 3 – Monitoring of freshwater and wastewater

As previously mentioned, there is no harmonized monitoring programme of marine litter in Cambodia to date. Available information comes from one-off studies with similar scope of focus and geographical coverage, but different methodologies used.

A 2015 study by Fondazione ACRA identifies wastewater drains, manholes and pumping stations as important accumulation points of plastic waste in urban areas, with a high percentage of plastic bags causing flow obstruction, malfunctioning and frequent flooding incidents. (38) Another 2020 regional report from the Asian Institute of Technology, comparing monitoring capacity in different countries in the Lower Mekong Region, identifies a lack of specific indications or regulations mandating monitoring activities at national and local levels, and a general lack of financial and

technical resources to conduct plastic pollution assessment and monitoring on rivers. (39)

In 2019, the World Bank undertook a macro-plastic litter assessment in rivers and freshwater canals in some selected cities and provinces in Cambodia, with the aim to map out spatial distribution and identify types of plastics fragments on shorelines of these freshwater systems. Using macro-plastic (> 2.5 cm) survey method developed by the National Oceanic and Atmospheric Administration (NOAA), the study focused on two river sites in Phnom Penh, multiple sites along the Siem Reap river, and one canal in Sihanoukville. Collected debris were counted, measured and classified, taking into consideration their functional origin (e.g., food wrappers, beverage bottles, cups, shopping bags, etc.) according to the NOAA Technical Memorandum (Lippiatt et al. 2013) and type (hard plastic, foam, film, etc).

Type of plastic debris	N. of items	%
Food wrappers	688	25
Bags	529	19
Straws and stirrers	322	12
Cups and cup lids	169	6
Beverage bottles	90	3
Cigarette butts	68	2
Cutlery – spoon/fork	49	2
Polystyrene/foam	42	2
Plastic bottle caps/lids	30	1
Strings and cords	24	1
Other	754	27

Table 8. Main SUPs products littered in rivers/canals - The World Bank, 2019 (40)

Haberstroh et al. research (2) assessed to amount of plastic released from Phnom Penh

into three main rivers—Mekong, Bassac, and Tonle Sap—and how the wet season and the

confluence of these rivers affect spatial distribution of plastic waste. Among the first of its kind, the study offers useful indications on the amount and type of plastic litter entering the waterways in Phnom Penh area, and the proportion of daily plastic waste that potentially becomes marine litter (estimated to be up to 42% of the total generated waste). The total sample size distribution is 65% of items being smaller than 1mm, 30% ranging between from 1 to 5 mm, and the remaining 5% being bigger than 5mm.

The study analyzed a sample of 482 microplastic particles with a Raman scanning microscope to determine polymer identity and their prevalence (table 11).

Type of plastic polymer	%
PP – Hard plastic items, fibers, ropes	74
PE – Bags, film, bottles	13
PS – Foam and food containers	8
PA – Fibers, food packaging	4
Other	1

Table 9. Plastic and microplastic composition in Mekong/Bassac/Tonle Sap river in PP, Raman microscope analysis (Haberstroh et al., 2021)

One important to keep in mind is that the study focuses on floating and underwater debris including microplastics. Whereas the World Bank study sampled litters on shorelines and riverbanks and counted macroplastic items >2.5 mm (based on the NOAA item specifications).

These findings illuminate the importance of understanding (plastic) litter pathways along wastewater and freshwater, and how much of the waste contributes to the accumulating marine

litter pollution. In fact, having marine litter monitoring data that are collected regularly and consistently across different geographical landscapes can serve as an important contribution for measuring plastic debris density, which can also align with the SDG Indicator 6.3.1 “Proportion of domestic and industrial wastewater flows safely treated”, indicator 6.3.2 (“Proportion of bodies of water with good ambient water quality”) and indicator 14.1.1 (b)

5.4 Pillar 4 – Monitoring of marine and coastal water

Similar to Pillar 3, monitoring of marine litter in coastal water is non-existent in Cambodia, while there are more data available than in freshwater systems, owing to past or ongoing research efforts on plastic and other marine topics (e.g., seagrass and coral reef surveys).

For instance, the online database PADI Aware Marine Debris map enlists 89 underwater clean-

ups registering the quantity and type of marine pollution found underwater, as well as the number of entangled animals in Cambodia. Data collection took place from 2013 until 2019, covering Koh Sdach Archipelago, Koh Rong Archipelago and Koh Ta Kiev island (Figure 7). (42) Volunteer surveyors recorded the coordinates of clean-up point, the number of surveyors involved, the duration of the clean-up, the total area surveyed and the quantity, weight and type of debris removed, together with the presence of marine debris affected animals (e.g., entangled, suffocated, pierced).

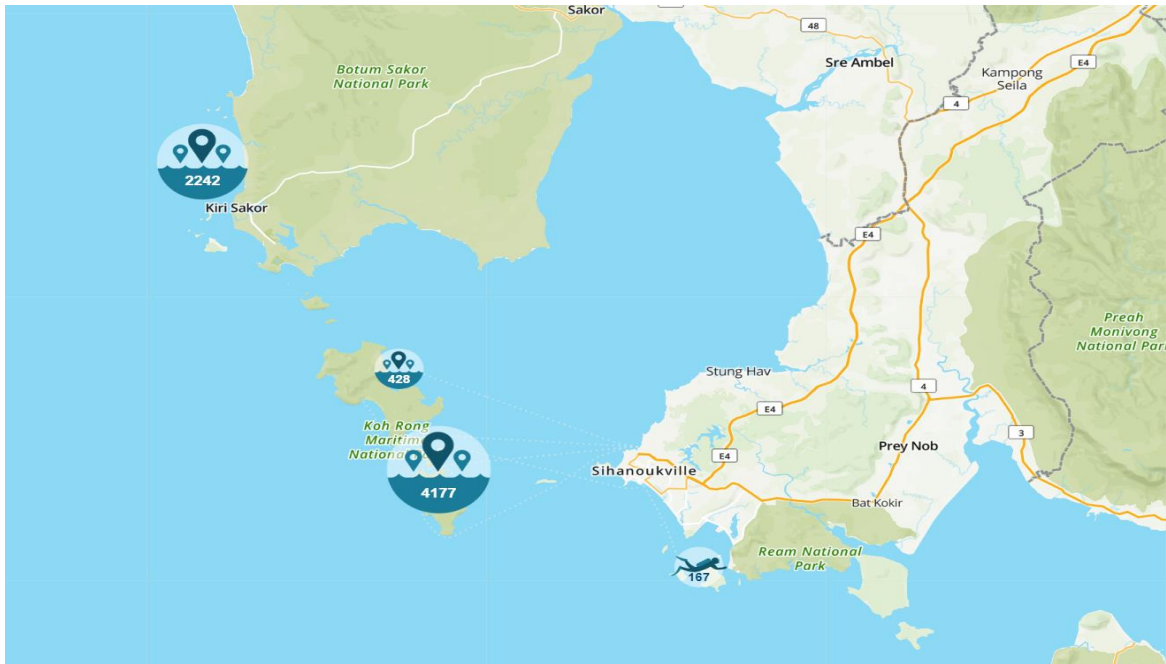


Figure 6. PADI Aware Dive Against Debris map - Cambodia Coast - 2022

Collected data offer a general picture of the quantity and kind of litter found underwater, highlighting high prevalence of plastic litter, in

particular ALDFG (Abandoned, Lost, Discarded Fishing Gears), and a higher accumulation in nearby villages and populated islands.

Material	Number of items	%
Plastic	5004	70.9
Metal	867	12.3
Cloth	560	7.9
Glass & ceramic	200	2.8
Paper & Cardboard	140	2.0
Mixed	98	1.4
Rubber	64	0.9
Wood	47	0.7
Other	73	1.0
TOTAL	6882	

Table 10. Composition of underwater marine debris in 89 clean-up sites in Cambodia - PADI Aware

Plastic Items	Number of items	%
Fishing gears – lines, nets, buoys, rods, poles	1833	36.9
Ropes	527	10.5
Bags	510	10.2
Bottles – beverage and other	474	9.5
Food wrappers	383	7.7
Polystyrene – food containers, insulation packaging	285	5.7
Cups, plates, bowls, cutlery	135	2.7
Straws, stirrers	86	1.7
Caps and lids	72	1.4
Other	699	14.0
TOTAL	5004	

Table 11. Composition of underwater plastic marine debris in 89 clean-up sites in Cambodia - PADI Aware

These plastic-item trends reflect those found in underwater monitoring activities by FFI in 2018 and 2019, including the count of litter within the Reef Check methodology to assess the quantity and type of marine litter underwater in Koh Sdach and Koh Rong archipelago. (43) The methodology establishes two teams from three to four surveyors recording biophysical information along two 50 meters transects for each selected site. Collected data included the count of single plastic items and discarded fishing gears. That said, comparison of results with the above-mentioned data collection is not really suitable, given different methodologies and the use of restricted transects for the Reef Check which limits the extension of the monitoring area.

In Koh Sdach archipelago, 268 items were recorded in 15 sites, 78% of whom were recorded as discarded fishing gears. Nets accounted for the 56% of the total debris (150 items), while monofilaments lines accounted for 22% (59 items). Other plastic debris accounted for 16%, and remaining materials for 6%.

In Koh Rong archipelago, 247 items were recorded across 20 sites. Fishing nets accounted for 68% (168 items) of the total items, while other plastic items and general trash represented 5% (12 items) and 27% (66 items) respectively.

Another survey included in the 2019 World Bank report focused instead on beach monitoring, following similar survey methodology on macroplastic defined by the NOAA to select transects at each site, classifying density and quantity of plastic litter, and dividing per type. (44) In one case, the high accumulation of litter suggested a direct impact of food vendors activity in the area, while in another site the high distribution of litter pointed to sea-based source (i.e., litter got washed up and accumulated on beach or coastline) instead of land-based source. However, such findings would require confirmation through similar repeated studies to better assess sources of plastic pollution.

Plastic Items	Number of items	%
Food wrappers	118	11.4
Bags	111.5	10.8
Foam/Polystyrene food containers	108.5	10.5
Beverage bottles	86.5	8.4
Cups and cup lids	82.5	8.0
Plastic bottle caps/lids	57	5.5
Straws and stirrers	46	4.4
Strings and cords	35	3.4
Cutlery – spoons or forks	31	3.0
Small food bags	31	3.0
Other types	328	31.7
TOTAL		1035

Table 12. Main SUPs products littered in coastal sites - The World Bank, 2019

The World Bank document reported a total of 1,035 macroplastic items collected over 72 quadrants in 7 coastal areas in Sihanoukville, Koh Sdach and Koh Rong, with 707 items within the top ten plastic categories and the remaining 328 items within 40 additional categories. The results imply household waste in general, and the high prevalence of SUPs used in particular, to be the dominant source of pollution. It is unclear, though, if businesses were included in study samplings.

Two different UN-Habitat surveys included in the source documents, based on the Waste Wise City

Tool methodology, estimate the quantity of plastic waste leaked in water due to mismanagement, indicating a direct source of marine littering in coastal areas. (31)

A 2022 UNEP draft report laid out possible plastic-pollution hotspots, defined as “the most relevant plastic polymers, applications, industrial sectors, regions or waste management stages causing the leakage of plastics into the environment (including land, air, water and marine environment). The report also discussed potentials impacts of plastic pollution, through the life cycle of plastic products, focusing on

improper disposal practices of HHs and fisheries waste, lack of SWM services in remote areas, intense coastal development facing limited enforcement of existing regulations, popular tourist sites causing higher generation and leakage of waste, riverine waste flows and flooding as key topics for further investigation. (45)

Another UNDP policy report on plastic foam suggests high consumption and zero recycling of Expanded Polystyrene products (EPS) as a possible source of leakage into the environment. This is partly confirmed by the findings from The World Bank report's beach surveys where EPS products or fragments resulted in one of the most frequent type of plastic litter. (46)

5.5 Spatial distribution of available data

Analysis of all source documents reveal a big discrepancy in spatial or geographical focus of current research efforts on plastic pollution in Cambodia, with cities and urban areas receiving most of the attention compared to remote and rural settings (including coastal and island sites).

Cambodian cities, in particular those major ones like Phnom Penh, Siem Reap, Sihanoukville and Battambang, are repeatedly at the core of multiple studies that investigate use/consumption drivers and patterns, waste generation, composition, collection rate and

recycling practices, as well as rivers/canals or coastal sites monitoring. There is no doubt that the growing rate of rural-to-urban migration in the country will only mean increasing SWM-related challenges, including resource needs, for these urban centres. However, more than half (60.6%) of the country's population live in rural areas, according to the 2019 National General Population Census. (13)

Lastly, an earlier environmental assessment in Kep archipelago by Marine Conservation Cambodia similarly focused on coral reef and ecosystems health, highlighting the lack of SWM system as a major cause for the island's waste accumulation, improper disposal and waste leakage into the marine environment. In addition, underwater surveys by the same organization recorded a high amount of pollution from fishing activities, including batteries from crab cages, broken nets, cages and lines, plastics and polystyrene waste. (53)

Therefore, data and figures collected in urban areas only can hardly be representative of the whole nation. Figure 8 presents the availability of data from the source documents along the four NSI pillars.

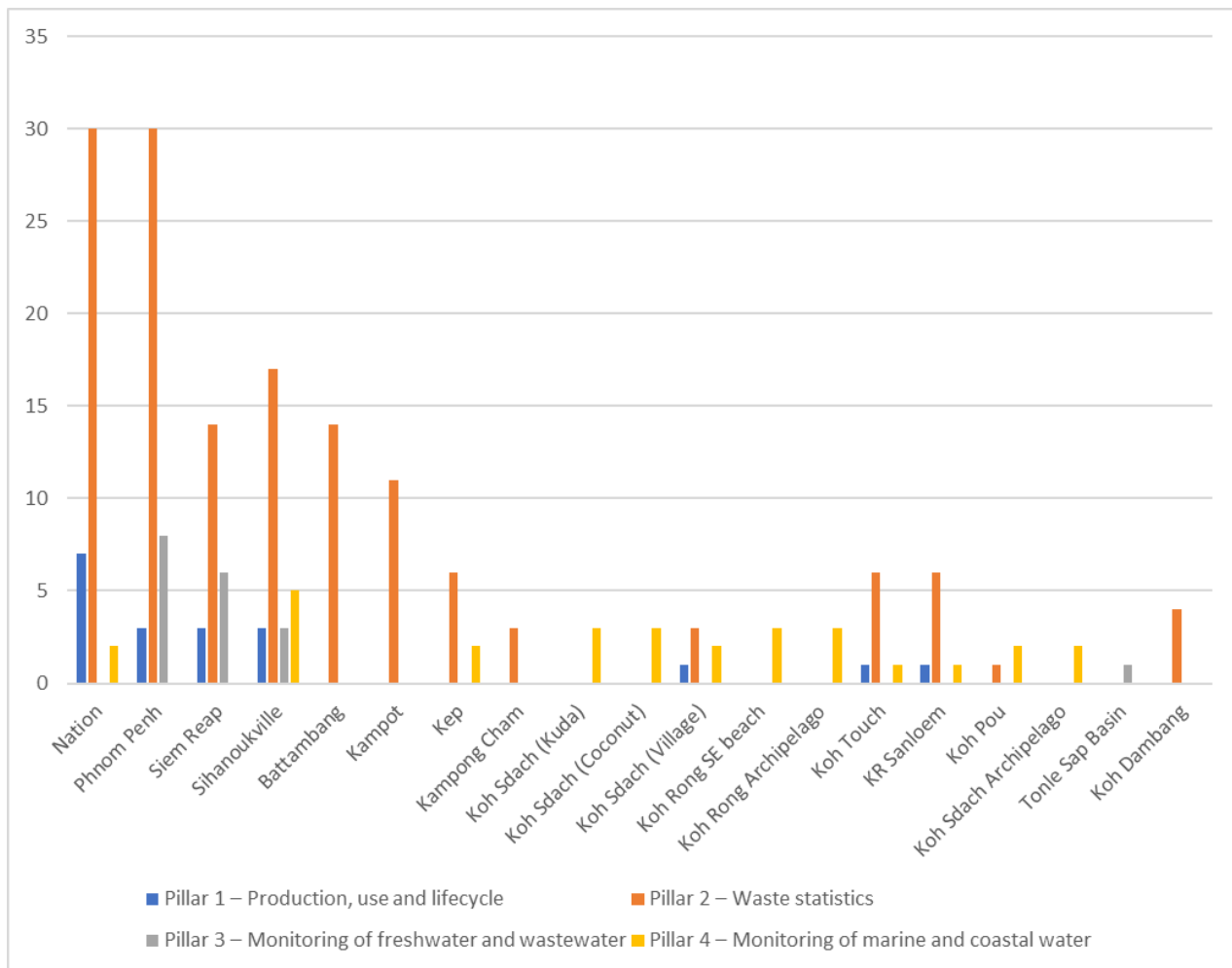


Figure 7. Spatial distribution of available data from source documents

The lack of data in rural areas is also raised in the national report “4th State of Environment”, the draft National Waste Management Strategy and Action Plan and the UNDP report on Nationwide SWM context, as one of the key challenges to establish clear national baselines. (47)

Determining plastic-litter pathways into the environment in rural areas requires reliable data on mismanaged plastic waste in these areas, especially those situated near or along rivers and streams. This is a vital point to stress, considering that the fact that a number of freshwater upstream are located in remote and/or rural areas. It is evident from the source documents that efforts to analyze and address marine plastic pollution is quickly gaining traction. Yet, freshwater rivers and waterbodies, like the Tonle Sap (the largest freshwater lake in Cambodia and Southeast Asia) are lagging

behind in research focus even though plastic pollution in these areas are becoming ever more rampant and worrisome. (1, 2)

Given the current decentralization of mandates and responsibilities on SWM within government structure, a better understanding of local drivers and patterns of consumption, waste statistics and leakages into the environment is crucial to help shape appropriate and effective policies and actions at local and national levels.

6. Policy review

Extensive and detailed reviews of existing policies and legal frameworks related to marine litter management in Cambodia are included in COBSEA and UNEP publications “*Legal and Policy Guidance on Addressing Marine Litter in Cambodia: Gap Analysis and Needs Assessment*. Bangkok: United Nations Environment Programme. (2021)” and “*Marine Litter in Cambodia: A Situation Analysis & Policy Recommendations*. Nairobi. (2022)”. (5, 48) This chapter provides a main summary of the overall legal and strategic framework in Cambodia relevant to marine litter prevention, reduction, control along the different steps of the PVC.

In Cambodia, the Ministry of Environment (MoE) is the leading agency in formulating policies, issuing regulations and coordinating actions on waste management. (47) The regulatory framework is developed through national laws and different sub-decrees and guidelines, although most of provisions do not provide essential details for full implementation and enforcement. (48) Waste management and environmental protection are directly and indirectly included in different regulations, with administrative power and responsibilities being progressively mandated to sub-national authorities, causing insufficient clarity, understanding and implementation of roles and responsibilities. (5) Moreover, marine litter is not directly treated within existing regulations, but some existing provisions contains key points pertaining to prevention and/or reduction of marine litter in Cambodia. Annex IV shows current ministries mandates related to waste management governance in Cambodia.

In addition, the National Council for Sustainable Development (NCSD), established in 2015 and serving as an inter-ministerial council chaired by the Minister of Environment, is an important policy-making body with a specific focus on sustainable development, economic, social, environmental and cultural balance in Cambodia. NCSD’s legal mandate is to “*prepare, coordinate and monitor the implementation of relevant policies, strategies, legal instruments, plans, and programmes in all areas of sustainable development and to monitor and report on Cambodia’s implementation of its international commitments to the respective international*

bodies”. (54) The following NCSD and MoE key strategies can be considered as particularly relevant to marine plastic pollution:

- 1- To raise awareness, including through environmental education and targeted campaigns;
- 2- To develop policy & regulations, including on SUP and to promote plastic alternatives;
- 3- To improve overall waste management practices and promote recycling and waste-energy options; and
- 4- To build a strategic coalition.

The NCSD, supported by JAIF and IGES, is currently leading the organization of inter-ministerial Technical Working Groups to discuss and develop a coordinated National Action Plan on marine litter, under the 2 main regional frameworks of action from COBSEA and ASEAN.

6.1 Current legislation – main relevant points

- **1996, Law on Environmental Protection & Natural Resources Management:** designed to harmonize the legal instruments pertaining to natural resource management, it includes the prevention, reduction and control of airspace, water and land pollution to be determined by subsequent sub-decrees
- **1999, Sub-Decree n. 27 on Control of Water Pollution:** the sub-decree prohibits “*the disposal of solid waste or any garbage or hazardous substances into public water areas or into public drainage system*”, as well as “*the storage or disposal of solid waste or any garbage and hazardous substances that lead to the pollution of water*”, including plastic waste pollutants of any kind.
- **1999, Sub-decree No.36 on Solid Waste Management:** this sub-decree establishes the mandate and responsibility of the MoE to enforce it, including monitoring SWM activities and establishing national standards and guidelines. In addition, it devolves responsibility to sub-national authorities to develop local medium and long-term SWM plans.
- **2006, Cambodia Law on Fisheries:** the law distinguishes mandates and responsibilities of the Ministry of Agriculture, Forestry and Fisheries (MAFF) over fishery management, and of the MoE over natural protected areas

management. With relevance to marine litter prevention, the law prohibits the disposal, discharging or dumping of liquid/solid substances that could cause harm to aquatic animals and plants in fishery domains, thus including plastic items and fishing gears.

- **2015, Sub-Decree No. 113 on the Management of Garbage and Solid Waste of Downtowns:** the sub-decree increases the devolution of mandates over SWM at Provincial and Municipal levels, and defines regulations and penalties for waste sorting and disposal for HHs, commercial activities and construction companies.
- **2017, Sub-Decree No. 168 on the Management of Plastic Bags:** the sub-decree addresses “*reduction, import, production, distribution and use of plastic bags*” to

improve “*public health, environment and aesthetics*”. In addition, it defines permissible dimensions (in terms of size and thickness) of plastic bags in Cambodia and penalties for non-compliance.

More specifically, the Sub-Decree 113 on decentralization of mandates and responsibilities for solid waste management, defines institutional roles among Ministry of Interior, Ministry of Environment, Provincial Administration, Department and Municipalities as follows:

Ministry of Interior Supports the functioning of the management entities	Provincial Administration	<ul style="list-style-type: none"> - Prepares any legal instruments required - Supports the municipality in action planning, budget planning, and creation of services - Approves landfill selection and use
	Municipality	<ul style="list-style-type: none"> - Overall management of urban garbage and solid waste in their territory - Has the right to delegate tasks to communes and share services with nearby municipalities or the private sector (with contracts of less than 10 years) - Can collect service fees for waste management purposes - Must provide enough bins and services in public places - Approves recycling activities or other uses of waste
Ministry of Environment Prepares policies, national strategic plans, legal instruments, and technical guidelines Provides technical advice and capacity building to the municipality	Provincial Department	<ul style="list-style-type: none"> - Provides technical advice to the municipality - Collaborates in planning and implementing laws, legal instruments, and promoting citizen education Approves landfill selection and use

Table 13. Institutional roles under Sub-Decree 113 - GGGI – 2018 (29)

Policies known to be underdevelopment consist of:

- A Sub-Decree on Plastic Management is currently under MoE’s review. The key objective of this sub-decree is to manage and reduce the use of plastic products, properly manage plastic waste, and prevent and minimize plastic waste leakage to land and waterways with an aim to ensure the protection of public health, environment, and

aesthetics. Among others, the sub decree covers

1. Measures related to EPR, green procurement, and eco-labelling; &
 2. Initial recommended regulatory and economic measures for top 10 plastic items were included for the annex 2 of the sub-decree, according to the National Plastics Roadmap.
- Cambodia’s Law on Fisheries, is currently under review, with more recent drafts

including provisions on inland aquaculture and mariculture management, water quality and discharge of waste matter.

6.2 Legislation and Advocacy - Existing relevant guidelines and National Plans

National strategic documents and guidelines can address policy gaps and support implementation of measures that respond to identified needs. Analysis of the legislative environment supports the positioning of a National Action Plan as a key actor to combat marine litter.

To better integrate current Cambodia's legislations related to marine litter and plastic pollution, the following national strategic papers, guidelines and plans were reviewed as recommended by development partners in the May 26th technical consultation on "*National Action Plan (NAP) to coordinate action and track results on Marine Litter-related activities in Cambodia.*"

- National Circular Economy Strategy and Action Plan
- National Waste Management Strategy and Action Plan 2017-2030 (Draft)
- National Environment Strategy and Action Plan, 2016–2023 (NESAP)
- Rectangular Strategy - Phase 4
- National Strategic Plan on Green Growth 2013-2030

Analysis of existing strategic documents and plans can identify common priority areas covered various government ministries, as so to avoid overlapping and unclear mandates, which can cause confusion as well as hamper effective implementation and enforcement of current regulations.

To inform the development of a National Action Plan on marine litter, the NSI report is instrumental in that it can highlight specific priority areas related to SWM, production, Circular Economy policies, and public awareness.

The National Circular Economy Strategy, National Environmental Strategy, National Waste Management Strategy are all focusing on plastic use and waste reduction through the promotion of alternative materials, multiple-use plastic

products (MUPs), bans on specific plastic products, promotion of 3R (Reduce, Reuse and Recycle) approach, and a general awareness raising toward more sustainable consumption habits and practices.

All available strategic documents have multiple objectives and actions relevant to Pillar 2 on Waste Management, focusing on improved collection and treatment, increasing waste sorting at source, and recycling within a 3R framework.

Pillar 3 and 4 on monitoring of freshwater, wastewater and coastal/marine water are indirectly covered in 3 out of 5 strategic documents. The National Waste Strategy and Action Plan touch on the creation of baseline, data platform and use of available data to monitor and improve waste management system, which could be utilized for marine litter monitoring activities in freshwater and marine water. The Rectangular Strategy (RS) is generally referring to strengthening the protection and conservation of biodiversity and ecosystems in river and coastal areas, which include pollution prevention. The National Strategic Plan on Green Growth presents some important priority actions related to monitoring of marine water by promoting the study and assessment of impacts by development projects on coastal ecosystems, researches on marine pollutant to protect water quality, and identification of main causes of socio-economic, cultural and environmental impacts for coastal and island communities.

Annex V summarizes key national strategy and guideline reports and their relevance to each of the four NSI pillars.

Some studies suggest legislative gaps on national strategic planning on plastic and urban solid waste management, which are currently being addressed in the National Circular Economy Strategy and Action Plan, the National Policy on Urban Solid Waste Management 2020 – 2030, and the upcoming National Plastic Roadmap. The CE Strategy and Action Plan is also addressing a stronger circular economic, market-based and lifecycle approach to plastic management.

MoE, MAFF and National Committee for Cambodian Coastal Zone Management and Development are the leading ministries/agencies

responsible for development and protection of marine protected areas, while the MoE and MoWRAM (Ministry of Water Resources and Meteorology) are the leading ministries for monitoring and researching of marine water quality, pollutants, impacts on economy, society, environment, biodiversity.

Some important guidelines are currently under-development:

- A report on Extended Producer Responsibility (ERR) Roadmap for Cambodia is drafted. This report introduces key objectives, actors, and instruments of EPR and includes an initially proposed EPR roadmap to transition from a “Voluntary EPR” to a “Mandatory EPR” framework in Cambodia. The report introduces three EPR pilot models as potential options for piloting Voluntary EPR in Cambodia
- National Plastics Action Plan and Roadmap is drafted, aiming to create realistic and effective plastic policies to reduce plastic pollution.

7. Gaps

Analyzed source documents identify multiple gaps in policy support and planning including, unclear and overlapping mandates, limited enforcement of existing regulations on waste management, insufficient coverage of waste collection service, as well as needed improvement on operation for existing private service contractors.

Findings of this NSI report highlight gap categories related to governance at sub-national level, research and monitoring, public awareness and outreach.

Policy and institutional gaps

- **Unclear and overlapping mandates:** the decentralization process under Sub-Decree 36 and 113 presents overlapping and unclear mandates over waste and plastic management from national to sub-national level. Government actors and local authorities register lack of awareness on the existence of laws and

regulations, specific roles and existing responsibilities. Although devolution of functions is included in several sub-decrees, effective implementation steps or plan remains unspecified. In addition, weak coordination mechanisms among ministries and relevant authorities need to be addressed to improve enforcement of existing legislation. A national inter-ministerial body, such as a committee or a commission, can play an instrumental role in coordinating waste and marine litter management, together with development partners, local and international NGOs and private companies.

- **Plastic import & production:** As noted in the May 26th Technical Consultation, to date there is no clear definition on the responsible entities, namely Ministry of Environment and Ministry of Finance (MoF), to review national plastic import/export registration, which makes it impossible to take stock of the type and quantity of plastic products, as raw material or finished, entering the national market. One key underlying issue that emerged from the consultation discussion is that it is important to start collecting clear and consistent figures and data on plastic products import and export, as well as their movements within the country, through a well-established registration system.

- **Data Management:** Sub-national authorities often lack technical capacity and budget to implement data collection and monitoring on solid waste. This tends to result in the reliance on secondary and/or old data that only covered some selected areas (often urban) to make national estimations related to waste generation, composition and so forth. National statistics that can supply robust and representative data to the SDG Indicator 11.6.1 “Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal solid waste generated, by the city” is key to establishing adequate waste and resource management at nation and sub-national levels.

- **Technical regulations:** sanitary landfills require higher technical, health and environmental standards for proper waste disposal and treatment, including plans for larger regional landfills instead of smaller local dumpsites. Likewise, plastic waste requires specific regulation for assessment and monitoring of quantity, disposal and recycling, since at present only general SWM guidelines apply, with limited enforcement.
- **Lack of financial and technical resources:** both national and sub-national authorities raise the lack of sufficient funding as a major barrier to implement new and improved SWM systems at all steps (i.e., collection, transport, storage, treatment, disposal), and to finance or co-finance waste sorting and recovery activities. There is also a lack of funding in research on waste management, awareness and behavioural change at local levels to motivate desirable practices and improve services.
- **Limited capacity:** Both UNEP and UNDP reports on Solid Waste Management highlight technical capacity gaps at national and sub-national level in terms of service management (i.e., contracting private actors and assessing performances) and local monitoring and data collection on waste generation, collection, leakage and, more specifically, marine litter. (5, 12) A capacity mapping for monitoring and assessment of plastic pollution in the Lower Mekong by the Asian Institute of Technology points out similar gap: while the MoE has a legal mandate to monitor, check and evaluate the management of urban solid waste, with the support of sub-national environmental departments, absent or inadequate financial and technical resources hinder progress to implement such actions. (39)

Research and Monitoring

- **Plastic production:** Further studies on raw polymers and plastic products use in Cambodia could support the definition of clearer, more consistent and robust national baselines that also reflect the

SDG Indicators 12.2.1 and 12.2.2 toward a sustainable management and use of resources, including setting up Extended Producer Responsibility (EPR) strategies and policies.

- **Standardized Monitoring:** There is a lack of one standardized methodology to collect data to develop robust and nationally representative baselines, along the different steps of the PVC. The geographical focus of data collected have been almost predominantly urban, and little information is available for remote and rural areas of Cambodia (which represents two-thirds of the country's land). This, coupled with the fact that data collection tends to be one-off rather than on a regular basis, makes it difficult to use them for monitoring purpose. Existing methodologies, such as the Waste Flow Diagram (WFD) and the Waste Wise Cities Tool, could support the identification of leakage points and quantities to help drive policies or actions at local level. A clear identification of the type and impact of local land-based and sea-based sources of plastic litter can help validate current estimates of pollution from land and sea activities, identify leakage and accumulation hotspots as well as different drivers to be addressed.
- **Informal recycling sector focus:** from a circular economy perspective, the informal waste (recycling) sector represents a priority target group to focus more research effort on. Informal waste collectors make a salient contribution to the reduction of waste, particularly recyclable waste types, dumped in landfills or leaked into the environment; however, all 17 source documents analyzed in this sector similarly suggest a lack of consistent standardized data on quantities and types of waste currently being recycled.
- **Establishment and alignment of water bodies monitoring efforts:** as mentioned earlier, there is no existing standardized and regular monitoring activity on freshwater, wastewater and marine water bodies. One-off activities can be a useful start to identify preliminary trends

or possible accumulation sites or hotspots, but a regular monitoring is needed to establish clear baselines and targets, define actions, and monitor progress long-term. It would be important to harmonize active monitoring activities and set clear indications for determining actual amount of plastic debris entering the freshwater systems, their pathways and accumulation hotspots, and the impact of marine plastic pollution in order to successfully drive policies and actions for long-term reduction and prevention. Monitoring activities should also be aligned with those implemented in neighboring countries to map out large-scale plastic flows in transboundary rivers, freshwater ecosystems and marine areas.

- **Microplastics research:** specific research and monitoring activities should focus on microplastic presence as an integral part of the marine litter problem, as suggested by Haberstroh *et al.* research results (2); the quantity of floating and underwater microplastic items directly relates to the definition of “good ambient water quality” and significantly contribute to the quantification of plastic pollution in water ecosystems. There is also very little understanding of microplastic presence and distribution in coastal and marine environment of Cambodia that would allow the country to contribute toward achieving the SDG Indicator 14.1.1 (b) *Index of plastic debris density*.
- **Impact of plastics:** In the long run, monitoring activities could also include sampling on biota in order to understand the impact of plastics, and of specific plastic items or polymers, on natural ecosystems and species; a modelling system developed by Finnegan and Gouramanis (2021) estimates an increasing leakage of plastic into the Tonle Sap Basin during the 2020-2030 decade under a Business-As-Usual scenario, suggesting a possible crossover point with a higher amount of plastic than fishes available by 2030. (1) The PADI Aware Debris Map identified

300 animals among crustaceans, fishes, corals, mollusks entangled in fishing nets or lines across the surveyed 89 sites in Cambodia, while in April 2022 Fauna & Flora International staff found a first-time evidence of plastic presence in the stool of a sea turtle in Cambodia. (49) Estimates at global level on the direct impact of plastic litter on species and ecosystems are available, but knowledge of plastic-pollution impacts at national and local levels is necessary to set up a clearly defined action plan and support policy development and implementation. (50, 51) Last but not least, very limited knowledge is available on the impacts of marine litter on local livelihood and economic activities, and human health.

Public awareness and education

The 2019 World Bank studies to identify the most common SUPs littered in urban waterways and coastal sites have been acknowledged and used to support the development of use reduction policies and awareness campaigns. (40, 44) That said, SUPs use may have different drivers and implications according to geographical areas and socio-economic status, and further and regular studies on frequency, quantity and types of SUPs use may be needed to strengthen the overall implementation of targeted campaigns.

8. Recommendations

The NSI report provides evidence base to inform decision-making and development of strategies and policies for tackling marine litter at a country level. Available figures and statistics and analysis included in the report are intended to give a snapshot of the current status of knowledge at national level, and to tease out gaps and challenges to be considered as part of developing a National Action Plan. The following recommendations are formulated based on findings from the source documents analyzed.

- a. **Enforce and implement the MoE’s mandate at national and sub-national level** to monitor, check and evaluate the management of urban and hazardous waste (including plastic waste from production or use of plasticizers),

through a centralized department for coordination, collection, management and analysis of available data that can help to improve plan and strategies related to SWM, freshwater and marine water pollution. (39)

b. **Improve technical capacity at government level** to manage, analyse and use different data sets to reduce marine litter. Available statistics and data are collected by multiple stakeholders in collaboration with different government bodies or ministries' departments. Given ambitious government mandates, it becomes increasingly necessary for local expertise to exist, especially within government, to perform technical and/or research-related work to inform policies, strategies and actions at national and sub-national levels.

c. **Consistently apply a harmonized methodology for monitoring** of waste generation, composition, collection and leakage to ensure collection of nationally representative data. Current data collection efforts are often fragmented, using different methodologies with a disproportionately high focus on urban areas. Sampling across landscapes including different cities, town and villages should be considered, taking into consideration different demographic, socio-economic, and geographical indicators to realize a holistic understanding of the scope of the problem and contextual challenges faced by local communities, so as to define actions that are locally appropriate and effective.

d. **Engage informal sector to assess waste recycling rates in different areas.** Waste pickers in Cambodia are known to contribute to most of waste recycling across the country, by collecting recyclable waste from HHs, collection points or landfills and sending them to junkshops and/or to foreign countries. Due to the "informal" nature of this sector, there are no robust data collection system in place to assess the quantities of recyclables collected. (12, 30) Multiple source documents recommend the inclusion of informal collectors in a formal system to ensure better working conditions, health insurance and better recognition. (12, 39, 52) But in terms of

data availability, the inclusion of their work should provide more important knowledge of quantities, types and pathways of recyclables in Cambodia to strengthen enforcement of policies on waste sorting, incentivize the recycling sector, and increase recycling rates in different areas—all of which contribute to the achievement of SDG Indicator 12.5.1.

e. **Create and implement a harmonized monitoring programme on marine litter**, that could include freshwater streams and land-based sources. The programme should propose a set of questions and objectives to shape possible surveys and engage local stakeholders in different activities at local level.

As highlighted in Chapter 3, main questions related to marine litter in Cambodia could be summed up as:

- baseline information such as abundance, distribution, type and origin of ML;
- key sources, drivers and hotspots of ML;
- impacts of ML on people, economy and environment;

In response to these questions, proposed key objectives for a national programme are:

- to assess baseline of ML (sources, flows and characteristics)
- links between freshwater and marine waste flows / ecosystems
- to serve as an assessment tool for effectiveness of related policies and measures

Existing or ongoing efforts could be then harmonized and included in a regular data collection system considering the 5 main tenets to shape appropriate programmes:

1. Clearly delineated and repeatable methods.
2. Quantification and reporting findings in a way that is harmonised with other surveys and uses policy-relevant categories, as best possible.
3. Representative capture of variation within each habitat to avoid sampling bias.
4. Accounting for data collection effort.
5. Representation of different habitats.

The monitoring programme should align data collection methodologies at different steps of the PVC, from production/import to waste management, collection, leakages, accumulation and distribution in land, river, coastal and marine environments. Monitoring data and results should be shared with research institutions, local and international NGOs and general public audience, for transparency and increased awareness.

f. **Define a clear inventory and register of raw plastic and plastic products import and production.** In order to understand the full plastic value chain and how much it contributes to marine litter, it would be fundamental to assess the quantity and types of plastic products entering the consumption cycle at national level. A clear mandate over the registration and overview of plastic import and production is needed at government level to ensure a regular data collection assessing the movement of plastic products within the country.

g. **Integrate Social Behavioural Change (SBC) component** to help reduce damaging waste-disposal behaviour. As suggested by some of the research in the source documents, SBC can work in tandem with other key components, such as adequate local infrastructure, to foster enabling conditions for improving disposal behaviour and thus reduce marine litter. It is key that specific behaviour related to plastic use and disposal, as well as behaviour-change outcomes, are clearly identified at the start of each intended project, to determine appropriate and effective operational approach. Creating a M&E system specific to the SBC in question will also be crucial to track progress and collect data needed to measure changes at the end of the project cycle.

h. **Strengthen coordination** between ministries, provincial departments, development partners, national universities, and research institutions to help achieve the evidence-based goals, targets, and indicators for tackling marine litter and plastic pollution.

ANNEX I – Technical Consultation

“Technical Consultation on National Action Plan (NAP) to coordinate action and track results on Marine Litter-related activities in Cambodia”

26 May 2022

Table 14. *Attending and invited participants to National Technical consultation, 26 May 2022*

Participants	
Name	Organization
Natalie Harms	United Nations Environment Program / Coordinating Body of the Seas of East-Asia UNEP/COBSEA
David Kuntel	UNEP/COBSEA
Vincent Aloysius	UNEP/COBSEA
Enrico Barilli	Fauna & Flora International (FFI)
Majel Kong	FFI
Roath Sith	Ministry of Environment (MoE)
Monomoyith Than	MoE
Lauren Roman	Commonwealth Scientific and Industrial Research Organization (CSIRO)
Moeko Saito-Jensen	United Nations Development Programme (UNDP)
Federico Tempestilli	UNDP
Premakumara Jagath Dickella Gamaralalage	Institute for Global Environmental Strategies (IGES)
Vanna Sok	United Nations Human Settlements Programme (UN-Habitat)
Piseth Sensamras	UN-Habitat
Denise Justin	Groupe de Recherche et d'Echanges Technologiques (GRET)
Claire Ogg	Song Saa Foundation (SSF)
Invited	
Name	Organization
Kamala Ernst	UNEP/COBSEA

Denise Hardesty	CSIRO
Chanthy Leang	UNDP
Yasuhiko Hotta	IGES
Maeve Nightingale	International Union for Conservation of Nature (IUCN)
Marcel Kroese	Food and Agriculture Organization (FAO)
Katelijan Van den Berg	The World Bank
Klaus Sattler	The World Bank
Kate Philp	The World Bank
Socheata Keo	GRET
Juergen Staeudel	Consultant for Ministry of Environment
Sovann Nou	River Ocean Cleanup Organization (ROC)
Neil Furey	University Capacity Building Program, Royal University of Phnom Penh (CBC)
Sothearen Thi	CBC
Jerome Farkhy	Global Green Growth Institute (GGGI)

ANNEX II - Current efforts at a national level to tackle marine litter and/or plastic problem in Cambodia

Implementing actor(s)	Project Name	Main objective(s) & scope of actions in-country	Timeline
United Nations Environment Programme – Coordinating Body of the Seas of East-Asia Ministry of Environment Fauna & Flora International, Cambodia Programme	SEA circular – Solving Plastic Pollution at Source	Marine litter planning: <ul style="list-style-type: none"> Situation Analysis on marine litter COBSEA Legislative guidance and gap analysis Developing a National Action Plan on Marine Litter Evidence base for decision making: <ul style="list-style-type: none"> City-level waste flow analysis in Kep & Sihanoukville (UN-Habitat WaCT) National monitoring programme, COBSEA Regional Guidance National baseline assessment on marine litter National training on monitoring of marine litter (with the aim to develop long-term national monitoring program on marine litter) Outreach & awareness: <ul style="list-style-type: none"> Massive Open Online Course (MOOC) on marine litter (to be available in Khmer language for the first time to boost accessibility of content materials for local audience) 	2019-2023
The World Bank Ministry of Environment Ministry of Interior Ministry of Economy and Finance Ministry of Public Works and Transport	Cambodia: Solid Waste and Plastic Management Improvement Project (55)	Component 1 - National Policy and Institutional Capacity Development: <ul style="list-style-type: none"> Strengthen the legislations, regulations, policies and capacity of central ministries (specifically Ministry of Environment, Ministry of Interior, Ministry of Public Works and Transport) strengthen the regulatory/legislative framework, solid waste sector monitoring, and regulatory oversight; policy development related to waste reduction and plastic management; institutional capacity building. 	2020 - ongoing

		<p>Component 2 - Technical assistance support and capacity building for participating pilot municipalities:</p> <ul style="list-style-type: none"> - Increase the technical and organizational capacity of participating pilot municipalities to improve the performance of the private solid waste collection services, - Improve the financial sustainability of solid waste management through local government regulations and waste fees - Increase the public awareness and citizen engagement <p>Component 3 - Investment Program for participating pilot cities:</p> <ul style="list-style-type: none"> - Finance priority lower-costs investments to improve effectiveness and efficiency of waste management and the environmental performance. <p>Component 4 - Program management, monitoring and evaluation:</p> <ul style="list-style-type: none"> - Establishment of Project Management Units at national level and at participating pilot municipalities to establish the system for solid waste management, monitoring and evaluation
<p>GIZ - Deutsche Gesellschaft für Internationale Zusammenarbeit</p> <p>General Directorate of Environmental Protection (GDEP), Ministry of Environment</p>	<p>Reduce, Reuse, Recycle to Protect the Marine Environment and Coral Reefs (3RproMar)</p>	<ul style="list-style-type: none"> - Support and subsidize the placement of one Integrated Expert in the MoE's Department on Solid Waste Management as Advisor on strategic planning in solid waste management. - Support information and knowledge management in Cambodia and in the region and provide technical, managerial, and other capacity development measures (e.g. trainings and workshops...etc.) - Trial of concepts of Extended Producer Responsibility (EPR), including the informal sector in Phnom Penh. - Approaches to optimize waste prevention, collection, and recycling of residual waste in a medium-sized city on the Mekong (Kratie)
<p>United Nations Development Programme – UNDP</p> <p>National Council for Sustainable Development</p>	<p>Combatting Marine Plastic Litter in Cambodia (Marine Plastic) Project</p>	<p>Prevent and minimize plastic waste pollution on land and in the ocean through promotion of a 4R (Refuse, Reduce, Reuse, and Recycle) framework. Target provinces include Siem Reap, Sihanoukville, Phnom Penh, and Kep, possibly Kampot and Koh Kong for the effective reduction of marine plastic pollution at the source.</p>

Ministry of Environment	Phnom Penh, Sihanoukville, Siem Reap Provincial Authorities	TonToTon	KRECA – Koh Rong Environmental Conservation Association	The project aims to attain five main outputs:	<ol style="list-style-type: none"> 1. Policy and regulation: Key enabling policies and regulations developed and implemented to promote 4Rs 2. Awareness raising: Improved awareness about the plastic crisis and its solutions among citizens and the private sector through environmental education and awareness-raising activities 3. Subnational implementation: Plastic waste reduced in target cities through education, private sector-led best practices and innovation 4. Business development: Priority business models for plastic recycling and alternatives supported and tested 5. Knowledge sharing: Best practices disseminated and shared
Institute for Global Environmental Strategies – IGES	Formulation of National Action Plan	National Council for Sustainable Development	for combatting marine debris in Cambodia	Reducing marine plastic litter by:	<ul style="list-style-type: none"> - controlling the management of production, consumption - Waste management - Development of National Action Plan - Promotion of Capacity for solid waste management activities - Knowledge Sharing and Dissemination
Asian Development Bank	Livable Cities Investment Project (56)	Ministry of Land Management, Urban Planning & Construction	Ministry of Public Works and Transport	Enhancing urban planning, building community resilience, and providing infrastructure to facilitate long-term sustainable and economic growth.	<ol style="list-style-type: none"> 1- Infrastructure development - rehabilitation of existing canals, construction of a wastewater treatment plant, sewerage network, new stormwater drains, and landfills. 2- Strategic planning – definition of a road map to boost revenue collection by municipal governments for wastewater and solid waste management 3- Technical Assistance – capacity development of the municipal administrations in urban and infrastructure planning to ensure the cities' sustainable development and resilience to climate changes. Two key outputs: (i) spatial and land use planning improved

and (ii) institutional capacity and governance strengthened.
The Ministry of Land Management Urban Planning and Construction will be the executing agency and will coordinate with the three participating cities and the other relevant line ministries for national regulatory and policy reforms.

ANNEX III - List of source documents

Type of source documents (n= 37)	Title	Scope of focus	Publication ownership & year	Geographic area of focus or coverage	Area(s) of relevance to marine litter according to NSI pillars	Relevant SDG indicator(s)
National reports (n=1, 3%)	Fourth State of Environment Report	Summarize the current status and trends of environment in Cambodia	General Directorate of Environmental Knowledge and Information, MoE (2021)	Nation	Pillar2: - Waste generation - Waste composition - Waste collection - Improper disposal - Recycling	11.6.1 12.5.1
	Phnom Penh Waste Management Strategy and Action Plan 2018-2035	To define the programs and actions that are developed under the common vision, mission and goal for improved waste management, and clarify the roles and responsibilities among stakeholders.	PPCA (Phnom Penh Capital Administration), IGES (Institute for Global Environmental Strategies), Nexus, UN Environment, CCCA (Cambodia Climate change Alliance) 2018	Phnom Penh	Pillar 2: - Waste generation - Waste composition at source - Waste disposal - Recycling exports	11.6.1 12.5.1
Policy guidelines (n=3, 8.1%)	National Waste Management Strategy and Action Plan 2017-2030	To build capacity for waste management and promote the development of conducive policy framework and strategies.	Kingdom of Cambodia - DRAFT	Nation	Pillar 2: - Waste generation - Waste composition - Waste collection - Waste proper disposal - Waste improper disposal - Recycling rate - Recycling exports	11.6.1 12.5.1
	Policy on Urban Solid Waste Management 2020-2030	To design, implement a modern, comprehensive urban solid waste management system, taking into account economic efficiency, financial resources, environmental	RGC - 2021	Nation	Pillar 2: - Waste generation - Waste collection	11.6.1

		sustainability and social aspects					
Online Database (n=2, 5.4%)	Marine Debris programme - Dive Against Debris	Collecting critical survey data from any or every dive that can be used by marine researchers and policymakers for conservation efforts	PADI Aware	- Koh Sdach Archipelago - Koh Rong Archipelago	Pillar 4 - Quantity of underwater debris - Composition of underwater debris	14.1.1 (b)	
	UN Comtrade Database	To collect official international trade statistics and relevant analytical tables	UN Comtrade	Nation	Pillar 1 - Plastic import	12.2.1	
NGO Reports (n=9, 24.3%)	Strategic environmental assessment of the proposed marine protected area, Kep Archipelago, Cambodia	To assess coral reef and biodiversity health in Kep Archipelago to support strategic marine management	Reed et al. – Marine Conservation Cambodia 2015	Koh Pou	Pillar 2 - Improper disposal habits Pillar 4 - Marine debris composition - Marine litter accumulation hotspots	11.6.1 14.1.1 (b)	
	Solid Waste Management and Marine Litter in the Koh Rong Archipelago -	To assess solid waste management (SWM) in the Koh Rong Municipality (KRA) with a focus on its relevance to marine litter and macro-plastic pollution in the Koh Rong Marine National Park (KRMNP)	Fauna & Flora International 2021	Koh Rong Archipelago	Pillar 1 - Use drivers - Consumption patterns Pillar 2 - Waste generation - Waste composition - Rates and fees - Waste collection - Proper disposal practices - Improper disposal practices	12.2.2 11.6.1	
	Investigating Solutions to Marine Plastic pollution in Cambodia	To investigate and articulate status and drivers of plastic pollution in coastal and marine ecosystems in Cambodia	Fauna & Flora International 2019	- Koh Sdach - Koh Rong - Sihanoukville	Pillar 1 - Consumption patterns Pillar 2 - Waste Composition - Improper disposal practice - Recycling Pillar 4 - Marine litter quantity (fishing nets) - Hotspots	12.2.2 11.6.1 12.5.1 14.1.1 (b)	
	Marine Litter in Cambodia: a Situation Analysis & Recommendations for Planning and Action DRAFT	To investigate and articulate the Cambodian context pertaining to marine litter	UNEP FFI 2020	Nation	Pillar 1 - Use drivers Pillar 2 - Waste generation - Waste composition - Waste collection - Improper disposal behaviours	12.2.2 11.6.1 14.1.1 (b)	

					Pillar 4 - Possible source, pathways and hotspots	
Marine Debris Clean-up in Koh Rong Sanloem Island, Cambodia: A Summary Report of Activities, Key Findings & Recommendations	To summarize locally-led clean-up activities	FFI 2022	Koh Rong Sanloem		Pillar 4 - Quantity of marine litter: coastal and underwater - Composition of marine litter: coastal and underwater	14.1.1 (b)
Assessment on the cost of plastic bags in Cambodia – Full research	Measure the cost of plastic bags to Cambodia's economy and society	Fondazione ACRA 2015	- Phnom Penh - Siem Reap - Sihanoukville		Pillar 1 - Use drivers - Consumption pattern Pillar 2 - Waste generation (plastic bags) Pillar 3 - Quantity of plastic litter in wastewater system - Composition of plastic litter - Accumulation hotspots	12.2.2 11.6.1 6.3.1
CAMBODIA'S PLASTIC BAG ECOSYSTEM AND USAGE - Summary of research report	To understand behaviours, attitudes, desires, needs and motivations as relevant to plastic bag use	Quicksand/Fondazione ACRA 2015	- Phnom Penh - Siem Reap - Sihanoukville		Pillar 1 - Use drivers - Consumption pattern Pillar 2 - Proper disposal habits - Recycling/reuse practices	12.2.2 11.6.1 12.5.1
Market Research Report	To understand the existing behaviours of various target groups with regards to reducing, reusing and the proper disposal of plastic bags.	17 Triggers/Fondazione ACRA 2015	- Phnom Penh - Siem Reap - Sihanoukville		Pillar 1 - Use drivers Pillar 2 - Proper disposal habits - Improper disposal habits - Recycling/reuse practices	12.2.2 11.6.1 12.5.1
Scaling Up Waste Recycling In Battambang City	To develop recommendations for the establishment of an efficient waste recycling system in Battambang city.	Global Green Growth Institute – GRET 2020	Battambang		Pillar 2 - Waste generation - Rates and fees	11.6.1
Regional reports (n=2, 5.4%)	Capacity mapping for monitoring and	identification of capacities required to undertake the monitoring and assessment of plastic litter	Asian Institute of Technology, Regional Resource Center	Nation		

	assessment of plastic pollution in the Lower Mekong	leakage on land and in the water environment in the 4 LMC countries	for the Asia and the Pacific 2020			
	Circular economy and plastics: a gap-analysis in ASEAN member states	Provide evidence-based gap analysis at regional level to move toward a circular economy approach	Akenji, L.; Bengtsson, M.; Kato, M.; Hengesbaugh, M.; Hotta, Y.; Aoki-Suzuki, C.; Gamaralalage, P.J.D. & Liu, C. – IGES 2019	Nation	Pillar 1 - Plastic import quantity Pillar 2 - Waste composition at disposal site - Recyclables exports	12.2.1 12.5.1
	Municipal Solid Waste Characterization and Recycling Potential in Phnom Penh City, Cambodia.	The paper presents the review of MSW management, MSW characteristics, and recycling potentials in Phnom Penh city, Cambodia	Seng, B., Fujiwara, T. 2016	Phnom Penh	Pillar 2 - Waste generation - Waste composition - Proper disposal - Collected recyclables	11.6.1 12.5.1
	Suitability assessment for handling methods of municipal solid waste.	To analyze the physical and chemical characteristics of the solid waste in the Dangkor Landfill of Phnom Penh city to assess the suitability for handling methods for future planning of the MSW management	Seng, B., Fujiwara, T., Seng, B. 2018	Phnom Penh	Pillar 2: - Waste generation - Waste composition before and after landfill - Recycling: collection amount, rates and revenues	11.6.1 12.5.1
Research papers (n=6, 16.2%)	Waste Management Challenges in Cambodia and Experiences from other countries	To examine the issue of waste management in Cambodia, and provides an analysis of the impacts of waste on human health and the environment.	Parliamentary Institute of Cambodia 2015	- Phnom Penh - Siem Reap - Battambang - Kampong Cham	Pillar 2: - Waste generation - Waste composition - Proper disposal: number of active landfills - Improper disposal practices and rates	11.6.1
	Perspectives of Solid Waste Management in Rural Cambodia	To explore waste management, community attitudes, practices and waste profiles in rural communities in Cambodia	Smith et al Journal of Humanitarian Engineering 2018	Koh Dambang island	Pillar 2 - Waste generation - Waste composition - Collection rate - Improper disposal habits	11.6.1
	Plastic transport in a complex confluence of the Mekong River in Cambodia	Analysis and quantification of amount of plastics released within the city of Phnom Penh	Charlotte J Haberstroh et al 2021	Phnom Penh	Pillar 3: - Quantity of plastic litter discharged in rivers - Polymer composition of plastic litter	6.3.2 14.1.1 (b)
	Projected plastic waste loss scenarios	To investigate the past, present and future volume of mismanaged plastic	Finnegan, A.M.D., Gouramanis, C.	Tonle Sap Basin	Pillar 3	6.3.2 14.1.1 (b)

	between 2000 and 2030 into the largest freshwater-lake system in Southeast Asia.	waste (MPW) that has entered Tonle Sap Basin (TSB: comprising Tonle Sap Lake (TSL) and Tonle Sap River (TSR)) in Cambodia.	Sci Rep 2021		- Estimated amount of plastic waste entering TSB	
	Scoping Study Report on Solid Waste Management in Kep Province	Understand existing SWM systems and infrastructure	The Asia Foundation 2020	Kep	Pillar 2 - Waste generation	11.6.1
	Solid Waste City Report Preparation for Selected Municipalities in Cambodia DRAFT	Understand existing SWM systems and infrastructure	The World Bank 2020	Sihanoukville	Pillar 2 - Waste generation - Waste composition - Rates and fees - Collection - Proper disposal rate - Recycling: type, rate and value	11.6.1 12.5.1
	State of Waste Management in Phnom Penh, Cambodia	To provide an overview of Phnom Penh's current waste management status	IGES 2018	Phnom Penh	Pillar 2 - Waste generation - Waste composition - Collection rate - Proper disposal rate in landfill	11.6.1
Development partners reports (n=14, 37.8%)	Final Report Work Plan for Mitigating Short-Lived Climate Pollutants (SLCPs) from Landfills and Municipal Solid Waste - Cities Reducing Emissions Through Improved Waste Management in Battambang, Cambodia	To collect and present summary of SLCP emissions associated with open burning, summary of comments from local stakeholders, summary of pilot project implementation, challenges and solutions, and the work plan.	IGES 2017	Battambang	Pillar 2: - Waste generation - Waste composition - Improper disposal rate and practices - Recycling: amount and type of recyclables sold	11.6.1 12.5.1
	Plastic pollution in Cambodian ecosystem: macro-plastic debris in rivers and coastal zone	To estimate the spatial distribution, types, and characteristics of macroplastic fragments in shorelines along freshwater canals	The World Bank 2019	- Phnom Penh - Siem Reap	Pillar 3 - Quantity of plastic litter - Composition of plastic litter - Brand audit	6.3.2 14.1.1 (b)

DRAFT						
Plastic pollution in Cambodian coastal zone ecosystems: with particular focus on the islands of Koh Rong and Koh Sdach	To estimate the spatial distribution, types, and characteristics of macroplastic fragments in shorelines coastal zones.	The World Bank 2019	- Sihanoukville - Koh Sdach - Koh Rong	Pillar 4 - Quantity of plastic litter - Composition of plastic litter - Brand audit	14.1.1 (b)	
DRAFT						
UN-Habitat WaCT Survey (not published)	To collect data on MSW generated, collected, and managed in controlled facilities	UN-Habitat 2021	- Sihanoukville - Kep	Pillar 2 - Waste generation - Waste composition - Waste collection - Proper disposal - Waste recycling Pillar 4 - Quantity of plastic waste leakage	11.6.1 12.5.1	
Survey Report on Waste Management Practices At Municipality/District Level.	To better understand the situation of the implementers at the sub-national level, and for documenting the current practices and challenges on Waste Management at M/D level in Cambodia	KAS 2018	Nation	Pillar 2 - Rates and fees: methods for calculation		
Country Chapter: State of the 3Rs in Asia and the Pacific.	To provide expert-based assessment of regional progress of 3R policy implementation in selected countries and regions in Asia and the Pacific	UNCDR 2017	Nation	Pillar 2 - Waste generation in urban areas - Proper disposal - Improper disposal - Recycling: quantity of recyclables collected	11.6.1 12.5.1	
Solid Waste Management Value Chain Mapping and Social Impact Investing.	Waste value chains in Cambodia with specific attention to the capital city Phnom Penh,	UNDP 2017	- Phnom Penh - Siem Reap - Battambang - Kampot	Pillar 2 - Waste generation - Waste composition - Waste collection - Recycling exports	11.6.1 12.5.1	
Report on Solid Waste Management in Cambodia - Nationwide Context	To quantify the amount of solid waste generated across Cambodia along with other information on the waste management system	UNDP 2018	Nation	Pillar 2 - Waste generation - Waste composition - Rates and fees - Waste collection - Recyclables export	11.6.1 12.5.1	

Combatting Plastic Bag Use in Cambodia: Policy Report and Suggested Regulations	To analyze regulations on plastic bags in other countries, review how generated tax revenue is used	UNDP 2019	- Phnom Penh - Siem Reap	Pillar 1 - Use driver - Consumption patterns	12.2.2
Combatting Plastic Foam Use in Cambodia: Policy Report and Suggested Regulations	To analyze regulations on plastic foam in other countries and suggests possible implementation of specific regulation in Cambodia	UNDP 2019	Nation	Pillar 1 - Import: origin - Use driver Pillar 2 - Improper disposal - Recycling	12.2.2 12.5.1
Combatting Plastic Straw Use in Cambodia: Policy Report and Suggested Regulations	To analyze regulations on plastic straws in other countries and suggests possible implementation of specific regulation in Cambodia	UNDP 2019	Nation	Pillar 1 - Use driver Pillar 2 - Recycling	12.2.2 12.5.1
Grand total= 37					

ANNEX IV - Ministry Mandates Related to Waste Management Governance in Cambodia Ministry - MoE 2021

Ministry	Responsibility
Ministry of Economy and Finance (MEF)	Allocation of budgets for waste management
Ministry of Environment (MoE)	Environmental planning and monitoring of effluent discharged in waterways, municipal solid waste, construction and demolition waste, industrial waste and hazardous waste under the General Directorate of Environmental Protection (GDEP) and Provincial Departments of Environment (PDoEs)
Ministry of Health (MoH)	Management of medical waste through the Department of Hospital Services (DHS) and Provincial Departments of Health (PDoHs)
Ministry of Agriculture, Forestry and Fisheries (MAFF)	Registration of agricultural pesticides and fertilizers under the General Directorate of Agriculture (GDA) and the management of its waste disposal in cooperation with MoE
Ministry of Interior (Mol)	Operation and management of wastewater treatment systems, landfill sites and outsourcing all waste management functions through the General Department of Local Administration (GDLA), Provincial and Municipal Administrations. Includes the Phnom Penh Capital Administration.
Ministry of Public Works and Transport (MPWT)	Managing wastewater treatment facilities and preparing regulations, policies and strategies for wastewater treatment through its General Directorate (Department) of Sewerage and Wastewater Management (GDSWM) and Provincial Departments of PWT

Ministry of Industry Science Technology and Innovation (MISTI)

Administration of private industrial sector entities including management of industrial waste and promotion of cleaner production processes

ANNEX V - Existing or planned National Strategic Documents actions related to marine litter

	National Circular Economy Strategy and Action Plan	National Waste Management Strategy and Action Plan 2017-2030	National Environment Strategy and Action Plan, 2016–2023 (NESAP)	Rectangular Strategy - Phase 4	National Strategic Plan on Green Growth 2013-2030
Pillar 1 – Production, use, lifecycle	<ul style="list-style-type: none"> - Reduction of Single-Use Plastic (SUP) products, and promotion of alternatives single-use plastic, to enhance reuse of multi-use products and alternative materials - Promotion of reuse and repair business models to decrease waste generation and plastic consumption 	<ul style="list-style-type: none"> - To promote non-plastic packaging by planning activities for use packaging materials that do not harm the environment - To conduct educational campaign promoting the use of traditional packaging and stop using plastic bags - To develop guidelines and standards for 3R activities 	<p>Objective 2.1: To promote development and application of innovative technology, products and services for wasting less, and using what is available better.</p>		
Pillar 2 - Waste	<ul style="list-style-type: none"> - Develop and support of recycle feedstocks market, to create enabling environment and market demand for recycling initiatives at national level - Develop Extended Producer Responsibilities (EPR) frameworks, to engage private sector actors in collection, recycling and different 	<ul style="list-style-type: none"> - To implement program in waste separation at source and establish a center for recycle and reuse of waste - To expand the waste collection service at cities and towns in provincial areas - To strengthen the management of solid waste in rural areas - To promote of awareness raising on illegal disposal and open dumping 	<ul style="list-style-type: none"> - Objective 2.3: To support national line ministries and institutions and subnational administration (districts) in improving waste management and 3 Rs (reuse, recycle and reduce) targets for a move to a recycling and green society. 	<ul style="list-style-type: none"> - Further strengthening the management of solid waste, waste water, gas and lethal substance by implementing principles of reduction, reuse, recycling and non-use as well as strengthening pollution monitoring and control mechanism and control 	<ul style="list-style-type: none"> - Managing marine pollution, including management of waste disposals, plastic disposal, organic pollutants, heavy metals and liquid waste discharge to protect the marine health, and marine biodiversity

	<ul style="list-style-type: none"> - To strengthen law enforcement (on illegal dumping) - To expand and improve waste collection service 	
<p>Pillar 3 – Monitoring of freshwater and wastewater</p>		<ul style="list-style-type: none"> - Further strengthening the management of protected areas, biodiversity conservation, natural resource conservation, especially the ecosystems of Tonle Sap lake, Mekong river and the coastline areas
<p>Pillar 4 – Monitoring of marine water</p>	<ul style="list-style-type: none"> - To create data base and platform across the country to increase capacity of the waste related data collection and management of the data - To use the accumulate waste related data to evaluate the progress of the waste management, the efficiency solid waste management and further future planning on waste management 	<ul style="list-style-type: none"> - Studying and assessing any impacts on marine natural resources, caused by developmental projects - Supporting and encouraging scientists to conduct researches on marine pollutants and preserve quality of sea water - Identifying factors causing impacts and reducing the impacts on economy, society, environment, and culture, especially on the people living on the islands, due to over-fishing and fishery overexploitation, and pollution to biodiversity, coral

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