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A qualitative study on risks and opportunities of plastic credit financing instruments being introduced into the informal waste management sector

Working Paper

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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 impact 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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Yunus Environment Hub (YEH) is the global social business network that creates solutions for the environmental crisis. Co-founded by Nobel Peace Prize laureate Prof. Muhammad Yunus, YEH supports and develops social business solutions that solve environmental problems in a financially self-sustainable way and with high socio-economic impact. Building on over 40 years of experience of Grameen in the development and implementation of social businesses, the organization offers extensive know-how on all aspects related to environmental issues.

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List of abbreviations and acronyms

ASEAN	Association of Southeast Asian Nations
EPR	Extended Producer Responsibility
FMCG	Fast-moving consumer goods
GAIA	Global Alliance for Incinerator Alternatives
HDPE	High-density polyethylene
ICT	Information, communication, technology
LDPE	Low-density polyethylene
MLP	Multi-layered packaging
MSW	Municipal solid waste
MSWM	Municipal solid waste management
NGO	Non-governmental organisation
PET	Polyethylene Terephthalate
PP	Polypropylene
PPE	Personal protective equipment
PS	Polystyrene
PRO	Producer responsibility organisation
PVC	Polyvinyl chloride
RDF	Refuse-derived fuel
SEA	South-East Asia
UNEP	United Nations Environment Programme
US	United States of America
WIEGO	Women in Informal Employment Globalising and Organising
WWF	World Wildlife Fund

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1. Introduction

According to estimations of the United Nations Environment Programme (UNEP 2015a), almost half of the world population does not have access to proper waste management services. Especially in countries of the Global South, the collection of recyclables depends almost entirely on the informal sector, with informal waste collectors constituting the most relevant stakeholders for the collection and recovery of waste material (Velis 2017, p. 329). Nonetheless, informal waste collectors are amongst society's most marginalized groups with no recognition of their essential services as well as lacking access to sustainable sources of income and basic social services (UNEP 2015b).

At the same time, the world is facing a plastic waste crisis of global outreach. In January 2022, in their study published in *Environmental Science*, Persson *et al.* suggested that, based on the weight of evidence, humanity is currently operating outside the planetary boundary in terms of plastic production and pollution (summarised as "novel entities"). According to the authors, this could have large-scale and irreversible impacts that threaten the integrity of earth system processes (Persson *et al.* 2022, p. 1510). Therefore, science suggests taking urgent action to reduce the harm associated with exceeding the boundary by reducing the production and release of plastics (Persson *et al.* 2022). A systemic change is needed to solve the systemic problems of the current plastic waste crisis. While systemic approaches for plastic circularity and the respective waste management may take time to be implemented, short-term solutions may alleviate the symptoms but overlook the root cause.

In recent years, various actors started developing innovative funding mechanisms and new financial instruments to address the financial gaps that characterize municipal solid waste management systems (MSWM) in countries of the Global South. As one of these innovative financing instruments, plastic credits are increasingly gaining attention in the international sustainability discourse as well as in discussions on innovative financing solutions for waste management.

Plastic credits may address global plastic pollution and increase living wages of informal waste management stakeholders by bringing additional funding from international fast-moving consumer goods (FMCG) companies aiming to decrease their plastic footprint. However, the introduction of plastic credit schemes to local waste management contexts may also unfold a series of unintended implications and potentially harmful side effects for the informal waste management sector and should thus be analysed thoroughly. Despite the variety of potential effects that plastic credits may have on the informal waste management sector and its stakeholders, so far, research on their risks and opportunities is still scarce.

This study aims to bridge existing research gaps and bring to light a better understanding of the potential risks and opportunities associated with the introduction of plastic credit schemes to the informal sector. The research incorporates the three dimensions of sustainability; social, ecological, and economic aspects of regional MSWM systems and the impact that plastic credit schemes as a new financing approach could have on them. As an outcome, the study delivers key insights and recommendations for different stakeholders involved in the development, implementation, or regulation of plastic credit schemes.

The study has a regional focus on South-East Asia, with a specific focus on Malaysia, Thailand, Indonesia, the Philippines, Cambodia, and Vietnam. As means of data collection, the authors conducted a total of 40 semi-standardised guideline interviews. These include independent academic experts as well as a variety of different stakeholders involved either in the development and implementation of plastic credit schemes (such as marketplaces or standard setters) or in plastic waste management activities closely related to the informal sector (such as informal waste worker associations, local NGOs, or international development organisations).

Definitions for the key concepts and terms used in this study (such as plastic credits, informal waste collectors, municipal solid waste management, and others) are given in annex A.

2. Introduction to Main Topics

2.1. Plastic Pollution in South-East Asia

South-East Asia is one of the regions most threatened by plastic pollution (Del Bello 2022), which is putting in danger ecosystems and livelihoods in countries such as Cambodia, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam (SEA Circular 2022). This region of the world has dramatically increased its production and consumption of plastic products and packaging in the last decades due to its steady economic growth, rapid urbanization, and a rising middle class. With national waste management systems in the region not being able to hold up to rapidly evolving plastic waste generation patterns, South-East Asia "has emerged as a hot spot for plastic pollution" (Kwakwa and Garcia Mora 2021).

However, the current plastic pollution of land and ocean is not limited to South-East Asia but constitutes a global crisis and special attention should be drawn to developed countries, which have played and continue to play a key role in generating and exporting plastic waste to the Global South (Ocean Conservancy 2022). For example, the United States generates more plastic waste than any other country in the world adding up to more than 42 million tonnes per year, of which in 2016 alone 0.15 to 0.99 million tonnes of collected material were inadequately managed in countries outside the US (Law *et al.* 2020, p. 2; Yale School of Environment 2021). According to Marks (2022, p. 283), 75% of globally exported waste ends up in Asia. This trend has been exacerbated since China banned imports of several types of waste (including plastic waste) in early 2018 onwards (Del Bello 2022). As a result, South-East Asia "has become a dumping ground for wealthier countries' waste" (Marks 2022, p. 283). After China's ban, the amount of plastic waste imported to countries such as Indonesia, the Philippines, Malaysia, and Indonesia more than doubled within the first year alone (Marks 2022, p. 283).

Even though South-East Asian countries are not the main plastic waste producers, their percentage of mismanaged plastic waste does exceed respective figures of larger plastic waste producing countries such as the US (Law *et al.* 2020). According to Law *et al.* (2020, p. 4), the percentage of mismanaged waste in Indonesia is 61% compared to 2.98% of mismanaged waste in the US. As a result, with MSWM systems notoriously overburdened, mismanaged waste in South-East Asia ends up leaking into the environment and the region's numerous waterways, eventually leading to the South China Sea and the Pacific Ocean being constantly littered with plastic waste (Del Bello 2022; Trajano 2022).

With six of the world's top ten countries ranked according to annual marine plastic waste leakage located in South-East Asia – namely: Philippines, Malaysia, Indonesia, Myanmar, Vietnam and Thailand (Guzman 2022), South-East Asia stands as "both a source and victim of plastic pollution" (Kwakwa and Garcia Mora 2021). Additionally, recycling rates ranging between 18 and 28% in countries such as Thailand, Malaysia and the Philippines, not only portray an environmental and climate issue, but also leave significant economic potential untapped as was recently outlined by a series of World Bank studies (Del Bello 2022).

The overburdening of national MSWM systems has further increased the importance of the informal sector to carry out elementary plastic waste collection and recycling processes all over South-East Asia (Del Bello 2022). However, with informal waste collectors generally being underpaid and socio-economically excluded, there is an urgent need for large-scale investments into local MSWM systems and recycling infrastructures in South-East Asia (Kwakwa and Garcia Mora 2021).

Consequently, momentum to solve the plastic waste crisis in South-East Asia has increased over the past few years. Alongside circular economy roadmaps and action plans being launched on the national level (e.g. in Thailand, the Philippines and Malaysia), the *Association of South-East Asian Nations (ASEAN) Regional Action Plan for Combating Marine Debris* also combines efforts on a transnational level and in cooperation with the international community (ASEAN 2021). More action is also forming in the private sector with national recycling associations being set up all across South-East Asia with the aim of ramping up and coordinating recycling efforts, accompanied by a variety of (mostly voluntary) commitments by leading FMCG and manufacturing companies.

Table 1 gives an overview of selected facts and figures portraying the dimensions of the plastic waste crisis in the selected countries from South-East Asia that constitute the geographical research focus of this study.

Cambodia	• Out of the 3.65 million tonnes of MSW generated per year, plastics account for 20%, mainly being generated in the country's urban areas such as Phnom Penh and Sihanoukville (SEA Circular I Cambodia 2020, p. 2). • With only about 11% of MSW being recycled, 41% is discarded at dumpsites, while the remaining 48% are illegally burnt or dumped in open water bodies (SEA Circular I Cambodia 2020, p. 2). • Plastic waste accounts for 80% of coastal pollution found at Cambodia's beaches (SEA Circular I Cambodia 2020, p. 2).
Indonesia	• Globally, Indonesia is the second biggest contributor to marine plastic litter with a total leakage that accounts for 10% of the world's marine pollution (SEA Circular I Indonesia 2020, p. 2). • Four of Indonesia's riverways (Brantas, Solo, Serayu, Progo) rank among the 20 most polluted in the world regarding mismanaged plastic waste (SEA Circular I Indonesia 2020, p. 2). • In Bali alone, 33,000 tonnes of plastic waste leak into the island's waterways annually (SEA Circular I Indonesia 2020, p. 2).
Malaysia	• With an annual leakage between 0.14-0.37 million tonnes per year, Malaysia ranks 8th amongst countries with mismanaged plastic waste in the world (SEA Circular I Malaysia 2020, p. 3). • With a total of 66%, plastic waste constitutes the main source of coastal pollution in the country (SEA Circular I Malaysia 2020, p. 3). • Malaysia is among the world's primary destinations for global plastic waste exports with a plastic recycling industry worth more than 7 billion USD (Jain 2020).
Philippines	• With 0.28-0.75 million tonnes of plastic waste entering the oceans per year, the Philippines rank as the world's 3rd largest contributor to marine plastic pollution (SEA Circular I Philippines 2020, p. 2). • Plastic packaging is the main source of pollution and marine litter in the country stemming from the Filipinos use of more than 163 million plastic sachets per day (SEA Circular I Philippines 2020, p. 2). • With only 28% of plastic waste being recycled, the great majority of plastic waste remains unaddressed leaving a material value of 890 million USD per year untapped (World Bank Group 2021, p. 14).
Thailand	• More than 50,000 tonnes of uncollected plastic waste leaking into the sea each year make Thailand the world's sixth largest contributor of marine plastic waste (SEA Circular I Thailand 2020). • 80% of plastic waste generated in the country consist of single-use plastic bags (SEA Circular I Thailand 2020). • With the increase of waste imports to Thailand that resulted from China's ban in 2018, prices for recyclables in the country have dropped significantly threatening the livelihoods of the informal sector (Duggleby 2021).
Vietnam	• Vietnam ranks as the world's 4th largest contributor to marine plastic pollution (Snell 2022). • Increasing plastic pollution is imposing severe threats to the country's coastlines and to its renowned natural heritage sites such as Ha Long Bay and Cat Ba (SEA Circular I Vietnam 2022, p. 2). • Per capita plastic consumption per year increased from less than 4kg in 1990 to more than 40kg in 2018, leaving MSWM systems overburdened with the rapid increase in waste quantities (Snell 2022).

Table 1: South-East Asia's plastic crisis at a glance

2.2. The Role of the Informal Sector for Municipal Solid Waste Management

The global plastic waste crisis constituted a central topic at the fifth United Nations Environment Assembly, which met in Nairobi from 28 February to 2 March 2022. During their closing session, the representatives of 175 nations adopted a "historic resolution" in the global fight against plastic waste pollution (UNEP 2022). From production to disposal, the foreseen resolution addresses the entire life cycle of plastic and provides the baseline for the development of a legally binding international agreement by 2024, which shall be fostered by the engagement of a committee set up specifically for this purpose (United Nations Environment Assembly [UNEA] 2022). According to UNEP Director Inger Andersen (via twitter on 02.03.2022), such a binding agreement on plastics and plastic waste would constitute the most important treaty of recent decades, second only to the Paris Agreement. Already today, the adopted resolution is the first of its kind to explicitly recognise the relevance of the collection and recycling activities of waste collectors and other stakeholders from the informal sector (UNEA 2022).

However, with the international community still waiting for such a legally binding agreement on the treatment of plastic waste to be implemented (UNEP 2022), the management and treatment of plastic waste so far remains in the hands of national and regional governments. While national systems of Extended Producer Responsibility (EPR) may constitute an effective framework for the financial viability of national solid waste management systems, the lack of a holistic implementation of EPR marks a significant obstacle in many countries of the Global South.

With EPR systems awaiting their legal introduction or not yet functioning systemically in many countries of the Global South, the collection and recovery of plastic waste still depends almost entirely on the informal sector and its stakeholders. According to the literature, between 15 and 20 million people worldwide make their living by informal waste collection and recovery, many of them women, children, elderly, unemployed or migrants (Yang *et al.* 2018, p. 2; Talbott 2019; Baker 2020). Their waste management activities such as waste collection, picking, sorting, and rudimentary forms of recycling amount to 50-100% percent of waste management activities in many cities of the Global South (Talbott 2019). As such, informal waste management stakeholders constitute an integral part of waste management, resource recovery and the circular economy in the region (Velis 2017).

Waste generation is growing rapidly due to increasing populations, rapid urbanisation and changing consumption patterns in the Global South (Yang *et al.* 2018), while MSWM systems continue to suffer from resource scarcity. As a result, informal waste collectors "are here to stay and thrive in the 'foreseeable' urban future" (Velis 2017, p. 329) carrying out crucial MSWM services on the ground all over the world.

Despite general global commonalities with regards to their vulnerability, stigmatisation, and socio-economic hardship, informal waste collectors and the organisational models in which they operate vary widely, ranging from informal pickers collecting in the streets to sophisticated cooperatives with municipal contracts (Talbott 2019). Thus, while generally summarised under the umbrella term 'informal waste sector', some waste collectors may work individually and under harshest conditions on open dumpsites, while others may take part in cooperative schemes that tend to, at least, increase bargaining power of waste collectors towards other stakeholders in the plastic value chain (Velis 2017, p. 330; Yang *et al.* 2018, p. 14). The latter, however, remains the exception with most studies indicating the quota of informal waste collectors belonging to cooperatives or associations below 10% (Velis 2017, p. 330).

With their activities, informal waste collectors and other stakeholders from the informal sector provide relevant waste management services to local households and municipalities (Yang *et al.* 2018). These services are not only essential for maintaining basic levels of health and hygiene standards, but also contribute to local environment protection with informal waste collectors oftentimes being the only stakeholders that prevent different waste types from entering nature and the sea (Talbott 2019).

Despite their key role in local MSWM systems and their contribution to waste removal from the environment, informal waste collectors and other stakeholders in most contexts hardly receive any recognition for their waste management activities but in fact belong to the most marginalised members of society. Oftentimes, informal waste collectors themselves hardly recognize the bandwidth of their contribution in terms environment protection since they are primarily driven by a mere existential financial motivation, generally focusing only on those waste types that bring quick financial revenue on the informal recycling market such as paper and cardboard, scrap metal, glass, or plastic bottles (Velis 2017, p. 329; Yang *et al.* 2018, p. 8):

> *The informal recycling sector is not necessarily motivated by delivering waste management services or saving the planet. Their core motivation, unfortunately, is driven by the vulnerable financial social position they are starting from, which is to secure their livelihood and therefore, they would focus on the most lucrative items.*
>
> **Dr. Costas Velis**
> ***University of Leeds***

Working and living under harshest conditions in the informal waste sector

Informal waste management activities are susceptible to numerous environmental as well as health risks. As such, environmental pollution stemming from rudimentary informal recycling activities is diverse and alarming to both local ecosystems as well as the people operating in them (Yang *et al.* 2018). Working on open landfills and dumpsites bears a variety of severe health risks for waste collectors and other stakeholders. This includes the direct and unprotected exposure to toxic materials, human and animal waste as well as high risk exposure to cholera, malaria or diarrhoea (Yang *et al.* 2018; Dias 2020). Furthermore, injuries from operating with sharp material such as glass waste or syringes without adequate protection gear such as gloves are common. The same holds for a constant threat of explosions and fires breaking out underneath or on open dumpsites (Yang *et al.* 2018; Dias 2020).

> *I often get injuries due to touching sharp waste materials from garbage bags, garbage dumps and public waste bins, as well as from walking on foot for long distances in hot climates, and not wearing protective gloves. I have a habit of not drinking water on my trash hunting tours. I just continue going until I'm too tired and decide to go home to take a short rest and go out again. Sometimes if I'm too far from my house, I will ask for free water from random places.*
>
> **Ms. Nguyen Thi Hang**
> ***Informal waste collector from Tien Giang Province, Southern Vietnam***

Without access to proper washing and sanitary facilities, informal waste workers oftentimes involuntarily bring toxic residues back home to their homes and families (Yang *et al.* 2018, p. 12). Around the world, informal waste workers suffer from direct health threats as well as social marginalisation and exclusion, the latter not seldomly leading to severe psychological consequences (Yang *et al.* 2018, p. 12).

2.3. Plastic Credit Schemes and their Stakeholders

With regards to the increasing pressure the global plastic waste crisis is putting on national governments as well as the private sector, innovative and sustainable financing approaches are desperately needed to bridge today's funding gap in plastic waste collection in most countries of the Global South. Against this backdrop, plastic credits have recently emerged as a frequently discussed innovative financing approach to plastic waste management.

While the basic idea behind plastic credits appears relatively straightforward at first sight, the current discourse and stakeholder landscape are, however, characterised by different perspectives and arguments as well as unclear and untransparent roles and responsibilities.

Currently, there is no universal definition of plastic credits from an international authority. However, several international institutions such as World Wildlife Fund (2021, p. 2) have defined a plastic credits as transferable units that represent a specific quantity of plastic that has been collected from the environment and for which collection has been funded by a third party. Plastic credits are sold either directly by project developers and initiatives or via intermediary platforms and marketplaces to the producers of plastic waste, usually companies, manufacturers or brands from the consumer goods sector (WWF 2021). The equivalent value of one plastic credit is hereby defined by the amount and composition of collected plastic waste, which may differ among different plastic credit schemes. The financial sum that the buyers pay for the plastic credits flows back into organisations that carry out or coordinate the local collection and disposal of plastic waste, usually in countries of the Global South.

The mediation of this exchange between local collection organisations on the one hand, and the buyers of plastic credits on the other hand, is regulated by independent standards or guidelines. While plastic producers, corporations or brands claim to compensate their own plastic footprint by buying plastic credits*, the exchange can be a valuable source of funding for local collection organisations or waste management systems on the opposite side of the plastic waste value chain (The Circulate Initiative 2021; WWF 2021).

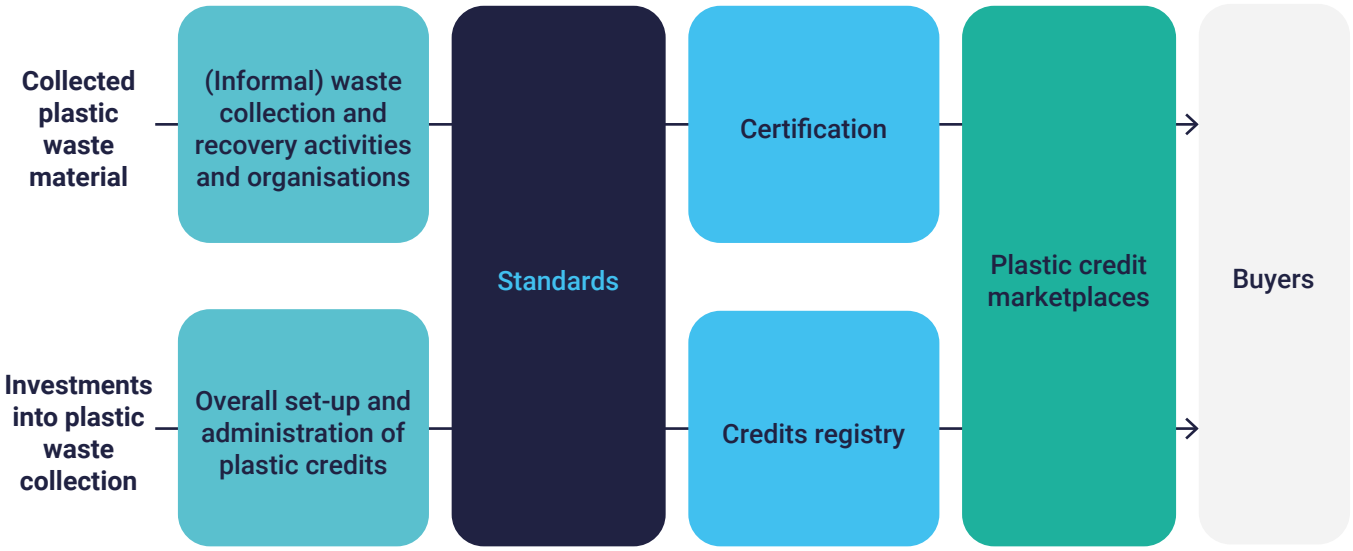


Figure 1: Key stakeholders and process steps of plastic credit schemes
(Design by Yunus Environment Hub, based on The Circulate Initiative 2021, p. 6)

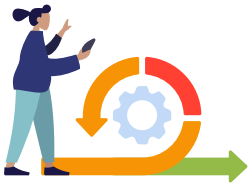
At first glance the structure of a plastic credit scheme (as presented in figure 1) may appear straightforward, however, roles, responsibilities, and activities of different actors in the global plastic credit market are rarely as clear-cut and transparent as outlined above. For example, some actors that develop and operate independent standards for the allocation of plastic credits simultaneously act as sellers for plastic credits, while organisations that act as marketplaces for plastic credits often conduct plastic waste collection themselves or have even developed their own standard.

These mixed roles of different stakeholders and the lack of independent auditors overseeing the overall plastic credit market leads to a significant lack of transparency and bears the risk that crucial social, environmental, and due diligence criteria are disregarded. Furthermore, this opens the door for potential greenwashing activities, as well as for a resulting fear of greenwashing accusations that appears to hold international FMCG companies back from buying plastic credits (ValuCred 2021a).

In clear contrast to the strictly regulated market for CO2 certificate trading, which is oftentimes (wrongfully) cited as a reference for the emerging plastic credit market, the latter is characterised by unclear dynamics and a fragmented landscape of actors (ValuCred 2021a; WWF 2021). Based on the thorough analysis carried out over the course of the ValuCred report† conducted by Yunus Environment Hub and its consortium partners, however, a rough categorisation of relevant actors and roles can nevertheless be made (ValuCred 2021a):

* **Disclaimer:** The term "*plastic neutrality*" does not reflect the actual environmental impact of plastic pollution. Therefore, the reader should not compare the term "*plastic neutrality*" to the carbon crediting system since plastic pollution's nature is fundamentally different from CO2 emissions. Yunus Environment Hub does not support this terminology.

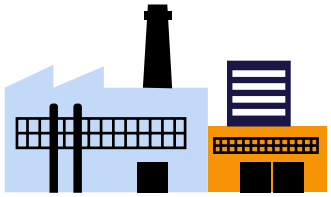
† ValuCred is a consortium led by Yunus Environment Hub, Nehlsen AG & Rodiek, and BlackForest Solutions, for the design and financing of sustainable plastic waste management systems. ValuCred forms part of the pilot project "Plastic Credits for Inclusive and Transparent Circularity" supported by the PREVENT Waste Alliance, with funding from the German Federal Ministry for Economic Cooperation and Development (BMZ) and the Röchling Stiftung. Find more information at ValuCred - Yunus Environment Hub.



Voluntary standard or guideline setters (generally from the private sector) that define methodological and material frameworks for the implementation of plastic credit schemes and set out environmental and social criteria that must be considered during implementation by the parties involved.

Certification service providers that independently certify the application and coherent implementation of plastic credit standards in the respective schemes and by the parties involved.

Platforms, marketplaces and other organisations that offer plastic credits for sale. These either originate from their own waste management activities or from the activities of external organisations.



Buyers of plastic credits are mainly corporations and brands from the consumer goods industry and other sectors that want to compensate for their own amount of plastic fed into national markets through corresponding compensation mechanisms. Institutions and organisations active in international development cooperation may also function as buyers of plastic credits with the goal of funding plastic waste collection activities in countries of the Global South.

Local plastic waste collection organisations that collect (and recycle) plastic waste and for which plastic credit schemes constitute an additional source of income. Their activities mostly focus on the collection and pre-sorting of plastic waste.

Figure 2: Categorisation of actors and their roles within plastic credit schemes
(Design by Yunus Environment Hub)

In the context of this introduction on plastic credits and their different stakeholders, it should be noted, however, that plastic credits cannot eliminate the plastic waste a producer may generate, but they merely focus on waste collection and primary forms of recycling. Companies that bring plastic products and packaging to the market should first and foremost, assess and reduce their plastic footprint. Secondly, where the use of plastic materials cannot be avoided, companies should aim for the substitution of virgin plastics with recycled materials. Finally, as a complementary measure, companies may provide funding to the establishment of waste management infrastructures as well as to the collection and recycling activities of third parties to address plastic waste leakage beyond the value chain for which the purchase of plastic credits may be one instrument. Against this backdrop, figure 3 illustrates how companies should prioritize reducing their total plastic footprint before making use of plastic credits as an instrument to bring additional funding to collection and recycling activities at the lower end of the plastic waste value chain. This conceptualisation of plastic credits being able to serve as additional investments alongside more systemic and direct actions within the value chain is also articulated by the PREVENT Waste Alliance (2022) that

recommends that plastic credits should be used to finance action outside of a corporation's value chain in tandem with its internal plastic reduction strategy to ultimately stop the flow of plastic pollution.

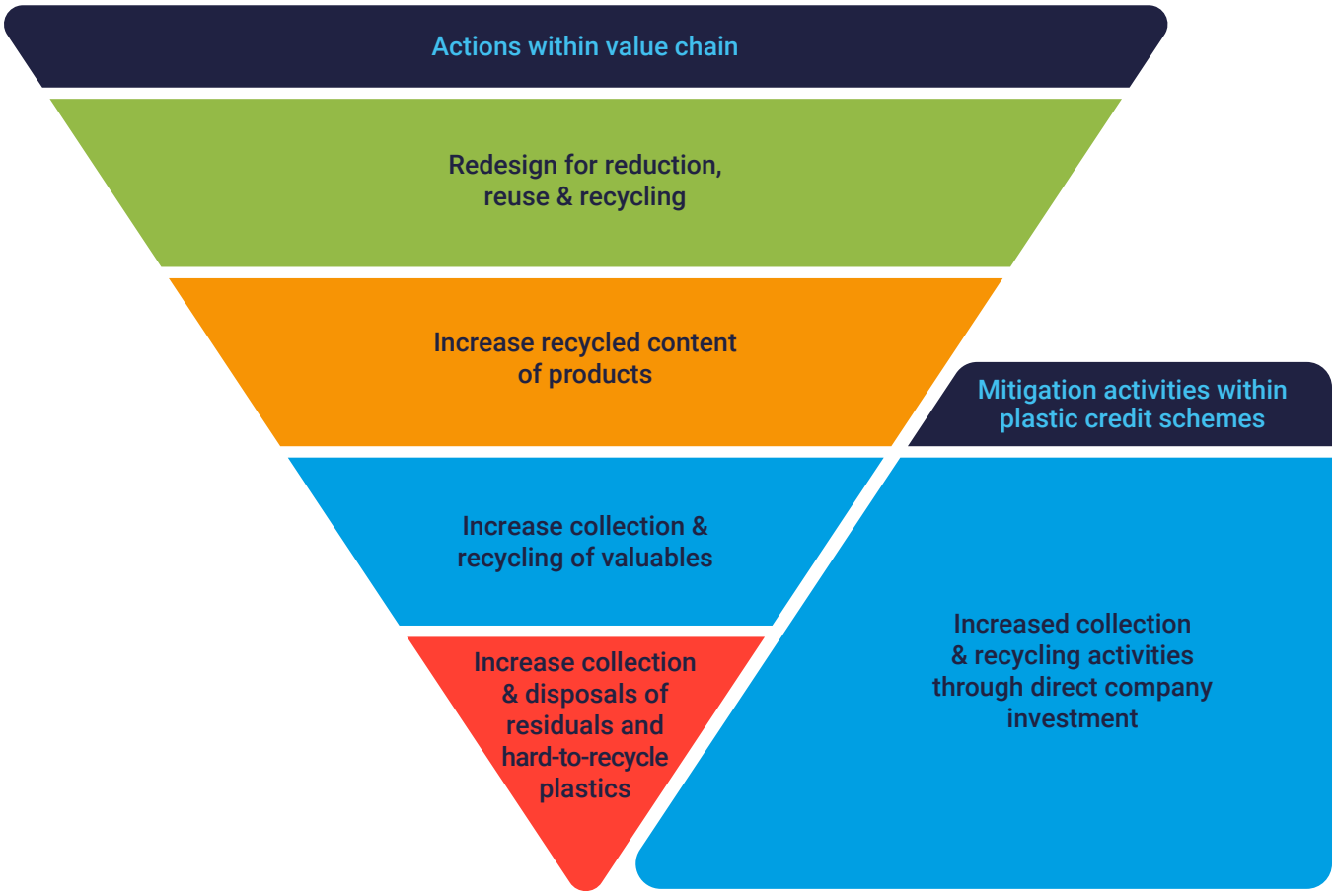


Figure 3: Hierarchy of plastic footprint and leakage mitigation activities (Design by Yunus Environment Hub, based on Verra 2022)

2.4. Plastic Credits and EPR

Internationally, EPR is increasingly recognised as a key framework for closing the loop in the plastic waste value chain (PREVENT Waste Alliance 2021a). EPR policies and systems hold the producers as well as importers of plastic (as well as other material types) responsible for managing the entire life cycle of their products, specifically including the collection, sorting, and recycling of waste (PREVENT Waste Alliance 2021a). In recent decades, the introduction of various EPR policies, systems and initiatives has increased around the globe with legislations being passed by national governments and private-sector initiatives forming simultaneously.

With both EPR systems and plastic credit schemes focusing on improving waste collection and recycling by bringing additional funding to MSWM systems, in any given context an alignment of the two concepts is crucial to avoid plastic credits undermining long-term EPR efforts.

In national contexts where EPR systems are not yet established on a legally binding basis, companies may use plastic credits as an "easy way out" for waste compensation since these offer a much faster and oftentimes cheaper instrument to compensate plastic producers' footprint by providing voluntary one-time investments to waste collection organisations in countries of the Global South. In this case, plastic credit schemes may hinder the establishment of legally binding EPR scheme as well as increase the risk of normalising linear production and consumption patterns while undermining long-term investments into MSWM infrastructures and circular systems. They may

further give companies an excuse to lobby against the establishment of holistic EPR systems. The price of plastic credits should thus always be carefully considered and set in relation to national EPR schemes (see chapter 5.3.4) in order for plastic credits to not undermine national EPR efforts.

In contrast to EPR systems, for which the establishment and operation is complex and time-consuming, plastic credit schemes may, however, offer an easy to implement and quick option to bring additional funding to significantly underfunded waste management systems and their informal stakeholders. Thereby, if applied under careful consideration of existing national EPR initiatives, plastic credits may function as relevant funding bridge until EPR systems are in place.

Plastic credit schemes may also support the establishment of EPR systems on a regional or national level by delivering important on the ground data on waste quantities and material types as well as the landscape of informal waste management collectors and other stakeholders.


3

3. Current Discourse on Plastic Credit Schemes

The current debate on plastic credits points out several effects that this nascent financial instrument may have, either negative or positive. Nevertheless, based on the existing literature, there is a lack of discussion that looks specifically at the potential risks and opportunities of plastic credits on the informal waste management sector despite informal waste collectors being directly affected by the implementation of plastic credit schemes.

The main effects of plastic credits discussed in the literature so far evolve around their environmental impact and respective concerns. For instance, international entities such as WWF (2021), the PREVENT Waste Alliance (2022), and The Circular Initiative (2021) argue that plastic credit schemes may foster greenwashing activities of FMCG companies and other plastic credit buyers since the unlimited and voluntary purchase of plastic credits will not incentivize more systemic change and action along the value chain of plastic waste producers. In other words, plastic credit schemes may not fundamentally change plastic waste production and management and may not reduce the overall flow of plastic waste into nature (PREVENT Waste Alliance 2021; WWF 2021).

Also, according to WWF (2021) and the Global Alliance for Incinerator Alternatives (GAIA 2022), plastic credit schemes do not adequately consider the geographies behind the environmental impacts of different types of plastic waste material and may thus incentivize plastic pollution to continue in one geography as long as collection efforts can occur elsewhere.

In addition to the unintended consequences that plastic credit schemes may have on the environment and public health, several international institutions emphasize a lack of harmonization and standardisation in the plastic credit market, underlining the resulting lack of consistency in the definitions and methodologies of crediting mechanisms and a general inability of different actors to speak the same language and work together towards better global plastic waste management (Lee 2021; PREVENT Waste Alliance 2021b; ValueCred 2021a; WWF 2021). According to the ValuCred report (2021a), in order to address the lack of common language and criteria among the actors, and to achieve a reliable system that allows comparability among all the stakeholders of the plastic waste value chain, it is therefore critical to improve the quality of information, transparency, and accountability. Otherwise, existing inconsistencies will weaken the sector's ability to communicate, collaborate, and advance the plastic credit market (The Circulate Initiative 2021).

The Circular Initiative (2021) conducted a compelling study of the weaknesses and strengths of the plastic credit market based on the assessment of 32 actors (standards, certifications, and credit programs). Despite not considering representatives from the informal waste management sector in particular, the authors highlight a potential risk of plastic credits unfolding unintended social consequences. These may specifically disadvantage existing stakeholders at the lower end of the plastic waste value chain such as waste collectors who may experience "limited benefits or even be excluded from new mechanisms that formalize or subsidize projects promoted by larger developers and operators" (The Circulate Initiative 2021, p. 10). Thus, the authors recommend that the potential social risks to informal waste collectors must not be overlooked (The Circulate Initiative 2021).

Regarding the potential positive effects of plastic credits, the PREVENT Waste Alliance (2021b) argues that standardized plastic credit schemes may ensure that both buyers and informal waste collectors benefit from the trade of plastic credits. More specifically, plastic credit schemes may provide a sustainable source of income for informal waste management stakeholders. According to the ValuCred consortium (2021a) as well as the PREVENT Waste Alliance (2021b), it is necessary that plastic credit schemes include independent and rigorous verification.

As pointed out, research on plastic credits and their particular effects on the informal waste management sector is scarce due to the novelty of the concept, however the current debate reveals an increasing interest of international development institutions and other actors in the topic leading to several recent publications and position papers on plastic credits. Recent publications provide relevant insights on the general risks and opportunities associated with plastic credit schemes, but do not specifically address the impact for the informal waste management sector in depth. The underlying study aims to contribute to this existing research gap by combining the findings from the current literature with the insights derived from expert and stakeholder interviews.


4

4. Methodology

The following section outlines the study's methodological approach. This refers to the overall research design as well as respective steps of data collection and analysis. Special emphasis is also given to the methodological challenges of conducting research on the informal waste management sector and its stakeholders (see section 4.4.).

4.1. Research Design

Acknowledging the lack of existing research dealing specifically with the effects of plastic credits on the informal waste management sector (see chapter 3), the underlying study follows a qualitative-exploratory approach combining a thorough literature analysis and stakeholder and expert interviews as main source of data collection.

The applied qualitative approach enables the authors to collect information that seeks to describe the complexity of the given research objective instead of measuring or quantifying it. In addition, since informal waste management relies on a considerable human dimension, the selected qualitative approach allows the authors to incorporate the human element of the given research object more directly by obtaining direct quotes from open-ended questions. The study thereby follows a constructivist research understanding.

4.2. Data Collection

Given the exploratory nature of the qualitative research, the study has gathered in-depth information about the potential risks and opportunities of plastic credit schemes in the informal waste sector by collecting data from three major sources. These include:

- an extensive iterative literature review;
- interviews with independent experts;
- interviews with key stakeholders from the plastic waste value chain.

In the following sections, each of the three major sources of data collection is briefly outlined:

Literature review

An extensive review of the academic literature was conducted iteratively throughout the entire research project. This literature review mainly evolved around the effects the implementation of plastic credit schemes may have on the informal waste management sector in countries of the Global South with a particular focus on South-East Asia.

The secondary data obtained through the literature review was extracted using the following search engines: Google Scholar, Web of Science, Scholarcy, Inciteful and Connected Papers, with a specific focus on Malaysia, Thailand, Indonesia, the Philippines, Cambodia, and Vietnam. Additional literary references were also extracted from previous projects Yunus Environment Hub has conducted on plastic credits and their application in the informal sector (namely the ValuCred project) as well as from the conducted expert and stakeholder interviews.

Expert interviews

In parallel to the outlined literature review, experts on plastic credits and informal waste management were identified and interviewed. These experts stemmed from academic and research-centred institutions as well as from international development organisations and institutions. The key distinguishing factor between experts and stakeholders was defined by the authors of this study by experts not being influenced by particular organisational or personal motives regarding the risks and opportunities of plastic credits for the informal sector and therefore potentially underlying a bias with regards to the research questions.

Over the course of the study's data collection phase, the expert interviews served the purposes of:

- validating the dynamics of informal waste management systems as derived from the literature before conducting interviews with stakeholders from the plastic waste value chain;
- providing insights on the risks and opportunities that plastic credits may bring to informal waste management systems;
- identifying additional stakeholders for data collection;
- validating the core findings at a later stage of the research process (after interviews with stakeholders from the plastic waste value chain had been conducted).

Each expert interview was conducted on the basis of a semi-standardised interview guideline that was slightly adapted in an iterative process allowing the researchers to fine-tune questions over the process of data collection.

Interviews with stakeholders from the plastic waste value chain

Interviews with stakeholders from the plastic waste value chain constituted an essential part of the study's data collection. On the one hand, these comprised representatives from waste collection organisations and informal waste collector associations from the six target countries in South-East Asia. To gather input on the living and working situation of informal waste management stakeholders as well as to gather their perspective on plastic credits, additional interviews were conducted with two informal waste collectors as well as with one scrap shop owner from Tien Giang Province in Southern Vietnam.

On the other hand, to get a holistic perspective on potential risks and opportunities of plastic credits, interviews were also conducted with representatives from plastic credit marketplaces and comparable organisations involved in the generation and trade of plastic credits as well as with representatives from plastic credit standard setters. The authors acknowledge that each stakeholder hereby may have had their personal perspective on the potential effects of plastic credit schemes based on the level of the plastic waste value chain they operate.

Similar to the expert interviews, each interview was conducted on the basis of a semi-standardised interview guideline which was iteratively adjusted.

In total, 40 expert and stakeholder interviews were conducted. An overview of all interviewees is given in Annex B.

4.3. Data Analysis

The conducted expert and stakeholder interviews constituted the study's main source of data which was complemented by the existing literature. To allow for a sound and transparent process, in which any relevant input regarding the underlying research question would be captured and taken into consideration, the study's data analysis evolved around the following steps:

- recording and transcription of each interview via Microsoft Teams;
- abbreviation of result categories from the given research question and the relevant literature via a top-down process (formulation of categories before interview conduction and analysis). These categories served the categorisation of interview data based on their contextual commonalities and differences, meaning a classification of statements derived from the interviews according to their information on a) risks, b) opportunities, c) income effects, d) gender differences, e) environmental impact;
- analysis of each interview which evolved around a contextual categorisation of separate interview statements to the given categories (e.g. identifying and categorising statements describing different risks of plastic credits for the informal sector);
- development of additional result categories via a bottom-up process (formulation of new categories in light of additional input derived from the interviews). These additional categories brought more differentiation int the risk and opportunity categories as well as comprised additional content categories regarding f) plastic credits and EPR; g) the role of digital tools;
- consolidation of all interview statements gathered under one category (e.g. finding differences, commonalities, patterns in all statements describing the risk of plastic credits being a voluntary source of funding only), including the identification of direct quotes underlining the key message of each result category;
- final review of all result categories identified and a final consolidation with the existing literature.

4.4. Research on the Informal Waste Management Sector: Methodological Challenges

When conducting research on plastic credits as innovative financing mechanisms and their effects with regards to the informal waste management sector in South-East Asia, certain methodological challenges need to be taken into consideration to ensure the manifold perspectives of different actors of the informal waste management sector are incorporated adequately into the study's findings.

Generally, most informal waste collectors, aggregators, and other stakeholders involved in plastic waste collection and recovery activities at the lower end of the value chain are difficult to identify and reach out to via simple desktop research. Existing language barriers may further complicate the conduction of interviews. Local contacts, as well as flexible means of communication are thus crucial to ensure these stakeholders' perspectives are adequately captured and incorporated into any study regarding the impact of plastic credits on their overall living situation. During the data collection phase of this study, the authors therefore identified relevant interview contacts from the informal waste management sector with the help of local NGOs, local partner organisations from previous projects, as well as interviewed academic experts and representatives from organisations involved in plastic credit schemes. Leveraging help from local colleagues in Vietnam provided access to in-person interviews with waste collectors and scrap shop owners and thereby gather direct and essential feedback to take into consideration the end beneficiary perspective.

Second, any study must first acknowledge that there is no homogeneous informal waste management sector, even within a country. On the contrary, the informal sector is a heterogeneous concept shaped by varying local power dynamics, stakeholder roles, and relationships. Further, the overall acknowledgment of informal waste management actors by local institutions and the private sector varies significantly from country to country and from region to region. This holds especially for the comparison of informal waste management dynamics in urban areas to dynamics and stakeholder landscapes in rural areas of the same country or region. Therefore, any findings regarding the risks and opportunities of plastic credits on the informal waste management sector need to consider significant regional differences and contrasting findings. To get a differentiated understanding, the authors of this study thus

incorporated a variety of perspectives from different stakeholders as well as from different regional contexts in South-East Asia.

Third, while their actions do bring relevant effects regarding environmental action and waste recycling, it is essential to acknowledge that most informal waste management stakeholders are driven primarily by financial objectives and an everyday struggle for securing their livelihoods (Velis 2017). It is crucial to consider these different motives when discussing the risks of opportunities of plastic credits with stakeholders from the informal sector to avoid any misunderstandings or research bias.

Finally, one major methodological challenge the authors of this study were confronted with resulted from the overall novelty of plastic credits as a financing instrument for waste collection activities. Despite more and more organisations experimenting with different plastic credit solutions and the respective literature slowly evolving, the overall number of (informal) waste collection organisations or waste picker associations that have already taken part in plastic credit schemes in South-East Asia is still limited. Identifying interview partners that would be able to discuss the risks and opportunities of plastic credits from a first-hand perspective thus constituted a challenge. To gain a more detailed perspective on the effects of plastic credits on South-East Asia's informal waste management sector, interviews were therefore also conducted with a variety of entities outside the informal sector, e.g. entities and organisations involved in the set-up and pilot implementation of plastic credit schemes, such as marketers, marketplaces, recyclers, standard setters, and certifying bodies. To further address the challenge of only a small number of waste collection organisations having actually already participated in plastic credit schemes, interviews were also conducted with entities from the plastic waste value chain not currently involved in crediting schemes such as local waste collection organisations and individual waste collectors from the informal sector to whom the concept of plastic credits was explained before asking for their general assessment of potential risks and opportunities.‡

‡ With this study focussing specifically on the effects of plastic credits on the informal waste management sector and its stakeholders, involved interviewees primarily stemmed from organisations involved in waste management or plastic credit generation activities at the lower end of the plastic waste value chain. Future research may therefore cover two additional stakeholder perspectives which are crucial for an effective development and implementation of plastic credit schemes, namely the perspectives of public sector institutions and policy makers, as well as the perspectives of plastic credit buyers (particularly international FMCG companies).

5

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5. Findings: Risks and Opportunities of Plastic Credits for the Informal Waste Management Sector

The findings presented in the following section are based on the thorough analysis of all interviews the authors have conducted over the course of this study (see methodology section). They were complemented with findings and references from the existing literature.

The study specifically focuses on the risks and opportunities that plastic credit schemes may bring to the informal waste management sector in South-East Asia. However, where explicitly mentioned, the study also considers complementary input regarding the effects of plastic credit schemes derived from discussions with experts and stakeholders active in other regions of the Global South with comparable socio-economic contexts, such as India, Mexico, Nigeria, or Peru.

The table below outlines the main risks and opportunities for the informal waste sector identified as a result of our research and interviews and will be discussed in detail in the following sections.

Risks

1. Insufficient distribution of plastic credit income
2. Dependency on voluntary sources of funding
3. Income vulnerability due to quantities-based compensation
4. Leaving relevant socioeconomic dimensions unconsidered
5. Exclusion of key waste management stakeholders due to rigid standardisation
6. Overburdening due diligence and reporting requirements
7. Manifesting the status quo

Opportunities

1. Bringing additional income
2. Improving the role of women in informal waste collection
3. Giving the informal waste management sector a voice
4. Providing data for better policymaking
5. Professionalization of the waste management value chain
6. Bridging the funding gap until EPR systems are in place

Table 2: Main risks and opportunities resulting from plastic credits for the informal waste management sector

5.1. Identified Risks of Plastic Credits for the Informal Waste Management Sector

1. Insufficient distribution of plastic credit income

Between informal waste collectors, aggregators, scrap shop owners and other informal waste management stakeholders involved in activities at the lower end of the plastic waste value chain on the one side and the buyers of plastic credits on the other, a variety of intermediary organisations and process steps exist. One core risk of plastic credit schemes thus lies in informal waste management stakeholders from the bottom of the pyramid not receiving significant financial benefits due to a large proportion of the income generated through plastic credits being distributed along the waste management value chain beforehand (The Circulate Initiative 2021):

> ***A question that I often receive from my clients is how they can ensure that the money they are providing to an organisation that is selling plastic credits is really proving benefits to the local organisations and the local waste collectors?***
>
> **Laura Peano**
> ***Quantis***

> ***Currently, the benefits that actually reach the informal waste collectors are very little because the organisations (private or non-profit) usually have set up the system in a way where everybody involved in the plastic credit scheme takes their cut and the actual benefit that reaches to the livelihoods of informal waste collectors is insignificant.***
>
> **Zoë Lenkiewicz**
> ***Technical and social global waste specialist***

The lacking standardisation of the international plastic credit market hereby further fosters a lack of transparency regarding the financial distribution along all stakeholders involved in the sale of plastic credits (WWF 2021). This leads to the risk that organisations and actors higher up the plastic waste value chain (e.g. plastic credit marketplaces or standard setters) receive a greater proportion of the total price of one plastic credit than informal waste management stakeholders on the ground that are responsible for initial collection and recovery. Instead, however, plastic credit schemes should *"get the money as close as you can to those that do the hard work on the ground"* (Velis 2022).

In addition, plastic credit schemes, in their current state, are set up in a way that oftentimes only compensates those informal waste collectors or collection organisations that deliver waste to a specific local aggregator or scrap shop. As a result, the collection efforts of so-called first-mile waste collectors that sell their material to other collectors, collection organisations, or middlemen, are oftentimes ignored and therefore not compensated within plastic credit schemes. This disregard of first-mile collectors may particularly take place whenever plastic credit schemes rely upon local waste collection organisations or larger aggregators to distribute the additional funding derived from plastic credits down to local collectors. As long as plastic credit schemes lack income distribution mechanisms to ensure money actually trickles down to these first-mile collectors, they bear the risk of excluding relevant stakeholders at the bottom of the pyramid:

> ***Whenever I hear that organisations are doing something with and for the informal sector, I get the feeling that they have never spoken to stakeholders from the informal waste management, and they have not sat down and understood how this whole system works. That way, implementing plastic credits that appear to give more money and opportunities to the informal sector will not work and the additional income provided will simply not get to them. Instead, someone in the middle will take the cash, keep it for themselves and that money will not reach the people on the ground because there is already a system in place, and you cannot disrupt that system. It is simply too difficult to take the power away from all the middlemen and aggregators that have power over these informal waste collectors. There are around five to ten people between the waste pickers on the ground and the recyclers and they will all claim their share***
>
> **Samanta Skrivere**
> ***Ministry of Waste Indonesia***

2. Dependency on voluntary sources of funding

It is expected that plastic credit schemes will bring potential benefits to the informal waste management sector in the short term after their implementation (see opportunities in chapter 5.2.). However, since plastic credits today constitute a voluntary instrument for their buyers, they do not ensure to bring stable long-term funding to local waste management systems and the informal sector (PREVENT Waste Alliance 2021c).

> ***The danger is that the informal waste collectors will depend on the plastic credits instead of using the plastic credits to strengthen them to become more independent and more self-sufficient.***
>
> **Peter Nitschke**
> ***Plastic Bank***

All benefits created by plastic credits, especially the economic well-being of informal waste management stakeholders but also accompanying benefits in terms of capacity building, training and education are thus highly volatile and may vanish as soon as the buyers of plastic credits decide to spend their funds elsewhere:

> ***Capacity building and economic wellbeing were developed, but the benefits stopped as soon as the funding stopped.***
>
> **Alessa Araiza**
> ***Entre Amigos***

If a company decides to stop buying plastic credits through a particular scheme, informal waste collectors will be directly affected and suffer from the loss of additional income opportunities. Considering the high socioeconomic

vulnerability of many stakeholders involved in the informal waste management sector, it is therefore essential that plastic credits incorporate a long-term and binding perspective. Such a long-term perspective is also crucial for gaining the trust of local communities in plastic credit schemes as well as their buyers:

> ***Once you tell these communities that you want to collect all this plastic waste and you build that network of trust among local collectors, if that is not sustained the next year, it starts to be something that the community lacks trust in.***
>
> **Nik Supatravanij**
> ***Second Life Thailand***

In addition, according to some of the interviewees, the voluntary nature of plastic credit schemes combined with the greenwashing criticism circulating in the current discourse bears the risk of the credits disappearing. With companies potentially deciding to invest their money *"in their own projects as opposed to buying plastic credits"* (Chocat 2022) to avoid any associations with perceived greenwashing activities, plastic credits may lose their potential to bring additional funding to informal waste collectors.

3. Income vulnerability due to quantities-based compensation

So far, the majority of plastic credit schemes has compensated informal waste collectors solely on the plastic waste quantities they have collected, with compensation mechanisms based on working hours spent on waste collection being rare to non-existent on today's plastic credit market. As such, plastic credits so far portray the waste management activities of the informal sector as a commodity trade, instead of acknowledging them as a relevant environmental service and thus paying waste collectors by the hour not by mere quantities collected (UNEP 2015; ValuCred 2021b).

> ***I often work for 10 to 14 hours per day. About 20 regular individual waste collectors bring recyclable materials to my facility to sell. I weigh them, write down data in a notebook, and pay the individual collectors.***
>
> **Ms. Nguyen Ngoc Tiep**
> ***Scrap shop owner in Tien Giang Province, Southern Vietnam***

Being compensated merely on a quantitative basis, as currently the practice, leaves informal waste collectors highly vulnerable in terms of their income streams since waste collection quantities vary significantly. The same holds for the prices of different recovered plastic waste types, which may vary significantly on local markets due to a variety of factors.

The resulting vulnerability particularly refers to women involved in informal waste collection, since men on average may carry more weight of collected plastic waste than women (Global Plastic Action Partnership 2021, p. 26). According to a recent analysis of the plastic waste sector in Ghana that may serve as a relevant reference in the context of this study, the lightweight plastic waste material picked by female waste collectors (mainly LDPE and PET) is less valuable as compared to the plastic waste material picked by male waste collectors (such as HDPE, PP, or PVC) (Global Plastic Action Partnership 2021). According to the analysis, female waste collectors were further limited in the choice of plastic material to collect as a result of a lower access to push carts and tricycles that would make waste collection and transportation more efficient (Global Plastic Action Partnership 2021, p. 26).

Plastic credit schemes should thus consider paying informal waste collectors not only on the quantity collected but also on the working hours spent on their relevant waste management activities. Issuing plastic credits should be considered an environmental service not a commodity trade. This would not only increase income opportunities for women but also for all informal waste collectors from locations where collection is particularly difficult or quantities are low, for example in remote locations, small islands, less populated areas.

According to several of the interviewed experts, the current compensation principles based on collected quantities

furthermore enhance the status quo of only the most valuable plastic waste material types being collected by stakeholders from the informal sector. Shifting compensation schemes to a more service-based paradigm may thus not only bring income stability to informal waste collectors, but also foster the collection of previously unconsidered material types thereby increasing environmental impact of plastic credits.

4. Leaving relevant socioeconomic dimensions unconsidered

The global plastic waste crisis has a significant social dimension, with marine plastic waste residues destroying the livelihoods of local fishing communities, decreasing revenues from tourism in coastal regions, and leading to a number of health threats (Nash 1992; Purba *et al.* 2019; Qiang, Shen and Xie 2019; Landrigan *et al.* 2020; Stanton *et al.* 2020). With their current (over-) emphasis on environmental aspects, plastic credit schemes, however, fail to adequately address this social dimension of the plastic waste crisis and to holistically incorporate a socio-economic perspective (Stanton *et al.* 2020). This refers both to the way plastic credit schemes are systemically set up and operated as well as to the narrative used for their promotion to external stakeholders, including FCMG companies as their main buyers.

With the emphasis on bringing environmental benefits and enabling plastic footprint compensation to buyers, plastic credits run the risk of overlooking relevant social dimensions and long-term socio-economic effects on local communities and participating informal waste management stakeholders.

For example, when interviewed about the socioeconomic impact, representatives from entities involved in the generation and marketing of plastic credits merely refer to the additional income the credits may bring to informal waste collectors. Specific indicators for additional socioeconomic factors such as the effect of plastic credits on waste collectors' education, health and safety digital literacy, or the effects on local waste collectors not participating in the plastic credit scheme seem hardly assessed. In the current set up, plastic credit marketers and other entities may thus not take into consideration the holistic impact of plastic credit schemes on the informal waste management sector in terms of relevant social dimensions. The same holds for today's standards that aim to regulate the generation and exchange of plastic credits but so far *"are not extremely demanding"* in terms of socio-economic criteria (interviewed representative from a plastic credit standard setter 2022).

> ***Social impacts should be at the forefront of plastic collection and recycling projects. You can't improve waste management infrastructure and systems without considering the social impacts.***
>
> **Sinclair Vincent**
> ***Verra***

> ***We work under a small tin roofed yard extended from my old house, so it's extremely hot in the sunny season and leaked with rainwater in the rainy season. There is limited space to operate and store materials. My workers often get slight injuries due to touching sharp metal waste.***
>
> **Ms. Nguyen Ngoc Tiep**
> ***Scrap shop owner in Tien Giang Province, Southern Vietnam***

5. Exclusion of key waste management stakeholders through rigid standardisation

Generally, plastic credit schemes require independent standards that regulate the generation and exchange of plastic credits in accordance with social and environmental criteria. The reality, however, is that the market currently lacks an international and binding agreement on specific standards and criteria, which leads to platforms, marketplaces and other entities that issue plastic credits setting their own standards (for which they may even act as the auditor themselves). The missing independence between plastic credit issuers, standard setters, auditors, and the resulting lack of transparency of the plastic credit market leave significant room for various greenwashing activities (The Circulate Initiative 2021), limit the large-scale adaptation of plastic credits (WWF 2021), and reduce the addi-

tional income opportunities plastic credits may bring to stakeholders from the informal waste management sector.

> *A plastic credit without a standard doesn't have any value as it cannot guarantee transparency, traceability and additionality of its impact.*
>
> **Vincent Kneefel**
> ***Plastic Credit Exchange***

However, according to the conducted interviews, while standardisation is needed, it also bears several risks for the informal waste management sector that may unfold if international standards fail to acknowledge and leave room for regional MSWM system dynamics and particularities. If so, well-intended international plastic credit standards may exclude relevant waste collection organisations and other stakeholders on the ground from participating in plastic credit schemes, thereby limiting their access to additional funding despite carrying out relevant waste management activities:

> *If the plastic credit standard protocols turn rigid, they may exclude many actors that sustain the plastic waste value chain, such as the informal waste collectors and aggregators on the ground. These actors are not aligned to the requirements of the standard guidelines such as quality control, health and safety, environmental impact, registration as a formal collection center, monitoring of inflows and outflows, and record of the waste that is not recycled.*
>
> **Alessa Araiza**
> ***Entre Amigos***

> *Several of the plastic credit standards require the project developer to ensure no human rights abuses – essentially by auditing all of the players in the system and showing that their workers are being paid appropriately and on time, that they have the right access to healthcare and personal protection equipment, etc. The reality is that in most cases this rules out the informal sector from getting plastic credits in the first place.*
>
> **Shannon Bouton**
> ***Delterra***

For example, as the conducted interviews portray, plastic credit standards may demand waste collection organisations on the ground to provide proof that plastic waste material they have collected is properly processed and recycled. However, since many regional MSWM systems in South-East Asia don't even have controlled landfills, waste collection organisations can hardly be held responsible for the lack of proper waste recycling higher up the value chain and should therefore not be excluded from plastic credit schemes solely on this basis:

> *Few landfills in South-East Asia met the requirements we had in our standard. This unfairly burdened the local communities collecting plastic waste who don't have a say in how waste disposal sites are managed. We had to revise the criteria for landfills so that at least in the short term, we're not punishing communities that don't have any other place to take their waste. It's still better for them to remove the waste from the environment and put it into a landfill with a much lower leakage rate than to leave it in the environment.*
>
> **Sinclair Vincent**
> ***Verra***

As long as standards regulating the trade of plastic credits and the participation criteria for informal waste collectors don't incorporate a minimum degree of adaptability to different local MSWM contexts, without disregarding core social and environmental criteria, they bear the risk of excluding organisations and actors that carry out relevant waste management activities on the ground from benefitting from the additional funding. If so, the income from plastic credits may, in fact, flow to larger recycling organisations instead:

> ***The standard setters will set up standards that you have to adhere to without making an investment in infrastructure and skill building of the workforce. Eventually, they [standard setters] may, however, end up going to bigger recycling companies, which are big enterprises organised in the market, and they may get credit from the market to do recycling, even though they rely on the informal supply chain.***

Kabir Arora
Global Alliance of Waste-pickers, India

6. Overburdening due diligence and reporting requirements

Most plastic credit schemes are developed by stakeholders based in countries of the Global North. Additionally, in their external communication, many plastic credit schemes are directed towards the buyers of plastic credits, namely FMCG companies from the Global North aiming to offset their plastic waste footprint. In this sense, some of the interviewed experts from international development and advocacy organisations highlight that, in their initial design and implementation, plastic credit schemes bear the risk of not holistically incorporating the perspectives of stakeholders from the informal waste management sector in the Global South.

This one-sided perspective on plastic credit schemes and the requirements demanded by all parties involved may lead to a variety of challenges unfolding when local waste collection organisations and stakeholders from the informal waste management sector are required to adhere to the due diligence criteria and process steps of international FMCG companies as well as the intermediary marketplaces, standard setters, or auditors. Interviews with stakeholders involved in plastic credit schemes show that required due diligence criteria oftentimes do not reflect the realities of waste collection organisations on the ground.

The perspectives and needs of stakeholders from the informal waste management sector are essential to consider during the development, piloting, and implementation of plastic credit schemes. If excluded, there is a high risk that the schemes will not take into consideration their core needs, and may in turn overburden them with process steps, due diligence criteria, reporting standards and capacity building requirements:

> ***We are talking about workers who may not fully understand the requirements and criteria of monitoring their waste collection activities. Thus, there is a risk of excluding the majority of informal waste collectors, because they won't be able to fulfil these reporting requirements, even if they get more money to carry them out.***
>
> **Sonia Dias**
> ***WIEGO Brazil***

This overburdening may not only cause a feeling of resignation and discouragement in participating waste collection stakeholders and organisations but may in fact deter them from carrying out actual waste collection activities thereby resulting in high opportunity costs. When waste collection activities continuously need make room for due diligence and reporting requirements, for most informal waste collectors this in fact goes hand in hand with declining income opportunities since lower collection quantities equal lower financial compensation. Wherever plastic credit schemes require extensive data reporting from informal waste collectors, these should therefore be compensated for their invested time:

> ***It feels like we are being taken advantage of, because all these organisations and entities are super interested and take a lot of your time, a lot of your resources and a lot of your data and then nothing comes back. So, I think there needs to be a quicker and more immediate exchange of money in return for us providing valuable data to the developers and standard setters of plastic credits.***
>
> **Sean Nino Lotze**
> ***Merah Putih Hijau***

7. Manifesting the status quo

To tackle the global plastic waste crisis and its regional consequences, today's patterns and systems of plastic production, consumption and waste disposal require holistic change towards circularity. By giving companies an easy opportunity for plastic waste compensation without having to adjust their manufacturing processes, supply chains or product design, plastic credits, however, bear the risk of normalizing and manifesting linear systems of production, consumption and waste disposal (The Circulate Initiative 2021; ValuCred 2021a; WWF 2021; GAIA 2022):

> *Plastic credits can normalize patterns of production and consumption of plastic products, as long as the buying companies can claim that they are plastic neutral, and they don't have any incentive to improve the design of their product or to actually take responsibility for the plastic waste.*

Henning Wilts
Wuppertal Institute

> *Plastic credit schemes can enable business as usual, allowing companies to still make environmental claims without actually undertaking significant changes to their own operations.*

Alix Grabowski
WWF

Besides the risk of not incentivising systemic change, plastic credit schemes bear the risk of manifesting the status quo in terms of linear waste management and disposal on the ground and not sufficiently channelling funding to the establishment of more circular waste management and recycling systems (PREVENT Waste Alliance 2021c; WWF 2021). First-mile collection activities constitute a crucial element in the plastic waste value chain and waste collectors from the informal sector carrying out these services should be among the first beneficiaries of the additional income provided through plastic credits. In addition, plastic credits schemes need to make sure investments flow into the local MSWM systems infrastructure and their improvement towards circularity:

> *What is needed are investments in infrastructure coupled with public authority support and coordination in case the system stops. It should be an obligation for companies to invest some of the revenue or the income into long-term infrastructures and it should always be guaranteed that circular systems are in place. In case these systems drop out from the market, they can be taken over by public authorities.*

Henning Wilts
Wuppertal Institute

According to some interviewed experts, wherever plastic credit schemes merely pay local waste collectors for their collected plastic waste material without providing additional capacity building activities, they bear the risk of locking local communities and waste collection stakeholders into dependency on generating a highly vulnerable income from waste collection activities. It is therefore crucial that plastic credit schemes are accompanied by capacity building programs and social security services (WWF 2021; Johnson 2022).

5.2. Identified Opportunities of Plastic Credits for the Informal Waste Management Sector

1. Bringing additional income

One major opportunity plastic credits may bring is (much-needed) short-term funding to MSWM systems in the Global South. Consequently, additional income could trickle down to stakeholders from the informal waste management sector such as informal waste collectors at the lower end of the plastic waste value chain (Bryce 2022):

> *At the moment, there are already informal waste collectors doing this work for a very low wage. Introducing plastic credits would create more demand for their work, which should result in them getting a higher wage if there is no coercion. So you're already having a positive impact on their livelihood even before introducing any sort of education or additional programs that might then come on top.*
>
> **Matthew Gordon**
> ***Yale University***

> *We carried out a social impact assessment in Vietnam on our plastic credit project, and recently published our findings. In the assessment we found that 22% of the survey participants reported more stable lives, and they didn't have to worry about where their next meal would come from. In addition, 13% could now afford daily essentials such as food for their families.*
>
> **Jess Kalisiak**
> ***TONTOTON***

Plastic credit schemes could potentially increase incomes of individual waste collectors and other stakeholders as well as their overall household revenues and health and safety conditions. If implemented correctly, plastic credits have the potential to shift the income of informal waste management stakeholders from being merely based on quantities of collected materials to incorporating a baseline compensation based on the number of working hours spent on waste management activities as well as necessary infrastructure investments.

By supplementing their income, plastic credits may thus significantly contribute to informal waste collectors earning at least living wages, which should be considered a baseline criterion for all plastic credit schemes. With regards to the variety of different poverty line and living wage conceptualisations and the significantly varying income levels they promise, this study builds upon the extensive research conducted by the ValuCred consortium comparing different poverty line concepts with regards to the remuneration of labour within plastic credit schemes (ValuCred 2021b). Based on this research, the authors of this study suggest the regional living wage definitions and compensation levels of the Global Living Wage Coalition (GLWC) as the most viable basis for the compensation of informal waste collectors and other stakeholders within plastic credit schemes (ValuCred 2021b).

2. Improving the role of women in informal waste collection

Despite women being responsible for a great proportion of informal waste collection and recycling in many regional contexts (Dias and Ogando 2015; UNEP 2019a), according to a UNEP blogpost "waste management is not gender neutral" (UNEP 2019a) with inequalities existing in the respective overall society permeating the informal waste management sector:

> ***The [informal] recycling chain is very women-heavy if you look at the total number of livelihoods involved, but the majority of these livelihoods are in the waste sorting and collection bracket. As you move up the value chain, you don't have enterprise owners that are women. Even at scrap shops or aggregation centers, if there are women, they are usually employed only for sorting and they are usually paid a lower wage than men. So, there is an income gap in itself, there is a work difference, and there is definitely a gap in women leadership and ownership as you go up the value chain.***
>
> **Lubna Anantakrishnan**
> ***SWaCH Coop***

According to the conducted interviews as well as to the literature, when developed and implemented under careful consideration of regional and local gender aspects, plastic credit schemes may foster the socioeconomic empowerment of women engaged in informal waste management activities. This holds for both urban as well as rural areas (UNEP 2019a). For example, the distribution of funds generated through plastic credits specifically to women may increase their overall income and therefore their opportunities for independence (UNEP 2019a). It may also have higher effects on the overall living situation of their family and children:

> ***When the money goes to the mother in the family, there is a better use for that money than if it goes to men. From our experience on the ground, women have a different set of needs and responsibilities.***
>
> **Barak Ekshtein**
> ***TONTOTON***

With women significantly carrying out more unpaid work than men (Ferrant, Pesando and Nowacka 2014; Dias and Ogando 2015), women engaged in informal waste management may also particularly benefit from plastic credit schemes that pay waste collectors for the number of working hours instead of merely the quantities of collected waste. Relevant capacity building and trainings that go along with the implementation of plastic credit schemes should always accompany the financial benefits of plastic credits and may further benefit women, e.g., by teaching them relevant technology or accounting skills, which may be of use outside of the scope of plastic credit schemes,

thereby increasing their employment opportunities outside of informal waste management and in more formalized and safe jobs (IETC 2017).

According to some of the interviewees involved in the implementation of plastic credit schemes in South-East Asia, plastic credits may particularly help decrease existing gender inequalities in remote and rural areas where, so far, little to no plastic waste collection is carried out. As plastic credits may serve to incentivise waste collection activities in these areas "from scratch", female representation and participation could be incorporated and ensured from the beginning which may foster a more holistic consideration of the role of women in comparison to existing MSWM systems and dynamics in urban areas where gender roles and differences have manifested over decades.

However, with informal waste management systems formalizing over time (a development which is also fostered by the implementation of plastic credit schemes), women hereby oftentimes benefit less than men with the latter taking over more lucrative and safer formal jobs as they become available during the formalising of plastic waste value chain activities (UNEP 2019a). Plastic credit schemes may therefore incorporate quotas on the involvement of women. However, these should follow the baseline ratio of women involved in informal waste management activities in the region as the following quote vividly illustrates:

> ***As for the demographics in Pune, about 80-90% of waste collectors are women. So, if you have an affirmative hiring to make sure that that ratio is maintained, then that works. But someone may think that a 50/50 quota is enough, but in fact, that would actually be much lower than the percentage of women already involved in the informal waste management sector.***
>
> **Lubna Anantakrishnan**
> ***SWaCH Coop***

3. Giving the informal waste management sector a voice

Historically, waste collection organisations or associations from the informal sector have oftentimes been excluded from the discussion on improving waste management systems in the Global South despite being the key players in carrying out waste management activities on the ground (Gunsilius *et al.* 2011). To some extent, the same holds for today's climate action and sustainability discourse which mainly evolves around crucial environmental aspects, but tends to ignore the effects that sustainability policies may unfold on the livelihoods in the informal waste management sector.

By building upon the crucial work of informal waste collectors and other stakeholders, plastic credits therefore, could bear the opportunity to bring greater visibility and recognition to informal waste management stakeholders and to strengthen their voice in the international sustainability discourse:

> ***Waste pickers recognize that the environment and sustainability domain doesn't necessarily include them. But we recognize that their livelihoods are deeply linked to policy changes and system changes in that domain. So being present in those spaces is critical for advocacy. Now, the "just transition" demand made by some environmental groups is very much saying that plastic should be eliminated, but as part of that, if you have new refill and reuse systems, those should systematically incorporate the waste pickers whose livelihoods will be affected by the elimination of plastics.***
>
> **Lubna Anantakrishnan**
> ***SWaCH Coop***

Thus, by providing a space to engage in the discussion, plastic credit schemes should involve different actors from the informal sector, including waste collectors, scrap shop owners, aggregators, and others to share their expectations of the plastic credits and the social, environmental and economic impact they may unfold. Holistically de-

signed and implemented plastic credit schemes would create an opportunity for waste management stakeholders to be part of the end-to-end processes and therefore strengthen their role and acknowledge their relevant services on the ground. Stakeholder involvement would also ensure the creation of plastic credit schemes where needed the most and increase impact across the plastic waste value chain. According to several interviews with representatives from waste collection organisations, plastic credits could also improve the self-esteem of informal waste collectors.

4. Providing data for better policymaking

For plastic credits to be generated, valorised, and accepted by their buyers, continuous data tracking and reporting is required with regards to the waste quantities and material types being collected on the ground and passed along the plastic waste value chain (see also section 5.3.1. on the role of digital tools in plastic credit schemes). With plastic credit schemes being implemented on the ground, policymakers in countries of the Global South could get access to a significant quantity of additional waste management data as well as information on the crucial role of the informal sector within local MSMW systems, which would allow them to develop better policies and make better decisions:

> ***Plastic credits bring transparency and credibility into the system. This could inform policymakers and could result in sound and efficient public policies. In other words, good data could result in good policies. For instance, in the Indonesian context, the funding of [waste management] infrastructure currently does not necessarily follow specific good practices in terms of stakeholder consultation.***
>
> **Eric Chocat**
> ***Systemiq***

By providing additional as well as more accurate waste management data, plastic credits may thus support MSWM policies that would improve the efficiency of local MSWM systems while fostering the integration and acknowledgement of stakeholders from the informal sector within them. Furthermore, according to some of the interviewed experts, through tracking and reporting a variety of waste management data from on the ground operations, plastic credit schemes may provide relevant baseline data for the establishment of EPR systems in the long run. This refers especially to data regarding the waste material composition in different areas and regions as well as waste flows and potential recycling routes within the local MSWM system.

However, plastic credit schemes need to make sure that informal waste collectors are adequately compensated for their time-consuming data collection, administrative and reporting efforts. Furthermore, plastic credit schemes need to ensure that the data provided is not taken advantage of by third parties, e.g. for the set-up of new private waste management businesses that would compete with local waste collectors and initiatives from the informal sector.

5. Professionalisation of the waste management value chain

Due to the required due diligence and auditing processes and potential capacity building efforts, plastic credit schemes may generally professionalise the waste management activities of informal waste collectors as well as of semi-formal waste collection organisations:

> ***I think that the fundamental effect of a plastic credit is that it should enable professional and formal waste management.***
>
> **Joel Tasche**
> ***CleanHub***

While it must be ensured that these processes and requirements don't overburden waste collectors and organisations involved in plastic credit schemes or exclude relevant waste management stakeholders from participating in general (see sections 5.1.5. and 5.1.6.), they may foster the establishment of transparent management and accounting processes, continuous data tracking and reporting procedures, as well as the adherence to environmental

and social criteria. According to several interviewed experts, plastic credits should ideally foster the professionalisation of waste collectors and other stakeholders from the informal sector involved in waste management activities without inflicting formalisation on them:

> ***The working hours set by a formalized system (about 6 to 8 hours per day) do not necessarily match the lifestyle of informal waste collectors because they may have to look after their family members and just do collection of waste on the side. Professionalization instead of formalization would be more accurate to avoid excluding vulnerable people at the start of the plastics value chain.***
>
> **Zoë Lenkiewicz**
> ***Technical and social global waste specialist***

Furthermore, according to several interviewees, while reporting and due diligence process activities which are oftentimes necessary to participate in plastic credit schemes may be challenging for informal waste collectors at first, required skills in terms of waste monitoring and reporting, digital literacy, adherence to social and environmental standards, and other areas may in the long run help informal waste collectors to "understand their crucial role in the plastic value chain" (Araiza 2022). These relevant capacities may increase the bargaining power of informal waste collectors towards local recyclers and municipalities as well as potential buyers of plastic credits. Bargaining power of informal waste collectors within plastic credit schemes may further be increased through the collectivisation of waste management activities previously carried out individually or by fragmented collectives.

An increasing collectivisation of informal waste collectors and an overall professionalisation of their activities may also increase their acknowledgement within regional MSWM systems, especially by local government bodies and municipal institutions that may increasingly incorporate collectives of informal waste management stakeholders into regional MSWM systems given the professionalisation they have undergone.

6. Bridging the funding gap until EPR systems are in place

If developed and implemented appropriately, plastic credits have the potential to serve as a relevant intermediate solution on the way to the establishment of circular systems and systemic change with regards to MSWM infrastructures in the Global South – a finding not only highlighted by several of the interviewed experts and stakeholders but also frequently mentioned in the existing literature (WWF 2021).

> ***I understand that some people might be critical of plastic credits because they believe it is just another opportunity for greenwashing. But, with independent standards and 3rd party project certification, plastic credits can fill a gap in waste management infrastructure especially in developing countries. Plastic credits therefore offer part of a valuable solution to solving the plastic crisis on the ground on the way to one day transition towards a fully circular system.***
>
> **Vincent Kneefel**
> ***Plastic Credit Exchange***

By bringing short-term investments to local waste management systems, plastic credits may increase capacities in terms of waste collection and recycling and may thereby serve as a relevant funding bridge contributing to the establishment of coherent EPR schemes in the long run (PREVENT Waste Alliance 2022). They could also help improve the living situation of informal waste management stakeholders on a short-term basis until more systemic solutions are in place.

Plastic credits may thus serve as a relevant and flexible interim funding solution until the required legal frameworks for national EPR systems as well as other circular systems are in place and implemented on the ground. Once this point in time has been reached, and the short-term funding provided through plastic credits is no longer needed for bridging the current funding gap, plastic credits may be integrated into EPR systems and overtake additional

steering functions herein (Lee 2021).

> *I don't think that plastic credits will be a competition to EPR. In fact, they should be part of EPR systems, because for me these are overlapping systems that you can plug and play together and merge. For example, how would you incorporate a company's (voluntary) spendings on plastic credits into their (mandatory) EPR activities, if the systems are not connected with each other? I think companies have to find a way of blending these two together for both of them to work.*
>
> **Samanta Skrivere**
> ***Ministry of Waste Indonesia***

To successfully serve as an intermediate and effective short-term funding bridge, plastic credits schemes should be designed and implemented under careful consideration of existing and upcoming EPR efforts in the respective countries of implementation. Most importantly, as outlined in section 2.4., this refers to the prices of plastic credits which must not undermine EPR fees, thereby allowing the buying companies a cheaper option for reducing their plastic footprint and for engaging in waste collection and recycling. The same holds with regards to the voluntary character of plastic credits which bears the risk of undermining the establishment of more mandatory EPR legislations and of companies lobbying against national EPR systems by referring to their involvement in plastic credits.

5.3. Key Areas of Consideration within Plastic Credit Schemes

In addition to the above-mentioned risks and opportunities, four key areas of consideration were identified. These constitute core factors that should be considered during the development and implementation of plastic credit schemes. From each key area of consideration, both potential risks and opportunities may unfold for the informal waste management sector. Thus, a more nuanced reflection of each key area is given below:

1. Considering the role of digital tools

Digital tools are crucial for continuous and transparent reporting and management of operational data such as waste collection, sorting, transport, and treatment data as well as socio-economic data such as living wages, gender, educational background, information, communication and technology (ICT) skills, or access to basic healthcare services. A rigorous use of digital tools for tracking waste collection data along the plastic waste value chain and the subsequent generation of plastic credits may also prevent the risk of double counting within plastic credit schemes:

> ***An important issue to bear in mind will be making sure there is no double counting. In some programs, the same plastic waste may serve for issuing a plastic credit while also being counted toward a recycling commitment by the company that eventually buys that material. Without transparency and traceability, many of the plastic credits proliferating in the market today will not have a rigorous way to track the material and financial flows.***
>
> **Shannon Bouton**
> ***Delterra***

In addition, digital tools may be used for the establishment of anonymous grievance mechanisms through which informal waste collectors could report any issues (such as outstanding payments) with the buyers of plastic credits or the intermediary organisations directly to coordinating organisations, involved standard setters or third-party auditors. Through implementing such grievance mechanisms, digital tools may significantly decrease the vulnerability of informal waste workers involved in plastic credit schemes.

Digital tools may also support the long-term impact assessment of plastic credit schemes by regularly gathering data from waste collectors and other stakeholders via mobile questionnaires investigating the specific extent to which the participation in the respective plastic credit scheme has altered their living situation, income, social recognition, and other relevant social factors which, in today's plastic credit schemes are oftentimes not captured thoroughly.

Despite the numerous advantages of digital tools, a few key factors need to be considered carefully with regards to their use within plastic credit schemes to avoid potential pitfalls and negative effects on informal waste collectors. These refer primarily to the latter's access to technology and digital literacy. If the participation in plastic credit schemes depends on whether informal waste management stakeholders possess or know how to use a smartphone or other digital devices rather than their willingness and potential to acquire digital skills, plastic credit schemes bear the risk of excluding the poorest and most vulnerable stakeholders from additional income opportunities, thereby enhancing local inequalities within the informal sector:

> ***No, I don't have a smartphone. I only have a normal phone that my friend gave me for free. I just keep it in case someone rings me, and I press a button to receive a call. I think I can learn to use a smartphone but there's no opportunity to own one or receive training.***
>
> **Ms. Nguyen Thi Hang**
> ***Informal waste collector from Tien Giang Province, Southern Vietnam***

> *We have this blockchain app where every transaction is recorded, and every waste collector has a profile, and they can see how much they have collected and what will be their rewards. But the problem is that many of them don't have smartphones or don't know how to use them, which makes it very limiting.*

Peter Nitschke
Plastic Bank

The implementing parties thus need to make sure relevant digital tools and devices are provided to waste collectors who are willing to participate in the plastic credit scheme. This must include trainings on how to use relevant devices (such as capacity building in terms of digital literacy), which can be a significant challenge for some stakeholders of the informal sector that may be illiterate. To ensure informal waste management stakeholders will accept and use the foreseen digital tools, as outlined in section 5.2.3., their experiences and needs should be incorporated into the design of each plastic credit scheme including when and how to use which types of digital tools or applications:

> *If you start to introduce a digital system where you're asking waste collectors to plug into it in order to access markets and get paid, then there's a big risk of excluding many of them. So, you have to design the system in such a way that you're thinking about what works in the specific context.*

Andreas Beavor
Urban Emerge

> *I wasn't confident using a smartphone due to my low digital and literacy background. But I was transformed after the ValuCred Testing project. Now I can use an app on my smartphone and I'm more familiar with the smartphone keyboard now.*

Ms. Nguyen Ngoc Tiep
Scrap shop owner in Tien Giang Province, Southern Vietnam

In many regional contexts, stable electricity and Wi-Fi connections may be an additional issue for the continuous use of digital tools. Tools and applications should thus be designed for offline data entries.

2. Environmental considerations

The voluntary nature of plastic credits in their current state not only brings high instability and vulnerability to the potential benefits they may bring to the informal waste management sector, but also leads to a variety of relevant aspects that need to be considered from an environmental standpoint.

As outlined previously in this study, plastic credits offer no guarantee that the buyers, which are mostly FMCG companies, are undertaking primary measures to reduce their overall plastic footprint, alter product design and packaging in a more sustainable way or substitute the use of virgin plastics in the long run. Plastic credits may thus offer a cheaper and easier option for companies to (falsely) claim plastic neutrality§ and promote themselves as environmentally conscious. Therefore, plastic credit schemes need to be designed in close alignment with other, more long-term and systemic measures of reducing companies' plastic footprints and should only be considered and promoted as an additional, last resort solution.

To ensure significant environmental benefits, plastic credit schemes should provide a framework that limits credit purchasing from companies to collection activities that focus on the same types of plastic material the companies primarily bring to the market. For example, compensating the introduction of non-recyclable multi-layered packag-

§ **Disclaimer:** The term "*plastic neutrality*" does not reflect the actual environmental impact of plastic pollution. Therefore, the reader should not compare the term "*plastic neutrality*" to the carbon crediting system since plastic pollution's nature is fundamentally different from CO2 emissions. Yunus Environment Hub does not support this terminology.

ing (MLP) to a market by buying plastic credits from waste collection organisations mainly focussing on easy to collect and recyclable PET or HDPE, for which (informal) collection and recycling infrastructures already exist in many places, should not be possible since it disregards the negative environmental impact of a company's plastic output. Wherever a company's plastic waste output mainly evolves around plastic material types that are already being collected by the informal sector due to their high value on the market (such as PET bottles), plastic credit schemes should incorporate other low-value plastic waste types to foster the collection of previously uncollected waste material with a high environmental impact:

> ***Non-recyclables will always have a very low value in the market, or even a negative value, meaning that the price to recycle is higher than the revenue that the recycler would get from the sale. So, there is a huge question on that and I think it's also where plastic credits will play the biggest role and the best role that they could because there is maximum additionality there.***
>
> **Nik Supatravanij**
> ***Second Life Thailand***

Plastic credits may in fact not only be limited to plastic waste, but instead compensate the collection of other waste types previously uncollected in specific local contexts. Similarly, relevant environmental considerations refer not only to the collection of plastic waste carried out by the informal sector but also to subsequent recycling and disposal activities. As a first step, as outlined by one of the interviewed stakeholders, this may include the collection of potentially hazardous substances such as detergent or paint filled into plastic containers, where informal waste collectors should be compensated for collecting and safely disposing not only the plastic containers but its content as well.

From a merely environmental perspective, the principle of additionality should be incorporated into plastic credit schemes meaning that plastic credits should only be generated for waste quantities and material types that were previously not collected in the respective region. Only when the principle of additionality is applied, plastic credit schemes will facilitate additional positive environmental effects to their contexts of implementation:

> ***PET and PE are already highly targeted and globally traded quite effectively. It is going to be a lost opportunity if the plastic credit schemes are just directed on the things that are already targeted.***
>
> **Dr. Costas Velis**
> ***University of Leeds***

> ***To me, proving additionality is very easy. You attach the plastic credit to certain material types where you know the global collection rates are zero or close to that. And looking at the numbers of which types of plastics end up in the ocean, it's multilayer and it's flexible packaging. 80% of this kind of material is not economically recyclable. And this is why I believe that the plastic credit is needed.***
>
> **Joel Tasche**
> ***CleanHub***

However, from a social perspective, it should be noted that plastic credit schemes may nonetheless significantly improve the livelihoods of informal waste management stakeholders even if the principle of additionality is not applied thoroughly (e.g., by bringing additional sources of income to informal waste collectors for their ongoing collection activities). Whether plastic credit schemes mandate the principle of additionality as a baseline requirement to the entities involved thus needs to be carefully considered within each specific context and cannot be answered categorically.

From an environmental standpoint, next to the principle of additionality, economies of scale in terms of actual plastic waste reduction on the ground are crucial. When assessing and communicating the environmental impact of plastic credits, buying companies as well as selling marketplaces should therefore focus on the actual reduction of waste pollution achieved in the respective regional MSWM context via plastic credits instead of emphasising the quantities of collected plastic waste only. Simple statements about the overall quantities of collected plastic waste material within a plastic credit scheme do not allow for any assessments of the actual environmental impact in the given context (what is the percentage of collected plastic waste quantities in relation to overall plastic waste leakage in the respective region?).

3. Plastic credit pricing considerations

Questions regarding the price of one plastic credit and the methodology behind calculating this price comprise core considerations of each plastic credit scheme. With different national living wage levels as well as different prices for collected plastic waste materials on the national (even regional) market, prices for plastic credits generally need to differ among different contexts. However, while specific prices for plastic credits may differ from country to country, the methodology as well as the criteria used for calculating the price of one plastic credit should be universal and transparent.

With such an internationally accepted methodology or framework determining the value and price of plastic credits still missing, different plastic credit schemes bear the risk of competing each other on the international market. This could result in buyers selecting the cheapest option possible, creating a dangerous raise to the bottom scenario where socio-environmental criteria are increasingly disregarded:

> ***When different plastic credit systems exist in the same market, they start to compete for access to companies that buy plastic credits. As soon they start to compete over the price, they do so by lowering the social, security, and environmental standards.***
>
> **Henning Wilts**
> ***Wuppertal Institute***

> ***That is the problem of plastic credits being set up in a voluntary way: The pressure from the buying companies to make these credits affordable will be very high, otherwise they are not going to purchase them. And this could then result in laxer certification standards, as long as these are not following official policy guidelines or legislation.***
>
> **Matthew Gordon**
> ***Yale University***

As a result, the current lack of standardised price calculation mechanisms may significantly undermine the potential of plastic credits to bring additional funding to the MSWM infrastructure of those regional contexts where respective FMCG companies are most active in and leave the greatest socio-environmental trace of their plastic footprint. The current compensation based on collected quantities furthermore enhances the status quo of only the most valuable plastic waste material types being collected by stakeholders from the informal sector. Shifting compensation schemes to a more service-based paradigm would thus foster the collection of previously unconsidered material types.

When calculating the price of one plastic credit, internationally renowned sustainability frameworks and concepts of labour protection should be incorporated to ensure that the needs of informal waste management stakeholders involved in plastic credit schemes are considered adequately. First and foremost, plastic credit prices need to ensure all stakeholders involved in the respective plastic credit scheme receive at least living wages. Building upon the comparison of different living wage concepts which was recently carried out by Yunus Environment Hub, the authors suggest that plastic credit schemes hereby consider the living wage calculations published by the Global

Living Wage Coalition (GLWC) as these allow for a regional and sector-specific estimation of living wages paid to informal workers (ValuCred 2021b). Besides incorporating national (or even regional) living wage indications, plastic credit prices should further consider national inflation rates to ensure informal waste collectors are compensated adequately.

Second, when distributing the funds generated through selling plastic credits, responsible marketers and other organisations that sell plastic credits to FMCG companies should guarantee that informal waste management stakeholders at the lower end of the plastic waste value chain receive the greatest proportion of a plastic credit's price. Marketplaces, standard setters, auditors, and others should only receive a fraction of the funding brought through plastic credits since it is the informal waste workers on the ground carrying out plastic waste collection and recovery activities.

Third, to significantly decrease the vulnerability of informal waste workers by providing more stable income opportunities to them, plastic credit prices should incorporate a baseline compensation which is based on the working hours spent on waste collection and not merely on the quantities of collected waste as currently the case in most plastic credit schemes. In addition to working hours spent on waste collection activities, the proposed baseline salary should also consider other cost factors of informal waste collectors such as investments in storage or time spent on waste data reporting. Combining a baseline salary with a flexible surplus payment that is based on collected quantities may hereby be a valuable payment mechanism since informal waste collectors are granted living wages without undermining their entrepreneurial freedom and identity as following quote underlines:

> ***When we tried to recruit informal waste collectors, we offered them a fixed salary with social security and health security in a long-term contract. However, almost every single one of them said no. They prefer to be able to work their own hours. I truly believe it's a question of identity and character for them as well as other commitments such as childcare and farming that won't fit around a job with set hours. […] I think they have a mindset of being independent entrepreneurs as opposed to being employees.***
>
> **Eric Chocat**
> ***Systemiq***

Fourth, plastic credit pricing models should be aligned with national EPR systems (if already existing) to avoid any risks of undermining the latter. This alignment of both plastic credit schemes and EPR systems would first and foremost need to make sure plastic credit prices are not cheaper than mandatory EPR fees in order to not offer companies a cheaper opportunity for (voluntarily) financing waste collection activities and fulfilling producers' obligations thereby giving them a reason to lobby against the implementation of more holistic EPR systems.

4. Considering additional employment opportunities in waste management

When discussing the potential opportunities of plastic credits with representatives from entities involved in their generation and sale, the latter frequently highlight the additional employment opportunities that plastic credit schemes may bring to local communities in countries of the Global South:

> ***Around 50% of our current collectors in our plastic credit projects in Cambodia and Vietnam were totally unemployed. They had no source of income and now we work with almost 450 waste collectors who previously weren't collecting that waste.***
>
> **Jess Kalisiak**
> ***TONTOTON***

Especially in rural coastal communities in South-East Asia, where many people depend on income streams from tourism, the introduction of plastic credits provided a significant source of new job opportunities to people that had

previously lost their main sources of income due to the consequences of the COVID-19 pandemic:

> *There are both new and old collectors. So, there are old collectors that have been on these islands before. […] And there were also new collectors that would come on board. For example, during the Covid period, there was a huge shut-down and because of that, especially in the Southern islands where the majority of the economy is tourism-dependent, we saw a lot of people who now came to be collectors, for example former tour guides. So, that's what we saw. Sometimes there were whole new enterprises that were set up.*
>
> **Nik Supatravanij**
> ***Second Life Thailand***

Overall, however, despite the great number of interviews conducted within the scope of this study, no final answer can be made regarding the degree to which plastic credits in fact create additional jobs that are taken over by previously unemployed people from the local community.

Furthermore, in alignment with plastic credits bearing the risk of manifesting the status quo of a linear economy and linear systems of waste production and disposal (see section 5.1.7.), one could argue that the additional funding provided through plastic credits should rather flow into the establishment and improvement of (circular) MSWM infrastructure systems rather than into the creation of additional jobs in informal waste collection at the lowest end of the waste value chain. Whether additional job opportunities constitute an advantage of plastic credits or whether these should rather focus on improving the living situation of informal stakeholders already involved in waste management activities should thus be carefully considered during the development and implementation of plastic credit schemes and can only be answered for each scheme or program individually:

> *There is no decent way of living as a waste picker. You may pay them more money, but can you really give them a proper and dignified life as a waste picker? Such thing doesn't exist. […] Why are we trying to keep on thinking how to keep people where they are, instead of giving them new opportunities. This is why I love programs that work on landfills where these people are upskilled to not be waste pickers anymore. But that is another story.*
>
> **Samanta Skrivere**
> ***Ministry of Waste Indonesia***


6

6. Discussion of Key Findings

With regards to the current discourse on plastic credits and their potential effects (see section 3.), the underlying study helps close the existing research gap that prevails with regards to the risks and opportunities plastic credits may unfold on the informal waste management sector and its stakeholders. While the findings presented above hereby confirm some of the topics already articulated in the existing literature, the study has identified a variety of additional risks and opportunities of plastic credits that are of relevance when considering their impact on the informal waste management sector.

As outlined in section 3., the current discourse on plastic credits mainly evolves around their environmental contribution in terms of incentivising and financing plastic waste collection. Several organisations and authors have underlined the risk for potential greenwashing activities and a lack of more systemic action from plastic credit buyers that result from voluntary nature of plastic credit schemes (The Circulate Initiative 2021; ValuCred 2021b; WWF 2021; PREVENT Waste Alliance 2022). The findings of this study clearly underline that the voluntary nature of plastic credits not only constitutes a risk from an environmental perspective, but is also one of the key risks of plastic credits with regards to their socio-economic effects on informal waste collectors. With plastic credits today constituting merely a voluntary instrument for their buyers, they do not ensure stable long-term income opportunities for waste collectors nor long-term funding to local MSWM systems. All benefits created via plastic credit could quickly vanish as soon as buying companies decide to spend their investment elsewhere, which would first and foremost affect highly vulnerable waste collectors and other stakeholders from the informal sector. From an environmental perspective as well as from a socio-economic perspective, plastic credit schemes thus need to incorporate a long-term and binding perspective.

In addition to the unintended consequences that plastic credit schemes may have on the environment and local communities, as outlined in section 3, several international institutions have emphasized a lack of harmonization and standardisation of the plastic credit market in its current form (Lee 2021; PREVENT Waste Alliance 2021; ValuCred 2021; WWF 2021). While many of the experts and stakeholders interviewed for this study thus underline the need for standardisation of the plastic credit market, the conducted interviews also reveal a variety of potential pitfalls and risks associated with standardisation efforts. These include a potential risk of excluding key stakeholders from the informal sector involved in plastic waste management activities on the ground wherever plastic credit standards do not reflect local waste collection and disposal realities. In addition, as outlined in section 5.1.6., the due diligence and reporting requirements resulting from plastic credit standards may overburden participating informal waste collection stakeholders on the ground. While overall standardisation is urgently needed to bring transparency to today's plastic credit market, this study's findings thus highlight that any standard needs to carefully consider local realities to not exclude or overburden informal waste collectors.

Regarding the potential positive effects of plastic credits, the interviews conducted during this study underline the argument frequently presented in the current discourse that plastic credits may bring additional funding to local MSWM systems in countries of the Global South as well as to waste collectors from the informal sector in particular. However, as outlined by a number of interviewees, when compensating informal waste workers for their collection activities on the ground, plastic credit schemes should move away from today's logic of waste collection as a commodity trade in which collectors are only paid for the waste quantities they have collected no matter the hours they spent on it. Instead, based on the conducted interviews, the authors of this study suggest a compensation mechanism that combines a fixed salary for waste collection services with a flexible premium based on collected quantities.

Other potential opportunities of plastic credits frequently mentioned in today's literature that were confirmed by the findings of this study include the role of plastic credits to function as intermediate funding solution and to bridge the funding gap until EPR systems are in place (PREVENT Waste Alliance 2021c) as well as a potential professionalisation of the informal plastic waste value chain. With its specific focus on the effects of plastic credits for the informal waste management sector, this study has revealed several new potential opportunities that so far that had not received much attention to date. These include the potential to improve the role of women involved in informal waste collection (see section 5.2.2.), the provision of waste management data from on the ground which may help

national policymakers in their decision making (see section 5.2.4.), as well as bringing greater visibility and recognition to informal waste management stakeholders and to strengthen their voice in the international sustainability discourse (see section 5.2.3.).

7

7. Recommendations

Considering the outlined findings with regards to the risks and opportunities of plastic credits for the informal waste management sector, a variety of recommendations can be derived. These recommendations may help practitioners (such as plastic credit marketers, standard setters, and auditors) to gain a holistic socio-environmental perspective when developing and implementing plastic credit schemes and to carefully consider the manifold potential pitfalls and challenges resulting for the informal waste management sector in countries of the Global South.

The recommendations may also serve organisations and institutions from the international development sector to gain a better understanding of plastic credits and their potential effects on the informal waste management sector. As a result, this could enable targeted activities and programs to benefit informal waste collectors and other stakeholders.

In addition, the recommendations may help policymakers and institutions from the public sector on the international, national, and municipal level to play a more active role wherever plastic credits are being generated and traded and to formulate policies and guidelines that ensure that informal waste management stakeholders as well as local MSWM systems benefit from them.

1. Plastic credits should only be used as a complement to a holistic plastic waste reduction strategy

For their buyers, plastic credits cannot and should not replace the elimination of non-recyclable materials and virgin plastic, the introduction of more sustainable supply chains and an increased use of recyclable materials. Since plastic credits only address the collection of plastic waste but, in their current form, have no contribution to preventing future waste, they should only be considered as an instrument that comes after a company's efforts to (first and foremost) avoid the use of plastic in the supply chain and (secondly) substitute virgin plastic with recycled materials.

2. An international plastic waste treaty is needed and may streamline global plastic credit activities

At the United Nation's Environment Assembly in March 2022, member states passed a resolution to end plastic pollution and to forge an international legally binding agreement on plastic waste by 2024. Such a global plastic waste treaty is urgently needed for streamlining global action against the environmental, social, and economic consequences of the plastic waste crisis.

With regards to plastic credits and other private sector-based funding instruments for plastic waste management activities, an international plastic waste treaty can serve as relevant guideline reference, e.g. for setting universal definitions and a common language. The treaty may also serve as a framework for the definition of plastic credit pricing mechanisms as well as underlying social and environmental criteria that need to be considered and may streamline activities of today's voluntary standard setters.

3. Plastic credit schemes need a long-term and binding perspective

The voluntary nature of plastic credits brings high vulnerability and instability to informal waste management stakeholders and MSMW systems benefitting from the additional funding. Plastic credit schemes must not be considered and set-up as short-term "projects" and thus need to be designed according to the principles of EPR schemes and with a long-term and binding perspective.

4. Companies should only be able to buy plastic credits matching their plastic waste output location and material type

International FMCG companies should first and foremost only be able to buy plastic credits that were generated through collection and recycling activities in the same country context where they bring plastic products and packaging into the national market.[¶] Similarly, they should only be able to buy plastic credits that were generated through the collection and recycling of the same plastic waste material they have brought to the market. As a surplus, plastic credit schemes should always incorporate the collection and recycling of low-value plastic waste types to foster the collection of previously uncollected waste material with a high environmental impact such as post-consumer MLP.[**]

5. Plastic credits should bring a three-fold investment to local communities

As opposed to their current set-up, plastic credit schemes should not be understood as short-term funding opportunities for plastic waste collection in countries of the Global South. Instead, they should be understood as a complex financing mechanism that addresses (at least) three different areas in which investments should flow. While the proportions of investments may hereby differ depending on the respective local context and the needs of local MSWM systems and stakeholders, the income generated through plastic credits should focus on:

(1) Investments into local MSWM infrastructures in alignment with existing or upcoming EPR systems and under careful consideration and integration of the informal sector. Next to recycling facilities, this includes the establishment of safe collection and drop off facilities for waste collectors as well as controlled disposal sites and increased possibilities for segregation at source.

(2) Improving the livelihoods and income opportunities of informal waste management stakeholders. Besides providing additional, long-term income opportunities to waste management stakeholders at the lower end of the plastic waste value chain, this also includes the provision of protection equipment.

(3) Building long-term and waste management-independent capacities in local communities. This may include creating awareness on waste separation at source, enhancing (digital) literacy, accounting skills, ICT skills and others.

6. Plastic credit prices need to align with national EPR fees

Prices for plastic credits need to be calculated and set in accordance with national EPR fees to avoid undermining the establishment of EPR schemes by offering FMCG companies a "cheaper way out" and lobby against EPR.

¶ Companies should, however, still be allowed to purchase plastic credits from collection activities in other country contexts, after their plastic credit investments on the national market match their respective national annual plastic waste output.

** Wherever possible, plastic credits should further foster the reintegration of collected plastic waste material into the supply chains of their buyers.

7. Plastic credits should be aligned to national living wages and include a quantity-independent baseline salary

Prices for plastic credits should incorporate national (or even regional) living wages plus country inflation and ensure that all waste management stakeholders receive an adequate compensation for their activities in terms of regionally adjusted living wages. For calculation living wages, indications carried out under the framework of the Global Living Wage Coalition (GLWC) are recommended.

Compensation for informal waste workers should combine a stable income comparable to a baseline salary with a premium for collected quantities rather than only evolving around quantities of collected plastic as currently the case for most plastic credit schemes. While thereby still granting informal waste collectors the freedom to work independently, paying them a stable baseline income would acknowledge their waste collection activities as relevant environmental services within local MSWM systems rather than treating it as a commodity trade.

8. Plastic credit prices should be based on an internationally acknowledged calculation methodology

To avoid different prices and valorisation methods undermining each other as well as relevant socio-environmental criteria and standards in a race to the bottom, the price calculation of plastic credits needs to be carried out in accordance with an internationally acknowledged calculation methodology.

While considering relevant local realities and country-specific indications such as average income, annual inflation, national prices for different plastic material types and other factors, a universal calculation methodology would bring significant standardisation and comparability to the global plastic credit market. Such a universal calculation methodology should also define the quantities of collected plastic waste that make up one plastic credit.

The upcoming global treaty on plastic pollution, which was initiated by the United Nation's Environment Assembly in March 2022, may serve as relevant independent framework defining these price calculation considerations for plastic credits as well as universal criteria for plastic credit standards.

9. Plastic credit schemes need to incorporate the perspective of the informal waste management sector

When developing, piloting and implementing plastic credit schemes, stakeholders from the informal waste management sector must be involved in every step of the development phase, in order to incorporate their perspectives, needs and experiences. This is especially important considering the heterogeneous nature of each MSWM context; implementing organisations and buying companies should not assume that insights or ways of work from one plastic credit scheme can be transferred or are relevant to the next. In specific local contexts, the integration of informal waste management stakeholders may be enhanced through close collaboration with informal waste collector associations and collectives as well as with local NGOs that are familiar with stakeholders and dynamics in the informal sector and may serve as intermediaries between individual waste collectors and organisations higher up the plastic waste value chain.

10. Plastic credit schemes should empower female waste collectors

Female waste collectors should be given a particular role in the development and implementation of plastic credit schemes which may, if incorporated thoroughly, help decrease existing gender inequalities and acknowledge existing waste management activities of women. Quotas regulating the participation of women involved in plastic credit schemes may help ensure gender equality. However, these quotas must reflect the status quo of female involvement in informal waste management activities in the region, e.g. a 50/50 quota is inadequate if actual involvement of women in local waste management activities prior to the establishment of plastic credits has ranged at 80-90%.

Besides reducing existing gender inequalities in waste management by ensuring equal pay to women, plastic credit schemes may also empower female waste collectors via non-financial measures and capacity building opportunities. For example, operating organisations of plastic credit schemes may provide day care facilities for children of female waste collectors. This would not only give female waste collectors more income opportunities but would also prevent them from taking their children with them when collecting waste thereby decreasing health threats to children as well as lowering the probability of young children being involved in waste collection themselves.

11. Informal waste management stakeholders need to be involved in the design of digital tools

Digital tools bring transparency to plastic credit schemes, reduce administrative costs and may decrease the vulnerability of informal waste collectors. However, their specific use should be designed under careful consideration of the realities, skills and needs of local waste management stakeholders to be inclusive and reflecting the realities on the ground.

12. Plastic credit standards need to consider local realities and leave room for adaptability to local MSMW particularities

International standards regulating the generation of plastic credits need to carefully consider the dynamics and stakeholder landscape of local MSWM systems. In order for informal waste collectors and respective organisations to access additional sources of funding and not be excluded from plastic credit schemes, it is critical to ensure the process criteria can be met taking into consideration local realities. Existing plastic credit standards therefore need to leave room for flexibility and adaptation to local MSWM dynamics and particularities.

13. Plastic credit schemes need to consider the social dimension of plastic waste management on the ground

With their current (over-) emphasis on environmental aspects, plastic credit schemes and the parties involved in their operation fail to adequately consider relevant social and human health dimensions of waste management activities carried by informal stakeholders on the ground. While a certain degree of adaptability to local MSWM realities is needed, existing plastic credit standards nonetheless need to more thoroughly incorporate relevant social criteria and health safeguards to ensure that companies can only buy plastic credits from marketplaces or service providers where working (and living) conditions of informal waste collectors are acknowledged and improved over time. This may include the establishment of safe drop off and disposal facilities, the construction of sanitary facilities at waste collection or sites, a regular provision of personal protection equipment as well other measures. In addition to plastic credit standards incorporating more specific social and human health criteria, third-party auditors should track the socio-economic impact of plastic credit schemes on participating informal waste collectors over time.

8

8. Study Limitations and Suggestions for Future Research

The authors of this study have undertaken a variety of measures to ensure high quality results as well as transparency with regards to the data collection and analysis process underlying this study (see also chapter 4). Nonetheless, with regards to the specific research question about risks and opportunities of plastic credits for the informal waste management sector in South-East Asia, several research limitations deserve acknowledgement.

First, the findings presented in this study focus primarily on the effects that plastic credits may unfold on the informal sector in a selected number of countries from South-East Asia, namely: Malaysia, Thailand, Indonesia, the Philippines, Cambodia, and Vietnam. Generally, this study's findings can be expected to be relevant also to other geographical contexts. For example, plastic credits would also increase the income opportunities for local informal waste collectors when implemented in contexts outside the South-East Asian context. Similarly, plastic credit schemes in other regions also bear the risk of not sufficiently channelling the additional funding they bring down to individual waste collectors as well as increasing the latter's' dependency on voluntary sources of funding. However, since this study focused explicitly on South-East Asia, with most interviewed experts and stakeholders being active in this region, the listed findings should only be considered relevant in the given context until validated by future research in other regional contexts.

Second, as outlined in section 4.4, in alignment with the existing literature, this study acknowledges that the informal waste management sector shall not be considered as homogenous research object. In fact, the informal waste management sector and its stakeholder landscape are highly context-sensitive and dynamic. Stakeholder roles and relationships, power dynamics as well as respective waste management activities of different stakeholders may vary significantly not only on the country-level but also from region to region. Any findings regarding the risks and opportunities of plastic credits on the informal waste management sector thus need to be considered in light of significant regional differences. While the authors of this study tried to incorporate a variety of perspectives within each identified opportunity and risk section, they nonetheless acknowledge that local dynamics in specific MSWM systems may, in some cases, paint a different picture. Future research is thus needed to validate and contrast this study's main findings with regards to a variety of different informal waste management systems in different regional contexts.

Third, as outlined in section 3, plastic credits constitute a very recent instrument that may serve for financing waste collection activities in countries of the Global South until EPR systems are in place. Due to the novelty of plastic credits, the extensive literature review conducted as part of this study identified almost no academic papers dealing specifically with the risks and opportunities of plastic credits for the informal waste sector. The same holds for related topics and research questions around plastic credits for which academic literature is comparably scarce. Most publications on plastic credits available to date have been published by organisations active in international development such as WWF, WIEGO or UNEP as well as by initiatives coordinated by national governments and ministries such as the PREVENT Waste Alliance initiated by the German Ministry for Economic Cooperation and Development (BMZ). With little research and data on the given research question available, this study consequently followed an exploratory approach and a qualitative research design more suitable to identify complex patterns rather than causal relationships. In the long run and based on additional qualitative research, future studies may however also analyse the effects of plastic credits via a quantitative research approach (for example with regards to the relationship between plastic credits and income levels of participating waste collectors).

Fourth, with plastic credits constituting a modern-day financing instrument that has only been piloted and implemented by a variety of organisations in recent years, the identification of interview partners constituted one major challenge of this study. With a total of 40 conducted interviews, the authors of this study nonetheless managed to capture a variety of perspectives from different backgrounds and countries on the risks and opportunities that plastic credits may bring to the informal waste management sector. It should be noted, however, that, the number of independent (academic) experts that were able to speak about the potential effects of plastic credits without being involved in their implementation in any sense, was still very limited. This study therefore also incorporates different perspectives of organisations actively involved in plastic credit schemes (e.g. as marketplaces or standard setters).

While the latter provide relevant insights on potential risks and opportunities for the informal sector, they nonetheless bear the risk of being biased in favour of plastic credits and should thus be analysed and interpreted with care. To counter such a potential bias of stakeholders and organisations directly involved in plastic credits, next to the conducted expert interviews, the authors also conducted a variety of interviews with representatives from waste collection organisations and local NGOs which may function as advocates for individual waste collectors and generally expressed a more critical perspective on the effects of plastic credits. Future studies may build on the variety of perspectives combined under the umbrella of this study and may analyse the risks and opportunities of plastic credits from a more specific perspective, for example by only capturing independent experts' and NGOs' opinion on the topic, or only interviewing organisations involved in plastic credits about potential challenges and needs for support.

With this study focussing specifically on the effects of plastic credits on the informal waste management sector and its stakeholders, involved interviewees primarily stemmed from organisations involved in waste management or plastic credit generation activities at the lower end of the plastic waste value chain. Future research may thus cover two additional stakeholder perspectives which are crucial for an effective development and implementation of plastic credit schemes, namely the perspectives of public sector institutions and policy makers, as well as the perspectives of plastic credit buyers (particularly international FMCG companies).

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9. Conclusion

Today, South-East Asia ranks as one of the regions most threatened by plastic pollution, which is putting ecosystems and livelihoods in countries such as Cambodia, Indonesia, the Philippines, Malaysia Thailand, and Vietnam in danger. The reasons for South-East Asia's plastic waste crisis are manifold and by far not only created in the region alone. As such, rapidly increasing figures in terms national production and consumption of plastic products and packaging have equally been met by increasing global plastic waste exports to the region.

With national waste management systems in many local contexts across South-East Asia not being able to hold up to the rapidly increasing plastic waste output, the informal waste management sector is growing increasingly important. Today, informal waste collectors and other stakeholders carrying out crucial waste management activities such as collection, sorting and processing make up between 50 to 100% of waste management activities in many urban areas of the Global South (Talbott 2019). Despite their integral contribution to plastic waste management and resource recovery across South-East Asia, informal waste collectors nonetheless are amongst society's most marginalized groups working under most harmful health conditions with no recognition of their essential services as well as lacking access to sustainable sources of income and basic social services.

With national EPR systems that would bring additional long-term funding to local waste management systems still awaiting their implementation in most countries in South-East Asia, additional financing instruments are thus urgently needed to improve local waste management infrastructure as well as the livelihoods within the informal waste management sector. In this context, plastic credits have recently emerged as a frequently discussed financing approach to plastic waste management. However, while more and more players have been entering the global plastic credit market, research on the various effects of plastic credits is generally scarce and mainly evolving around their potential environmental contribution to the global plastic waste crisis.

Against this backdrop, the underlying study contributes to closing an existing research gap by examining the risks and opportunities that plastic credits may unfold on the informal waste management sector in South-East Asia.

The opportunities that plastic credits may bring to the informal waste management sector presented in this study go far beyond the provision of additional income opportunities. In fact, plastic credits may also improve the role of women in informal waste collection, give the informal waste management sector a voice in the international sustainability discourse, and collect and provide relevant waste management data which may serve for more adequate and inclusive policymaking on the national and municipal level. Furthermore, plastic credits may help professionalise waste management value chains and serve as relevant funding bridge until EPR systems are running effectively in all national contexts.

However, as was vividly illustrated over the course of this study, the implementation of plastic credit schemes also bears a variety of risks for waste collectors and other stakeholders from the informal sector. These include the risk that most of the funding provided through plastic credits is lost during their distribution along the waste value chain before reaching stakeholders from the informal sector. With plastic credit schemes currently merely constituting a voluntary financing mechanism, the resulting dependency of informal waste collectors on a highly instable source of income constitutes another relevant risk. This instability of income opportunities is further fostered by the fact that most plastic credit schemes of today only compensate informal waste collectors based on their collected waste quantities, thereby manifesting waste collection as a commodity trade instead of acknowledging the informal sector's significant environmental services by paying waste collectors a baseline salary.

Furthermore, the specific environmental criteria and requirements of today's plastic credit standards in terms of waste collection, recycling and disposal activities carried out on the ground may exclude stakeholders from the informal sector despite the latter carrying out relevant waste management services. The same holds for the waste data reporting processes and requirements of plastic credits that may pose a significant burden and entry barrier to informal waste collectors thereby excluding them from potentially relevant income sources.

These multiple risks and opportunities identified in this study underline that plastic credits, as a modern-day financ-

ing instrument driven by private-sector engagement, constitute a complex topic. If not developed and implemented under careful consideration, plastic credits may in fact not significantly improve the livelihoods in the informal waste management sector.

Respectively the recommendations outlined in this study may help practitioners to holistically consider the informal waste management sector when developing and implementing plastic credit schemes. They may further enable organisations from the international development sector to gain a better understanding of plastic credits and thereby act in favour of the informal sector. Third, the findings and recommendations presented in this study may enable policy makers from the international to the regional level to play an active role in the set-up of plastic credit schemes to formulate policies that include and benefit the informal waste management sector.

Future research with regards to the manifold effects of plastic credits is needed to ensure that plastic credits in the long run benefit all stakeholders involved in waste management activities in the Global South. The underlying study may hereby serve as baseline and thought-provoking first step in what hopefully will soon become a diverse discourse on plastic credits and their potential role in fighting today's plastic waste crisis.

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Appendix

Annex A: Overview of Key Definitions

(in alphabetical order)

Buyers of Plastic Credits	Organisations and companies that purchase plastic credits to compensate for their own plastic footprint. These include FMCG companies and brands, manufacturers, and others (The Circular Initiative 2021). Government institutions and foundations acting in the international development sphere may also buy plastic credits as means of funding local waste management systems in the Global South.
Informal Waste Collectors	In the context of this study, informal waste collectors are defined as either independent individuals or organized groups, such as waste cooperatives, that recover recyclable materials from streets, public places, waterways, landfills, dumpsites, or disposal sites to earn an income. The great majority of waste collectors does not have formal employment or commercial contracts with municipal institutions or companies. Informal waste collectors constitute the main driver behind plastic waste recovery in the Global South (Velis 2017). Despite carrying out key activities, informal waste collectors belong to the poorest, the most vulnerable, and disadvantaged stakeholders in the waste management value chain. They are often migrants, homeless, sick, old, and unemployed. Some synonyms for informal waste collectors include waste pickers, ragpickers, scavengers, reclaimers, bagerezi, canners, among others.
Informal Waste Sector	Umbrella term for individuals or organisations that are involved in waste management activities but are not sponsored, financed, recognized, or allowed by the local formal solid waste authorities; as well as for stakeholders and collectives of stakeholders that operate in violation of or in competition with formal authorities (UN Habitat 2010).
Marketers	Entities (for-profit or non-profit) that promote or broker the purchase of plastic credits, mainly via online platforms (The Circular Initiative 2021). The online portals oftentimes include general characteristics of local waste collection organisations that are collecting plastic waste such as the name of the project, location, type of plastic collected, available capacity in tonnes, cost per metric tonne, type of clean-up, type of activity, and name of partners involved in the project.
Municipal Solid Waste (MSW)	Includes waste originating from households, commerce and trade, small businesses, office buildings and institutions (UNEP 2019b). The content of MSW differs between different countries, and even between regions and cities. For example, MSW in countries of the Global South generally has a much larger proportion of organic waste than in countries of the Global North (Hoornweg and Bhada-Tata 2012). Respectively, municipal solid waste management (MSWM) as an umbrella term refers to all activities related to the collection, processing, recycling and disposal of MSW. These activities are carried out by a variety of stakeholders such as (informal) waste collectors and collection organisations, formalized waste management businesses, municipalities and municipal institutions, and others.

Plastic Credits	Following the definition provided by WWF, a plastic credit can be understood as a transferable unit representing a specific quantity of plastic that has been collected from the environment (WWF 2021). In exchange for the collection (and recycling) of plastic waste, stakeholders carrying out these collection activities (mainly in countries of the Global South) receive a financial compensation for their services. Respectively, the term plastic credit scheme refers to the overall system underlying the generation, valorisation and transfer of plastic credits within one specific context, including the involved stakeholders and entities, the dynamics among them as well as the process steps to facilitate this trade.
Plastic Footprint	Describes the total output of plastic waste of a company (or individual consumer) over a given period of time. For companies, the plastic footprint can be indicated as a global measure or on a national level (indicating total plastic waste output on one specific national market).
Waste Aggregators, Brokers, Middlemen	Umbrella terms for informal to semi-formal stakeholders and entities, usually informal organisations or small businesses. Mainly involved in recovery of valuable waste components such as metal or certain plastic waste material, they operate as intermediaries between informal waste collectors and formalized recycling businesses. Paying informal waste collectors and waste cooperatives as well as community-based organisations for their waste in terms of weight, they aggregate and manually pre-sort waste which is then collected by recycling companies or other buyers in larger quantities.

Annex B: Overview of Interviewees

(in alphabetical order)

No.	Institution	Interviewee	Geographical area of expertise
1	CleanHub	Joel Tasche	International
2	ClimeCo	Chris Parker	International
3	Delterra	Shannon Bouton	Indonesia
4	Entre Amigos	Alessa Araiza	Mexico
5	Global Alliance of Waste-pickers	Kabir Arora	International
6	Independent waste collector in Tien Giang Province, Southern Vietnam	Nguyen Thi Hang	Vietnam
7	Independent waste collector in Tien Giang Province, Southern Vietnam	Phan Van No	Vietnam
8	Informal scrap shop owner in Tien Giang Province, Southern Vietnam	Nguyen Ngoc Tiep	Vietnam
9	International Solid Waste Association - ISWA	Aditi Ramola	International
10	International waste management consulting organisation	Waste management expert who asked to remain anonymous	International
11	Jan & Oscar Foundation	Capucine Paour	Thailand
12	Jan & Oscar Foundation	Michael Pardos	Thailand
13	Lagom Vietnam	Le Thong	Vietnam
14	Malaysian nonprofit organisation	Program manager involved who asked to remain anonymous	Malaysia
15	Merah Putih Hijau - MPH	Sean Nino	Indonesia
16	Ministry of Environment - Nigeria	Dorathy Ukemezia	Nigeria
17	Ministry of Waste Indonesia	Samanta Skrivere	Indonesia
18	MyNEF	Hamdi Mokhtar	Malaysia
19	Plastic Bank	Peter Nitschke	Indonesia; Philippines
20	Plastic Credit Exchange	Vincent Kneifel	International
21	Plastic People	Nestor Catalan	Vietnam
22	PYXERA Global	James George	International
23	Quantis	Laura Peano	International

24	Second Life Plastics	Nik Supatravanij	Thailand
25	Seven Clean Seas	Tom Peacock-Nazil	Indonesia
26	Seven Clean Seas	Siti Kusmiati	Indonesia
27	Sinba Peru	Pipo Reiser	Peru
28	SWaCH	Lubna Anantakrishnan	India
29	SYSTEMIQ	Eric Chocat	International
30	Technical and social global waste specialist	Zoë Lenkiewicz	International
31	TONTOTON	Barak Ekshtein	Vietnam; Cambodia
32	TONTOTON	Jess Kalisiak	Vietnam; Cambodia
33	University of Leeds	Costas Velis	International
34	Urban Emerge	Andreas Beavor	International
35	Verra	Sinclair Vincent	International
36	WasteBazaar Ltd	Victor Amusa	Nigeria
37	Women in Informal Employment: Globalizing and Organizing - WIEGO	Sonia Dias	International
38	World Wildlife Fund - WWF	Alix Grabowski	International
39	Wuppertal Institute	Henning Wilts	International
40	Yale University	Matthew Gordon	International
41	Zero Plastic Oceans	Vincent Decap	International

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