IKHAPP
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Inclusion of the Informal Recycling Sector in a Global Agreement on Plastic Pollution

WORKING PAPER #1

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ABOUT IKHAPP

The International Knowledge Hub Against Plastic Pollution (IKHAPP) is an initiative driven by an international community of scientists who recognize the crucial role that data and knowledge play in addressing plastic pollution. IKHAPP's mission is to collect, critically review, and disseminate existing scientific knowledge to decision-makers and society worldwide, sharing research on the drivers, sources, and impacts of plastic pollution along with policies, measures, and technologies to effectively address them.

The Knowledge Hub brings a community of scientists together to critically analyse peer-reviewed research and produce publications including working papers, policy and research briefs, syntheses and reports on relevant current events. IKHAPP includes an open library of relevant scientific publications, national and international policy documents, and selected grey literature. The IKHAPP website also hosts interactive tools that can be used to model and track flows of plastic and plastic waste through value chains and the environment.

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1. Introduction

Plastic pollution has become a defining feature of the modern age, and a threat to human and environmental wellbeing. During the past seven decades, more than eight billion tonnes of plastic have been produced.[1] An estimated 79 per cent has been dumped into the environment or landfills, with another 12 per cent burned and only 9 per cent recycled.[2] Unsustainable disposal is likely to continue as plastic production accelerates. Macroplastics and microplastics enter the marine and terrestrial environments worldwide, harming animals and affecting the health, productivity, and biodiversity of ecosystems from oceans to agricultural soils. This also has economic consequences: Marine plastic pollution alone could potentially cause global ecosystem services losses of tens of thousands of dollars (USD) per tonne, adding up to an annual loss of benefits from marine ecosystem services valued up to $2500 billion dollars (USD).[3] Crucially, it hurts the health and quality of life of people in areas that are overburdened by mismanaged plastics; these are often vulnerable groups in low- and middle-income countries in the Global South.

The forthcoming legally binding global agreement on plastic pollution, initiated by the United Nations Environment Assembly (UNEA) resolution on 2nd March 2022,[4] will need to cover the entirety of plastic products' life cycle around the world. This requires pollution-preventing interventions at every stage of plastics' journeys, from design and manufacturing to use and disposal. Waste management needs and systems vary widely across countries and regions, calling for a treaty that facilitates national and local-level policies and initiatives alongside global actions.

The informal recycling sector (IRS) is a crucial part of global waste management systems, and the plastic treaty must reflect the informal workers' central role. The informal recycling sector is a waste collection and processing ecosystem made up of individuals and small enterprises that are not officially recognized or employed in public or private waste management services. It commonly includes waste pickers that collect and sort discarded materials, along with small scrap shops and material recovery facilities that handle and process these materials. The IRS often operates critical waste management infrastructure, particularly in economically developing countries and the Global South, but is often overlooked or excluded in official policies.[5] This perpetuates the social and economic injustices that informal workers experience, and fails to take into account a fundamental pillar of global waste management.

Effective waste management policies – including the global plastic treaty and private sector schemes – must include IRS workers in their development and implementation, and provide opportunities to improve informal workers' living and working conditions. The informal recycling sector has deep and valuable knowledge of the day-to-day realities of waste management in their areas of operation. Policies cannot be properly developed and implemented without understanding the full ecosystem in which they will be deployed – and, at worst, out-of-touch policies can worsen the lives of informal workers. True inclusion of the IRS, considering the possibility of legally formalizing the sector, would facilitate informal workers organizing to have a voice and negotiating power in matters that affect them. It would aim to provide them with social stability, a reliable income, labour rights and health protections – which they currently lack – and overall reduce their socioeconomic vulnerabilities. IRS inclusion can simultaneously enable effective policy implementation and promote equity.

IRS inclusion faces major challenges such as data and knowledge gaps, but an increasing number of research initiatives and policy case studies provide insights. India is a hub of informal sector activity and innovation, and provides several such initiatives and example within politics, research and civil society. The Indian government has instituted several Extended Producer Responsibility scheme regulations.[6] While data-driven researchers at Kabadiwalla Connect[7] (a waste management organization providing decentralised waste collection and processing solutions for cities in the developing world) have mapped an informal sector supply chain, academic researchers at the University of Leeds are developing detailed modelling tools and analytical frameworks.[8] Informal workers

themselves have spoken about their experiences through coalition organizations like The Alliance of Indian Waste Pickers.[9] And the informal sector as a whole is involved in the international environmental treaty and initiatives such as The Minamata Convention on Mercury and Global Mercury Partnership.[10]

Discussions surrounding the UNEA agreement on plastic pollution should reflect the important reality that it cannot succeed without involving the informal recycling sector. As such, this working paper maps perspectives and recommendations from stakeholders in several different sectors. It brings forward knowledge from the informal recycling sector, thereby spotlighting India, as well as researchers and international policy development experts. The paper is based on the presentations and discussions that emerged during the webinar "Important but ignored? The role of the informal recycling sector in a prospective international agreement on plastic pollution" facilitated by IKHAPP on 2nd December 2021.[11]

2. A global agreement on plastic pollution: Objectives and opportunities

This text was developed based on the presentation by Erlend Draget, Senior Advisor at the Norwegian Ministry of Climate and Environment.

Current measures to prevent plastic pollution are not sufficient. Getting plastic waste mismanagement under control will require a legally binding global agreement. Plastic production is expected to double over the next 20 years,[12] contributing significantly to plastic waste leaking into the oceans. The world is on track to nearly triple the annual amounts by 2040, according to predictions from the Pew Research Center, [13] further overburdening waste management systems that are already unable to keep up with the present level of consumption and disposal. Existing national policy instruments, voluntary initiatives, and private sector commitments don't prove sufficient either to tackle this imbalance, as they would currently reduce plastic leakage into the oceans by only 7 per cent annually.[14] To successfully combat plastic pollution, it needs to be recognised as a global problem, hence solving it requires a collective commitment to a global solution.

The plastic policy landscape has been rapidly evolving across all decision-making levels over the past decade, moving in a promising direction.[15] The United Nations Environment Programme (UNEP)'s first session of the UN Environment Assembly (UNEA), held in 2014, has been instrumental in elevating the issue of plastic pollution to its current place on the global environmental policy-making agenda.[16] A 2017 UNEP report drew attention to gaps in existing international, regional, and sub-regional governance strategies targeted at addressing marine plastic litter and microplastics.[17] It pointed to a lack of interventions preventing pollution across the entire life-cycle of plastics, with an insufficient focus on upstream and midstream measures designed to mitigate plastic waste in earlier stages of its generation and disposal. Land-based sources of marine pollution were found to be largely unaddressed through existing mechanisms, chemical additives were only partially addressed, and microplastics were not addressed at all.[18] Many of these gaps persist, but decision makers are increasingly willing to fill them. In total, five resolutions regarding microplastics and marine litter have been adopted since the first UNEA.[19] The most recent resolution, adopted during UNEA's fifth session in March 2022, is by far the strongest. "End Plastic Pollution: Towards an International Legally Binding Agreement" declares UNEA's intention to begin negotiating a global plastic treaty with a full life-cycle approach.[20]

A global plastic treaty could establish international and national frameworks to reduce, sustainably manage, track, and assess waste generation at every step in the cradle-to-grave journeys of plastic products. The agreement, tasked with addressing a staggeringly large-scale problem with a wide-ranging scope, will need to identify high-priority focus areas and develop plans to target them. The life-cycle approach requires this to occur at all points along plastic product value chains, including manufacturing, processing, usage, and end-of-life management. The Nordic Council of Ministers reports that "possible elements of a new global agreement to prevent plastic pollution" proposes aims such as the elimination of problematic and avoidable plastic products, sustainable management of essential plastic products, and chemical hazard reduction.[21] The report also suggests measures such as implementation mechanisms, institutional arrangements, progress assessment, education, program funding, and capacity building. Globally coordinated actions will be broad, requiring more detailed and localized approaches. Against this backdrop, a widely suggested strategy involves individual countries developing and implementing National Action Plans within the global treaty. A potential model can already be found in Norway's national plastic strategy, announced in August 2021.[22] All in all, an ideal treaty framework will be adaptable, allowing strategies to evolve and strengthen over time as their effectiveness is assessed and new data is found.

A well-designed global plastic treaty could provide important tools and benefits to governments, particularly in countries with emerging economies, and industries. A robust framework including both global standards and

national action plans could give national governments tools to regulate domestic markets, ensure transparency across the value chain of products, and develop partnerships with industry. The plastics industry could receive guidance on objectives and criteria for sustainability, confidence in competitive opportunities that are fair and transparent, and a reduction of costs. Additionally, global coordination of product life-cycle could create economic incentives for businesses to make more sustainable products. Developing countries could receive financial assistance and support for capacity building to facilitate the development and implementation of their National Action Plans, including regulatory tools and market-based instruments. A successful treaty implementation could reduce the financial and physical burden of waste management, particularly in economically developing countries. It would contribute to a harmonization of global reporting and monitoring regarding plastic pollution thus allowing for progress assessment and providing valuable data that is currently lacking. There are many data gaps and uncertainties regarding national and global material flows of plastic, which limits governments' ability to target their actions and prevents them from implementing more stringent measures.

The treaty must ensure a just transition for the informal sector, which is a crucial part of a circular plastics economy. Circular material flows will be established through significant systemic changes worldwide, which will require the involvement of the informal recycling sector. It is crucial for IRS workers to be included in this process in a way that is fair and reflects their importance in achieving this global goal.

3. Establishing the role of the informal sector in a circular plastic economy: Challenges and research advances

This text was developed based on the presentation by Dr. Costas Velis, academic at the University of Leeds.

The informal recycling sector contributes substantially to prevention and mitigation of pollution, facilitating a circular economy by salvaging after-use materials such as plastics. It is difficult to obtain definitive numbers on the IRS due to data gaps, but preliminary assessment by the Royal Academy of Engineering estimated conservatively that 11 million waste pickers worldwide currently recover approximately 90 million metric tonnes (mt) of waste annually – 58 per cent of all plastic waste collected for recycling.[23] The IRS serves many important functions in waste management ecosystems ranging from cities to informal settlements in the Global South (regions of Latin America, Africa, Asia and Oceania), such as collecting and sorting materials. The extent to which the world relies on the IRS suggests a need to actively involve waste pickers, and other informal sector workers when mitigating global plastic pollution and establishing a circular economy. The high level approach to enable the IRS to prevent plastic pollution should be formulated around: (1). Expanding and improve IRS collection; (2) Improving revenue from recycled materials; and, (3 Improving materials quality.[24]

The IRS faces many challenges, including a lack of external support and numerous vulnerabilities. The participation of IRS actors in a circular economy is limited due to resource deficits and a lack of formal organization. Without external financial support, they can, at best, capture and process only the small fraction of recyclables that offer a sufficient profit margin.[25] IRS workers suffer from social vulnerabilities, along with health and safety issues coming from dealing with waste and hazardous substances. Waste pickers experience the biggest threats, as they have the most exposure to toxic materials. These impacts are most strongly borne by women and children.[26] Open burning of plastics is a major source of hazardous exposure for workers in the IRS, and comes with severely damaging environmental impacts. Inclusion of the IRS could alleviate some of these challenges, but is hindered by decision makers and authorities that miss to take the informal sector into account. This ignorance stems from a lack of awareness and education on the IRS's role in waste management systems. However, with proper consideration of the importance of IRS workers and their activities, the global plastics treaty has the opportunity to address these adverse conditions and bolster the informal sector's capacity through evidence-based policy-making and action.

Quantification of the informal recycling sector's activities is crucial to facilitate IRS inclusion, but requires closing significant data gaps. The IRS's role in preventing plastic pollution cannot be properly reflected on global agendas without having reliable data to work with. A lack of data makes it difficult to incorporate the IRS into international agreements such as the global plastic treaty, or to help informal sector workers scale up their pollution prevention work through efforts to improve their working conditions, provide them with higher profits for plastic recovery and recycling work, and expand their capacity to process difficult materials. Successful incorporation requires an understanding of the role of waste pickers and recyclers in the plastic value chain and systems of material flow as part of a complex ecosystem. However, limited documentation of the informal sector's activities poses a barrier to quantifying the movement and management of plastic and associated pollutants. This is particularly true for the informal collection and sorting of materials, largely done by waste pickers. Obtaining this information will require further research. To yield high-quality data, studies on IRS activities must be systematic, methodologically robust, and independent from individual stakeholder agendas.

Modelling tools and analytical frameworks are being developed to fill the gaps. Modelling tools that are being used to detail both formal and informal waste systems are increasing in number and complexity. These

tools provide further understanding, as they are used to analyze data and offer insights into the IRS' role in recycling systems in cities worldwide. Four such tools have been co-developed at the University of Leeds. The Spatio-temporal quantification of Plastic pollution Origins and Transportation (SPOT) model[27] is a geographic information system (GIS) tool that models plastic pollution hotspots, linking them to sources and pathways. The P_20 model[28] analyzes plastic pollution stocks and flows; The Waste Flow Diagram (WFD)[29] uses rapid assessment to map cities' waste flows and plastic leakage; and the Plastic Pollution Calculator[30] by the International Solid Waste Association (ISWA), which combines analysis of solid waste management systems with local external factors. Other tools include the 'Wasteaware' benchmark indicators set,[31] which allows measurement and comparison of cities' waste management performance; the Integration Radar (InteRa) analytical framework,[32] with studies that demonstrate how to improve IRS integration and inclusion while resolving ongoing problems that workers experience; and the Solidary Selective Collection of Solid Waste (SoCo) Tool,[33] which performs cost-benefit analysis for inclusive recycling.

There are many actions the international community can take to support the informal sector's work, including integrating the IRS into the global plastic treaty. Researchers and IRS experts at the University of Leeds, using insights gained from their modelling and analytical tools, have developed both overarching and treaty-specific agendas.[34] They propose six "Action and Evidence Needs" – research initiatives and data-driven interventions that are particularly crucial in tackling large-scale plastic pollution and the problems the IRS faces while dealing with it. These include implementing standardized and detailed reporting methods; establishing a global observatory to facilitate the design of targeted interventions; performing global burden of disease studies; conducting actionable research that allows for solutions to be managed on a local level; linking epidemiological observations to risk exposure evidence; and instituting inclusion empowerment interventions with systemic risk mitigation. Their goals for a global plastic treaty that involves the informal sector as part of the solution include reducing the evidence gap surrounding the IRS's role by quantifying their contribution to waste management; enabling them to handle plastic materials that are harder to collect; supporting informal workers' livelihoods and improvements to their health conditions; boosting circularity in the economy; and allowing for solutions that provide multilateral wins across sectors and stakeholders. They emphasized that all interventions regarding the informal sector must be evidence-based, transparent, and must avoid oversimplifying complicated issues.

It is imperative for decision-makers to understand the necessity of including IRS when establishing a circular plastic economy – and the extent to which informal workers could benefit from an inclusive treaty. Gathering and sharing sufficient data on the informal recycling sector and their role in global material flows must be an early and ongoing step in the process. Researchers are making this aspiration a reality by increasingly performing studies and developing tools.

4. The importance of data within an ecosystem approach to the informal sector: Insights from India

This text was developed based on a presentation by Siddharth Hande, Founder and CEO of Kabadiwalla Connect, with input from the presenter.

Understanding the local informal recycling supply chain, including waste pickers and scrap dealers, is a key component of effective urban waste management. Waste management is an expensive undertaking. It can consume between 20-50 per cent of the total budget of municipalities in developing countries and cities.[35] The informal supply chain's decentralized infrastructure positions it to help solve material collection and segregation issues faced by traditional waste management systems. Institutionalizing the successful aspects of the informal recycling system can enhance the efficiency of waste collection, producing tremendous economic benefits – including cost savings – for municipal bodies. The informal sector already operates as crucial infrastructure for many cities and informal settlements in the Global South. However, this informality puts IRS workers at risk: they lack social protection and legal rights to safe working conditions, forcing many workers to sacrifice their health to make an income. Smart integration of the informal supply chain could fully tap its potential as part of urban waste management systems, while providing IRS workers with stability and safety protections.

Data on the informal recycling sector is crucial in efforts to improve their working conditions and quality of life, but is often lacking. Policy making that affects the IRS must be science-driven, but current data – and the scale of efforts to acquire them – have not been sufficient to properly inform large-scale interventions. Most studies focusing on waste pickers have excluded important parts of the ecosystem surrounding them, such as small neighbourhood scrap shops, informal trading points, and larger informal recycling facilities. This is due in part to uncertainties regarding the different players in the informal supply chain, unclear definitions of their roles, and a lack of academic consensus regarding terminology used to refer to them. Despite these difficulties, a research-driven approach is particularly important given some defining attributes of the informal sector. It is a competitive environment in which minute values are sourced, extracted and traded. Institutional attempts to improve living conditions of IRS workers and their quality of health, increase their workplace safety, and achieve better environmental outcomes must consider this economic context.

The informal recycling sector in India is large, relatively efficient, but undercompensated. There are probably around 1.5 million waste pickers in India,[36] collecting and handling about 20 per cent of recyclable materials in the country.[37] Approximately 30-60 per cent of the paper waste, 50-70 per cent of the plastic waste, and almost 100 per cent of glass waste is recovered by the informal sector.[38] The informal sector saves the average municipality 24,500 INR (approx. USD $300) per ton of waste.[39] Despite this, informal workers work and live in precarious conditions and earn less than INR 300 per day (less than USD $4).[40]

Kabadiwalla Connect, an Indian waste management company, has been researching the informal sector to fill knowledge gaps. A study by Kabadiwalla Connect has mapped the informal recycling supply chain in Chennai (Tamil Nadu, India), classifying a total of 2500 informal sector stakeholders in terms of their functions and creating an overview of the system.[41] The study identified three typologies: Level-0 aggregators, the waste pickers (L0); Level-1 aggregators, the small scrap shops (L1); and Level-2 aggregators, the material recovery facilities (L2). Some L2 facilities were performing pre-processing for formal sector processors and recyclers that purchase materials from L1s and L2s to convert into usable raw materials for the manufacturing industry. The prices at which the materials were sold up the chain increased at each level. Chennai's informal sector was found

to be responsible for sourcing back about 130,000 tons of waste per year – 24 per cent of the 542,000 tons per year generated by the municipality – resulting in significant cost savings for its government.[42] The supply chain patterns identified in Chennai can potentially provide transferrable knowledge to other places, particularly in the Global South.

Kabadiwalla Connect used the study results to develop recommendations for potential informal supply chain formalization and integration. The recommendations state that any proposed pathway should start with enumeration which includes collecting data on informal sector operations and infrastructure to be used in properly crafting an integration plan. They stress the importance of creating social protections for informal workers, such as providing them with health insurance and a steady income. Their methods pair digitalized procurement, which involves increasing material traceability, alongside investments into site and labour compliance to facilitate worker safety. They also advocate for dignified collection, with a streamlined system that will allow waste pickers and small scrap shops to collect municipal waste directly from households instead of toxic dump sites.

To successfully address plastic pollution, policy-making must be driven by data on individual waste management ecosystems. Decision-makers must increase their knowledge of national and local-level value chains, informal sector operations, and locally appropriate recycling solutions. This is particularly true given the current movement towards adopting a circular economy approach for tackling pollution and to fully close material loops, policy-makers must understand every part of the ecosystem that determines the handling of the materials.

5. Informal recycling sector agency in Extended Producer Responsibility schemes and policies: Experiences and needs of waste pickers in India

This text was developed based on a presentation by Kabir (Qabeer Jalandhari) Arora, National Coordinator at The Alliance of Indian Waste Pickers, and supplemented by written contributions from the presenter.

Extended Producer Responsibility (EPR) schemes, an important tool for tackling plastic pollution, must fit into both a complex policy landscape and the day-to-day realities of waste management. The informal sector can help decision-makers achieve this. The IRS, as an integral part of waste management ecosystems, has deep knowledge of its local system's workings. It can identify issues that need to be addressed, and places where government or private sector measures fall short. Inclusion of informal sector workers in finding solution can help bring policies in line with reality, from individual EPR schemes to the global plastic treaty.

In India, waste picker organizations and development agencies are collaborating with businesses to address challenges in managing multi-layer plastics (MLP). The informal sector faces significant issues in recycling MLP, which is widely used as single-use packaging for fast-moving consumer goods (FMCG) such as food, household goods, and cosmetics.[43] IRS experiences difficulties in sorting MLP materials and separating plastic layers. The sector lacks incentives as MLPs have a very low value, faces capacity limits due to high treatment costs for this waste. In addition, not enough processing plants are able to absorb MLPs.[44] One such program is a MLP collection and recycling system launched in Pune by a major FMCG company ITC Limited and SWaCH, India's first wholly owned cooperative of self-employed waste pickers.[45] The UN Development Program (UNDP) is also working with FMCG companies to manage plastic waste in India.[46] These partnerships reflect growing recognition within the private sector that the informal sector brings cutting-edge knowledge and a cornerstone position in plastic waste management systems and the supply chain,[47] and hold the potential to facilitate the incorporation of the IRS in EPR scheme design.[48]

The Extended Producer Responsibility (EPR) scheme policy in India has evolved rapidly over the past decade, but has fallen short for informal sector workers.[49] EPR schemes were respectively introduced and cemented as a policy approach to waste management by two pieces of legislation from the Indian Ministry of Environment, Forest and Climate Change: "Plastic Waste (Management & Handling) Rules"[50] from 2011 and "Plastic Waste Management Rules" from 2016.[51] The ministry released a "Uniform Framework for Extended Producer Responsibility" for public comment in June 2020,[52] and published a draft notification for the final EPR regulations in February 2022.[53] Despite these documents, there is a need for further clarification of the "norms of the game", and uncertainties persist around how EPR policies by the government will impact current informal systems. Waste pickers still do not receive fair remuneration to compensate them for their work and cover their expenses. Waste picker organizations have asserted that these government frameworks are out of touch with the realities of plastic waste management across the country – something they experience first-hand. This discrepancy impedes the government's ability to properly implement these policies.

Government engagement with the informal recycling sector doesn't always lead to satisfactory policy outcomes for the IRS. Despite the government and National Institute for Urban Affairs (NIUA) including waste picker organizations in the process of framing the 2021 draft EPR regulations, informal sector workers have voiced disappointment with the results. The final regulations legally require producers to work only with waste management entities registered with the Central Pollution Control Board, and only permits registered entities to

operate – which excludes the informal sector, and potentially illegalizes the informal recycling work.[54] This could ultimately put informal sector workers at risk of exploitation or loss of livelihood. Additionally, a certain discourse around EPR schemes can divert attention from low-value but high-concern MLPs by concentrating on high-value and easily-processed plastics that are already being effectively recycled.

Waste pickers are speaking out with "key demands" for decision-makers. They stress the need for mandatory EPR schemes with government involvement, as voluntary systems can't handle the current scale of the challenge, and ensuring EPR schemes and policies are co-designed with waste picker organizations and informal sector workers. They advocate a holistic approach to the informal waste management ecosystem, in which the collection, transportation, and processing of plastic waste includes all IRS workers and provides them with fair remuneration for their work. They request infrastructure investment, dissemination of knowledge to IRS workers about the toxicity of certain waste materials and protective measures, and standardized settings in which the informal sector can interact with decision-makers on EPR related issues.[55] They ask for research into the IRS's role and scale of involvement in plastic waste management, EPR schemes in particular, culminating in a status report. They also want international entities to engage with waste picker organizations to understand the status of the informal sector's integration in EPR systems, their aspirations, and ways they can be included in the global plastics treaty and guide discourse on it.

Policy frameworks that are not designed and implemented with strong and ongoing IRS participation have a lower chance of success, but pathways for inclusion are present. EPR schemes co-designed with waste pickers, past IRS consultations in legislation development, and public demands by waste picker organizations can provide treaty negotiators with building blocks – if they are willing to use them.

6. Incorporating an informal sector in a multilateral environmental agreement: Strategies from the Minamata Convention on Mercury

This text was developed based on a presentation by Marianne Bailey, Programme Management Officer in the Secretariat of the Minamata Convention on Mercury, United Nations Environment Program, and supplemented by written contributions from the presenter.

Including the informal sector in the development and implementation of the global plastic treaty will be a complex process. Decision-makers could look to the Minamata Convention on Mercury as a case study. The Minamata Convention, a legally-binding United Nations treaty, provides an evolving example of an international environmental agreement that specifically involves the informal artisanal and small-scale gold mining (ASGM) sector.[56] The parallels between the ASGM sector and informal recycling sector, and how Minamata Convention strategies might theoretically be applied to the plastic treaty, can be of interest in the development of the plastics instrument.

The Minamata Convention on Mercury incorporates an informal sector by grounding a multilateral environmental agreement in research. The Minamata Convention, adopted in 2013 and entered into force in 2017, was developed by UNEP in response to adverse human health and environmental effects as a result of mercury use and emissions. Artisanal and small-scale gold mining (ASGM), defined in the Convention as "gold mining conducted by individual miners or small enterprises with limited capital investment and production", was found to play a role.[57] Scientific and academic research, beginning in the early 2000s and advancing over time, revealed the scale of ASGM. The sector was among the largest users of mercury globally, and ASGM gold extraction was the largest source of global anthropogenic mercury emissions.[58] However, the Convention's negotiators acknowledged that ASGM was an important source of livelihoods for millions of small-scale miners and informal mining communities, and that therefore, banning the use of mercury in ASGM outright would drive the practice underground and out of the reach of regulators and technical assistance. They realized the need to balance these realities, using practical provisions to address the dangers of mercury use in ASGM while simultaneously safeguarding the livelihoods of informal workers and reducing their socioeconomic vulnerabilities.

The Minamata Convention contains several elements that specifically address the informal sector, alongside targeted strategies to reduce emissions. The Convention addresses all stages of mercury extraction, use, and waste management through articles that aim to reduce mercury usage, regulate different uses of mercury, introduce emission and release control measures.[59] The Convention's official incorporation of informal sector activities was – and still is – highly novel. Negotiators set out core objectives that the Convention would have to meet in respect to the ASGM sector. It must address the informal sector in its own dedicated article, not merely as an element of other articles. It must adopt a flexible approach based on country-driven strategies, protecting mining communities and vulnerable populations while working towards formalizing the ASGM sector. It must not ban mercury use in the ASGM sector, as criminalizing mining activities would drive them into illegality and make it more difficult to provide informal sector workers with technical assistance and health protections. However, it must also delineate the worst practices in the sector to drastically reduce mercury use and emissions while improving the health of informal sector workers.

National Action Plans, accompanied by financial assistance, are a cornerstone of the Minamata Convention's approach to the informal sector. The Convention requires Parties who determine ASGM activity within their

territory is "more than insignificant" to notify the Secretariat, then develop and implement an ASGM National Action Plan (NAP).[60] NAPs must include national reduction targets, actions to eliminate worst practices within the given country, steps to facilitate formalization of the ASGM sector, pushes for baseline data, and trade provisions. The Convention's official guidance, originally developed by the UNEP Global Mercury Partnership, on developing a National Action Plan serves as a resource, including further requirements and optional strategies such as supply chain measures and global marketing approaches.[61] Parties have since adopted additional guidance developed by the WHO on health strategies in NAPs.[62] Financial assistance for NAP development is available through the Global Environment Facility (GEF, which has so far supported more than 40 countries in the process. As a result, 23 NAPs have been completed and published.[63] GEF provides funding for formalization efforts and moving towards mercury-free approaches to mining through the planetGOLD programme,[64] a global program involving several GEF implementing agencies, the Natural Resources Defence Council, and other partners.

Before the Convention was established, multi-stakeholder partnerships facilitated collaborative international action. The international community understood the importance of acting immediately on the mercury crisis, rather than waiting an indefinite length of time for a treaty. The UNEP Global Mercury Partnership had its formative meeting in 2005, following a UNEP decision that encouraged partnerships between governments and stakeholders in other sectors as a method to tackle mercury-related challenges.[65] It went on to develop eight Partnership Areas with participants from governments, NGOs, IGOs, academia, and the private sector; these included a dedicated ASGM Partnership Area. In 2009, the UNEP Global Mercury Partnership was designated as a mechanism through which quick action could be taken on mercury issues until the treaty was in place.[66] Prior to this, the United Nations Industrial Development Organization (UNIDO) launched the Global Mercury Project in six countries in 2002, demonstrating what a partnership focused around adopting best practices and pollution prevention measures in ASGM might accomplish.[67] Partnerships established pre-Minamata Convention continue to perform important work: the UNEP Global Mercury Partnership is active in supporting treaty activities, GEF projects, and collaborations with UN agencies and other stakeholders.[68]

Decision-makers can use insights gained from the Minamata Convention on Mercury and Global Mercury Partnership in crafting the global plastic agreement and measures to fill the gaps. The global agreement on plastic pollution has many of the same needs as the global mercury treaty, and the potential solutions can share many attributes. The Minamata Convention grounded its international policies in research and data, provided national-level flexibility, committed to including the informal sector specifically in the convention text, and used a partnership mechanism to ensure that short-term action could be taken during the lengthy treaty negotiation process. The Minamata Convention's full implementation is still underway, but plastic treaty negotiators can follow its development for lessons to incorporate into their own endeavour.

7. The way forward: Conclusion and recommendations

UNEA's forthcoming legally binding global agreement on plastic pollution is set to be the biggest – and most consequential – step forward on mitigating the pollution crisis thus far. Increasing plastic production will worsen the problem of plastic waste dispersal into oceans and terrestrial environments. Effective design and implementation is critical: without a stringent treaty that addresses all stages of plastics' life-cycle holding parties accountable to their obligations.

The informal recycling sector must be a cornerstone of the treaty's development and implementation, to ensure it is both inclusive and successful. The agreement offers a valuable opportunity to facilitate inclusion and provide life-saving protections for the IRS, but bears the risk of adversely affecting informal workers and their livelihoods. Including waste pickers and other IRS workers in the forthcoming negotiations and its design, and recognizing the central role of the IRS in the circular plastics economy, could improve efficiency and bring the treaty in line with day-to-day waste management realities. Policy-makers must have access to crucial data about the IRS's role in waste management systems and supply chains, along with the health and safety challenges informal workers face, to fully understand waste and recycling ecosystems.

The collective knowledge base on the IRS has many data gaps, but it is growing as more research tools and policies are developed. The Minamata Convention and Global Mercury Partnership offer evolving international multi-lateral environmental policy and partnership cases to watch. The implementation of India's 2021 rules on Extended Producer Responsibility (EPR) schemes will reveal valuable insights on establishing such schemes within a system that is heavily reliant on the IRS. Modelling tools, analytical frameworks, and supply chain maps like those developed by the University of Leeds and Kabadiwalla Connect establish a crucial database to build policies and interventions upon. Experiences and demands from IRS organizations like The Alliance of Indian Waste Pickers provide critical, first-hand perspectives on the needs and realities of informal workers. Analysing these in combination, while continuing further research, is foundational to forming a utilizable picture of a complex and urgent issue.

Objectives for the treaty and aspirations for IRS inclusion often overlap across stakeholders and sectors. These include the necessity of binding commitments, following the shortcomings of voluntary approaches. There is general support for a flexible framework that leaves space for localized and targeted approaches through National Action Plans, multi-stakeholder partnerships, and market-based initiatives like EPR schemes. Recognition of the informal sector is increasing; this includes the importance of the IRS's position in waste management systems as well as the necessity of providing informal workers with systemic inclusion, socioeconomic support, and health protections. The need to base the treaty on data, research, and scientific insights is widely reiterated, along with the need to conduct further studies to continuously improve understanding of the informal sector. There are significant knowledge gaps and equity gaps to close.

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