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**Third meeting of the intersessional process considering the Strategic Approach and sound management of chemicals and waste beyond 2020**
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Items 4(d) of the provisional agenda[1]

# Development of recommendations for consideration by the fifth session of the Conference regarding the Strategic Approach and the sound management of chemicals and waste beyond 2020: Financial considerations

## Note by the secretariat

1. The secretariat has the honour to submit to the intersessional process a draft document that reviews examples of successful mechanisms for cost recovery and implementation of the polluter pays principle. The secretariat was requested to develop the paper by the third meeting of the Strategic Approach Open-ended Working Group held from 2-4 April 2019 in Montevideo, Uruguay.

2. Participants may wish to review the draft document and consider it in the discussions under the relevant agenda item.

3. Stakeholders are invited to provide comments on the draft document by 1 November 2019. Input should be sent to the Strategic Approach secretariat (saicm.chemicals@un.org).

4. The paper will be finalized for consideration of the fourth meeting of the intersessional process in Bucharest, Romania, from 23 to 27 March 2020.

[1] SAICM/IP.3/1

**Annex**

# Draft

# Review of examples of successful mechanisms for cost recovery and implementation of the Polluter Pays Principle

13 September 2019

# Contents

# 1. Introduction

The overall objective of this report is to provide examples of successful mechanisms for cost recovery and implementation of the Polluter Pays Principle for the financing of risk management and risk reduction activities for the sound management of chemicals and waste at the national level, in response to the call from the third meeting of Open-ended Working Group of the International Conference on Chemicals Management (OEWG-3) held in April 2019 in Montevideo, Uruguay. This is an interim report, which will presented to the third meeting of the Intersessional Process of the Strategic Approach and sound management of chemicals and waste beyond 2020 in Bangkok, Thailand, from 1 to 4 October 2019, and finalized for consideration at the fourth meeting of the intersessional process in Bucharest, Romania, from 23 to 27 March 2020.

The study focuses on the application of the Polluter Pays Principle for risk reduction, including preventing, reducing, remediating, minimizing and eliminating risks to human health and the environment from unsound management of chemicals. The study makes distinction between economic instruments that consist of fiscal policies aiming to incorporate negative externalities into product prices and cost recovery measures intended to cover costs from staffing and operating national administration for chemicals control. Economic instruments complement traditional approaches to risk reduction. Non-market-based measures, including corporate social and environmental responsibility, are beyond the scope of this study.

Since the inception of SAICM in 2006, industry involvement has been a central feature in its work. Despite progress, the use of economic instruments and cost recovery measures in the context of sound management of chemicals and waste are still poorly understood and implemented. The second edition of the Global Chemical Outlook (GCO-II) highlights that "gaps remain in regard to increasing industry contributions to match responsibility and the required level of support" and recommends "promot[ing] extended producer responsibility (EPR) and internalization of costs by industry" (UNEP, 2019a). The preceding edition of the outlook (GCO-I) already noted that "the vast majority of human health costs linked to chemicals production, consumption, and disposal are not borne by chemicals producers, or shared down the value-chain" and emphasized that "uncompensated harm to human health and the environment are market failures that need correction" (UNEP, 2013a).

The high economic and societal price tag of market failures in the chemicals and waste sector has been well documented in many studies, including: USD 90 billion for health-related costs for smallholders from pesticide use in Sub-Saharan Africa in 2005-2020 (UNEP, 2013a); USD 157 billion median annual health costs for diseases associated with endocrine disrupting chemicals in the EU (Trasande et al., 2015); and USD 977 billon annual costs related to childhood exposure to lead in low- and middle-income countries (Attina & Trasande, 2013). Given that the size of the global chemicals industry is approximately USD 5 trillion and is expected to double by 2030, many actors have voiced the need for more action to internalize the costs to the environment and human health in the chemicals industry and throughout the entire value chain (UNEP, 2019a).

This report is structured around three main sections: the Polluter Pays Principle, cost recovery measures and economic instruments. The narrative is supported with examples from different countries. In general, there is a time lag between high-income countries and middle- and low-income countries in implementation of economic instruments. Most of the countries with successful policies in place are, in fact, high-income countries. This report attempts to recount low- and middle-income country examples to the fullest extent possible, while also bearing in mind that the objective as requested by OEWG-3 is to exemplify successful mechanisms. The lack of research on the effectiveness of economic instruments used for sound management of chemicals and waste is a critical limitation of this review.

# 2. Background

## *2.1 Industry involvement*

In 2013, the Governing Council of the United Nations Environment Programme (UNEP) adopted, through decision UNEP/GC.27/12, an integrated approach to financing the sound management of chemicals and waste. It is composed of three complementary and interlinked components: mainstreaming, industry involvement, and dedicated external financing. The component of industry involvement promotes the use of economic instruments that are defined as "a set of policy mechanisms that can provide financing for chemicals and waste management through, in particular, cost recovery," and clarifies that "cost recovery measures seek to shift the hidden public costs of managing chemicals from government budgets to private sources" (UNEP, 2013b). As summarized by the independent evaluation of SAICM, "industry involvement was envisaged as meaning that industry internalizes the costs of complying with chemicals and waste regulations, with economic instruments (e.g. taxes and subsidies) used to shift the external costs of production, use and disposal of chemicals away from the public sector to the private sector" (SAICM, 2019).

In 2015, ICCM4 welcomed the integrated approach, highlighted its applicability to SAICM and endorsed the overall orientation and guidance (OOG), which specifies "industry participation and responsibility across the life cycle, including cost recovery policies" as one of eleven basic elements that are considered critical at the national and regional levels for the attainment of sound chemicals and waste management (SAICM, 2015).[2] The OOG solidifies the objective in the overarching policy strategy (OPS) of SAICM, which in paragraph 19, calls for "assessing and adopting at the national and sub-national levels economic instruments intended to internalize the external costs of chemicals" (SAICM, 2006a). Furthermore, the Global Plan of Action (GPA) of SAICM includes the development and application of economic instruments as an activity (no. 193) (SAICM, 2006b).

The UNEP Executive Director's evaluation of the implementation of the integrated approach to financing the sound management of chemicals and waste was welcomed by the fourth session of the United Nations Environment Assembly (UNEA), in March 2019 in Nairobi, Kenya (UNEP, 2019b).[3] At OEWG-3, stakeholders requested that its conclusions and recommendations be considered during the preparation of this report.

One of the findings of the evaluation of the integrated approach is that, because industry involvement has never been properly defined in the context of the sound management of chemicals and waste and there are no existing indicators and verification methods to monitor and assess industry participation, the level of industry involvement is largely unknown. The evaluation calls for a more strategic and pragmatic approach to enhance industry involvement, including accompanying it with outcome and impact monitoring. To this end, any measures taken to promote the use of economic instruments and cost recovery measures, which constitute an important component of industry involvement, are poorly known.

[2] ICCM4 resolution IV/1 (para 1)

[3] UNEP/EA.4/Res. 8 (para 8)

Furthermore, the evaluation also notes that, although good examples of industry involvement are emerging, these experiences are not being synthesized to create replicable models. Consequently, there is a need for a clearer idea of what successful industry involvement at the national levels should look like, including the use of economic instruments.

The evaluation also recommends UNEP to prepare an updated guidance on the integrated approach and to reframe its narrative around the 2030 Agenda on Sustainable Development.[4] The evaluation further highlights that the SAICM Secretariat has assumed the role of a key broker in implementing the integrated approach and recommends the role of SAICM and its successor in delivering the integrated approach be reviewed and assessed.[5]

## *2.2 Definitions*

Definitions for key terms used in this report are listed below:

- **Polluter pays principle** "National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment." (UN, 1992)
- **Economic instruments:** "Set of policy mechanisms that can provide financing for chemicals and wastes management through, in particular, cost recovery" (UNEP, 2013a)
- **Cost recovery:** Fees paid by the regulated industries to cover costs of chemicals control activities (UNEP, 2019c)
- **Extended Producer Responsibility**: "Policy approach in which producers' responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life-cycle" (OECD, 2001)
- **Tax "**Compulsory, unrequited payment to government levied on tax base with a proven, specific negative impact on the environment" (OECD, 2016a)
- **Fee "**Compulsory requited payments to the government that are levied in proportion to the services provided" (OECD, 2016a)
- **Subsidy "**Reduces directly or indirectly the use of something that has a proven, specific negative impact on the environment" (OECD, 2016a)
- **Deposit refund systems:** Combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund), generally with the objective to discourage illegal or improper disposal (OECD, 2016a)
- **Risk reduction** "Chemicals or chemical uses that pose an unreasonable and otherwise unmanageable risk to human health and the environment based on a

[4] Recommendations 2 and 5

[5] Recommendation 7

science-based risk assessment and taking into account the costs and benefits as well as the availability of safer substitutes and their efficacy, are no longer produced or used." (SAICM, 2006a)

## *2.3 Methodology*

This report is based on input received from stakeholders, a literature review and semi-structured interviews with key stakeholders from governments, UN bodies, academia, the private sector and non-governmental organizations (NGOs). Following the request of the OEWG-3, the Secretariat invited stakeholders to submit input for this review. Responses were received from two countries (Iraq and Madagascar), the United Nations Rapporteur on human rights and hazardous substances and wastes, the Research and Education Center for Development (CREPD), IPEN, the Pesticide Action Network and a joint submission from 11 other NGOs. These inputs are available on the saicm web-site (www.saicm.org).

## 3. Polluter Pays Principle

The Polluter Pays Principle is a fundamental principle of international environmental law, which has been defined in Principle 16 of the 1992 Rio Declartion on Environment and Development as follows: "national authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment" (UN, 1992). The notion that polluters should pay the costs of dealing with their pollution reflects the most fundamental principles of economics, justice and responsibility (Khan, 2015).

The Polluter Pays Principle aims to address negative externalities that derive from the production and consumption of goods when their costs do not reflect their true social cost that is much higher than the market cost (Metcalf, 2019). Pollution is an **example of how government intervention can correct the problem of a "missing market"** by, for example, using taxes to raise the price of polluting goods and activities and to create revenues that can be used to mitigate negative externalities (Metcalf, 2019).

The Polluter Pays Principle can be considered as an overarching concept to be applied in various ways to achieve the desired outcome of internalizing environmental externalities. Ambitious applications of the Polluter Pays Principle towards whole industrial sectors are only just emerging, yet are still notable exceptions (Khan, 2015). The principle is commonly applied narrowly to individual products or substances on a case-by-case basis, given that successful application of economic instruments requires careful design.

Environmental taxation systems constitute a more systematic approach to implementation of the Polluter Pays Principle. However, chemicals appear to be not included in such systems, in particular in low and middle-income countries. The example from Vietnam below constitutes a promising attempt to internalize external costs arising from the use of chemicals. In this case, some chemicals have been incorporated into an environmental protection tax and chemicals management programs have been staffed accordingly. It is also noteworthy to mention that, in 2014, China introduced the Polluter Pays Principle in the Environmental Protection Law that was later modified by the Environmental Protection Tax Law that took effect in January 2018, which imposes a tax on 44 gas pollutants, 61 water pollutants and 4 solid pollutants, but does not address chemicals (Zahar, 2018; Li & Masui, 2019).

**EXAMPLE 1: Environmental Protection Tax in Vietnam**

In 2012, Vietnam implemented an Environmental Protection Tax (EPT) which set a range of tax rates for different pollutants, including those arising from the use of fossil fuels, pesticides, fertilizers and plastics. The EPT in Vietnam is often hailed as a best practice example of environmental taxation in the context of non-OECD countries because it is quite comprehensive and covers a wide range of pollutants and the design of the tax facilitates easy adjustment (VIDC, 2018). In addition to this tax, since 2016, the government has been collecting a mining environmental fee to mobilize revenues for environmental rehabilitation activities (VIDC, 2018). To ensure that chemical management meets intended objectives, Vietnam has invested in adequate staffing: 15 staff work with pesticides management in the Plant Protection Department, 15 chemicals staff work in the Pollution Control Department and 38 staff work in the Vietnam Chemical Agency (VINACHEMIA) (UNEP, 2019c). There is some evidence for positive behavioral responses and reduced pollution and emissions as a result of the EPT (VIDC, 2018).

The Polluter Pays Principle is enshrined in Article 191 of the Treaty on the European Union (EU) and is reflected in the EU Water Framework Directive (200/60/EC) and Directive on Industrial Emissions (2010/75/EU). The EU regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), which came into force in 2007, can be considered a genuine effort to apply aspects of the Polluter Pays Principle to enhance risk management of chemicals as set out in Example 2 below.

**EXAMPLE 2: REACH regulation in the EU**

REACH contributes to fulfilling the Polluter Pays Principle mainly by internalizing risk management through requirements that companies prove that their substances are safe by carrying out pre-market safety and toxicity testing of substances introduced to the markets. This applies to both existing and new substances, which, because it does not favor the use of existing substances that lack safety and toxicity testing, creates a level playing field and stimulates innovation. Since REACH came into force, 17 000 substances have been registered and, therefore, assessed by industry (EC, 2018a). Furthermore, the Polluter Pays Principle comes into play by using fees to recover the operational costs of running the European Chemicals Agency (ECHA), which manages the implementation of REACH (see section 4). The estimated scale of potential benefits for human health and the environment remains on the order of EUR 100 billion over 25-30 years (EC, 2018b). The second 5-year review of REACH shows that it has significantly helped to direct EU's work towards meeting the 2020 goal (EC, 2018b). REACH has also influenced legislation in other countries (e.g. Korea or China), although significant differences still exist (EC, 2018b).

In Madagascar, the Polluter Pays Principle is mentioned in the MECIE on the Compatibility of investments in the Environment Decree. The pollution tax in Iran obliges large polluting industries to pay 1% of their revenue as green taxes. This shows that internalization of costs can generate significant revenues: 2017 revenues collected totaled USD 2.5 billion (Harchegani & Dahmardeh, 2017; Financial Tribune, 2017).

# 4. Cost recovery

The Guidance on the Development of Legal and Institutional Infrastructures and Measures for Recovering Costs of National Administration for Sound Management of Chemicals (LIRA guidance), which sets out more concrete options in particular for cost recovery systems at the domestic level, is the most notable tool. It was developed by UNEP for operationalizing the industry involvement component of UNEP's integrated approach to financing the sound management of chemicals and waste (UNEP, 2015). The LIRA guidance provides practical guidance for setting up adequate legal frameworks and institutional capacity at the national level, which is considered a prerequisite for carrying out core risk reduction activities. It describes measures that governments can take at a domestic level to recover implementation costs such as registration, manufacture, import and user fees to cover overall national governance of chemicals expenditures. It also highlights that the implementation of cost recovery measures offers governments of even low-income countries the opportunity to mobilize new sources of income. Recently, UNEP supplemented the LIRA guidance with a series of more specific guidance documents on:

- Establishing and maintaining a national authority for chemicals control (UNEP, 2019c),
- Using risk reduction tools for chemicals control, including economic instruments (UNEP, 2019d)
- Enhancement of chemicals legislation (UNEP, 2019e).

In essence, cost recovery fees are aimed at regulated industries and designed to cover the expenses arising from carrying out administrative procedures at the national level for ensuring chemical safety. For instance, they can cover the cost for inspections and for providing and maintaining registration, licensing and authorization systems. Their use is recommended together with other financing options, including allocations from the state budget (UNEP, 2019c). The primary types of cost recovery fees are summarized in Table 1 and explained in more detail below.

**Table 1.** Types of cost recovery fees for carrying out administrative functions for chemicals safety (UNEP, 2019c; KemI, 2018).

| Type of fee | Who pays? | What is covered? |
|---|---|---|
| **Annual fees** | Companies placing chemicals on the market in a country, both chemical producers and importers | Maintaining registers, performing inspections, granting exemptions, providing a helpdesk and issuing licenses |
| **Fees / service** | Companies charged for each service provided (as alternative to annual fees) | Could include e.g. inspections of companies and assessments of applications from companies |
| **Authorization fees** | Companies requesting authorization for use of chemicals with hazardous properties | Processing of the application requesting for authorization |
| **Inspection fees** | Companies that place chemicals on the domestic market | Market surveillance of chemicals on the domestic market, including testing and verifying products |
| **Import fees** | Importers requesting licenses to import and sell chemicals on the domestic market | The costs of processing the licensing |

## *4.1 Annual fees*

In a system with annual fees, all companies placing chemicals on the market in a country—both chemical producers and importers—pay an annual fee. To implement such schemes, the country must first issue legislation to define such fees. Annual fees can consist of flat-rate fees or fees that are differentiated based on the number of products, quantities, toxicity class or a combination of these. Annual fees can be used to support related government responsibilities, such as maintaining registries and performing inspections of producers and importers of chemicals (KEMI, 2018).

**EXAMPLE 3: The annual chemicals fee of the Swedish Chemicals Agency**

The Swedish Chemicals Agency (KemI) was established in 1986. The annual chemicals fee is linked to the amount of chemicals produced or imported and on the number of chemicals products reported to the Swedish Products Register. For the authorization of pesticides there is both an application fee and an annual fee related to the value of the volume sold. These fees generate revenues that are allocated through the state budget to the agency. In 2017, the chemicals cost recovery fees financed 50 % of the costs for running the agency (KemI, 2018). Initially, 80 % of operations were covered by cost recovery fees, but over the years additional functions have been introduced (such as international cooperation) that have increased the share taken from the state budget.

## *4.2 Fees per service*

As an alternative to annual fees, cost recovery can also be implemented by charging companies for each service provided. This would require that the cost of a specific service be easy to define. Like annual fees, fees for services can include a degree of differentiation either by company size or by the complexity of the service provided (UNEP, 2019c).

**EXAMPLE 4: Registration fee in Costa Rica for "products of sanitary interest"**

The registration fee applied in Costa Rica for "products of sanitary interest" is an example of a cost recovery fee per service, which has been calculated to recover associated institutional costs (UNEP, 2019c). This includes the cost of designing and maintaining the registration system's online platform, the cost of keeping company files/registries on the platform's server, the institutional internet costs for working on the registration platform and bank charges for receiving and administering payments by companies that wish to register (UNEP, 2019c).

## *4.3 Authorization fees*

Authorization fees are typically applied to chemicals of high concern. Most countries have authorization systems for such pesticides, and many of these have introduced some level of fees to cover the cost of authorization (UNEP, 2019c). Authorization systems of industrial and consumer chemicals of high concern are less common (UNEP, 2019c).

**EXAMPLE 5: The authorization fee of the European Chemicals Agency**

The European Chemicals Agency (ECHA) was founded in 2007 as the central entity responsible for the administration of EU's REACH Regulation. The ECHA, which employs approximately 600 staff members, relies on a variety of fees that have helped to cover 70 % of the operational costs of the agency (EC, 2018b). REACH specifies that substances of very high concern can only be used after being granted authorization. Companies can apply for authorization of these substances. The fees for an application for authorization is EUR 54 000 for large enterprises and one tenth of this cost for micro enterprises (Official Journal of the EU, 2018). Other fees are also progressive to ensure that small enterprises are not overburdened and the capacity to innovate and stimulate job creation remains.

## *4.4 Inspection fees*

Countries may use different systems to inspect and collect fees from companies which place chemicals on the domestic market. Two main model include market surveillance (covered in this subsection) and border control (addressed in the following subsection). Inspection involves checking the quality of the information provided by producers or importers, including laboratory analyses. It is important that the fees cover access to qualified laboratories for conducting inspections of chemicals placed on the markets , including the use of certified laboratories from the private sector (KemI, 2018).

## *4.5 Fees for import licenses*

Many countries have systems with import licenses that provide the right to import and place chemicals on the domestic market. Countries often charge a fee for such licensing. In such cases, the fees for each delivery are paid at the border. Importers are either charged per ton or charged an administrative fee each time they import (UNEP, 2019c). Fees for import licenses normally cover the cost for processing the licenses but not for chemicals management activities in the countries (KemI, 2018).

## 5. Economic instruments

Since the early 1970s, the role and use of economic instruments has been growing, as evidenced by the considerable increase in the number of applications for pollution control and natural resource management and the diversification of those instruments already being applied (OECD, 2017). The most notable proliferation in the use of economic instruments occurred after the launch of the Brundtland report, which recommended their use to help integrate environmental considerations into other policy areas (World Commission 1987).

Essentially, economic instruments aim to internalize environmental externalities so that the true environmental and societal costs of products and services are accurately reflected (Metcalf, 2019). Economic instruments have been hailed for their ability to give producers an incentive to improve environmental performance in contrast to traditional command-and-control policies (Andersen, 1995). They are also credited for catalyzing innovations and research—since they do not prescribe specific technologies—and for their ability to generate new revenues (Andersen, 1995). Economic instruments are suitable for moderately hazardous substances and usually take the form of a new policy, law, or economic or social programme.

The OECD monitors the use of economic instruments and maintains the OECD Policy Instruments for the Environment database ("Pine database"), which contains 3 400 policy instruments categorized under 12 environmental domains. Chemicals and waste do not have an independent domain, but they are covered under some others, in particular "water pollution", "land contamination" and "ozone layer protection" (OECD, 2019). The OECD classification of economic instruments is described in Table 2, with indication of the categories' applicability to chemicals and waste.

**Table 2**. OECD classification of economic instruments and its applicability to chemicals and waste (OECD, 2016a; Slunge & Alpizar, 2019).

| Category | OECD Definition | Applicability to chemicals and waste |
|---|---|---|
| **Taxes** | Compulsory, unrequited payment to government levied on tax base with a proven, specific negative impact on the environment | Yes, e.g. pesticides, inorganic fertilizers and chlorinated solvents |
| **Fees** | Compulsory requited payments to the government that are levied in proportion to the services provided | Yes, e.g. hazardous waste, pesticide or chemical containers, tires, batteries |
| **Tradable permits** | Market-based instruments that provide allowance or permission to engage in an activity | Yes, e.g. lead in petrol, ozone depleting substances |
| **Deposit-refund** | Combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund), generally with the objective to discourage illegal or improper disposal | Yes, but could distinguish between traditional deposit-refund schemes (e.g. containers made for pesticides) and Extended Producer Responsibility schemes (e.g. on waste electrical and electronic equipment) |
| **Subsidies** | Reduces directly or indirectly the use of something that has a proven, specific negative impact on the environment | Yes, distinction could be made of two sub-categories: subsidies (e.g. for organic farming and lead paint removal) and subsidy removal (e.g. for the use of fertilizers and pesticides) |
| **Voluntary approaches** | All voluntary instruments whereby firms or industries make commitments to improve their environmental performance beyond what the law demands | Yes, but not considered in this context |

An analysis of economic instruments in the Pine database identified 113 applications relevant to chemicals and waste: 45 taxes, 50 fees, 15 deposit-refund systems and 3 tradable permit systems (Slunge & Alpizar, 2019). This covers only 3.3 percent of all the applications in the Pine database, indicating that the use of economic instruments for chemicals management is relatively limited. Undoubtedly, many more applications exist, but due to the absence of a specific domain allocated to chemicals and waste they are, arguably, less likely to find their way into the database compared to areas followed-up systematically.

An analysis by Slunge and Alpizar (2019) shows that economic instruments can be applied to all stages of the lifecycle of chemicals, but most commonly are used for hazardous wastes (Figure 1). Taxes, fees and deposit-refund systems are frequently applied for products such as tires, batteries, accumulators, electrical and electronic products, vehicles, and other aspects of hazardous waste management. Some countries also use charges or deposit-refund systems for containers made for pesticides and other chemicals. Less common are taxes and charges imposed on pesticides, fertilizers, ozone-depleting substances and chlorinated solvents. Tradable permit systems were found only for ozone-depleting substances and chlorinated solvents.

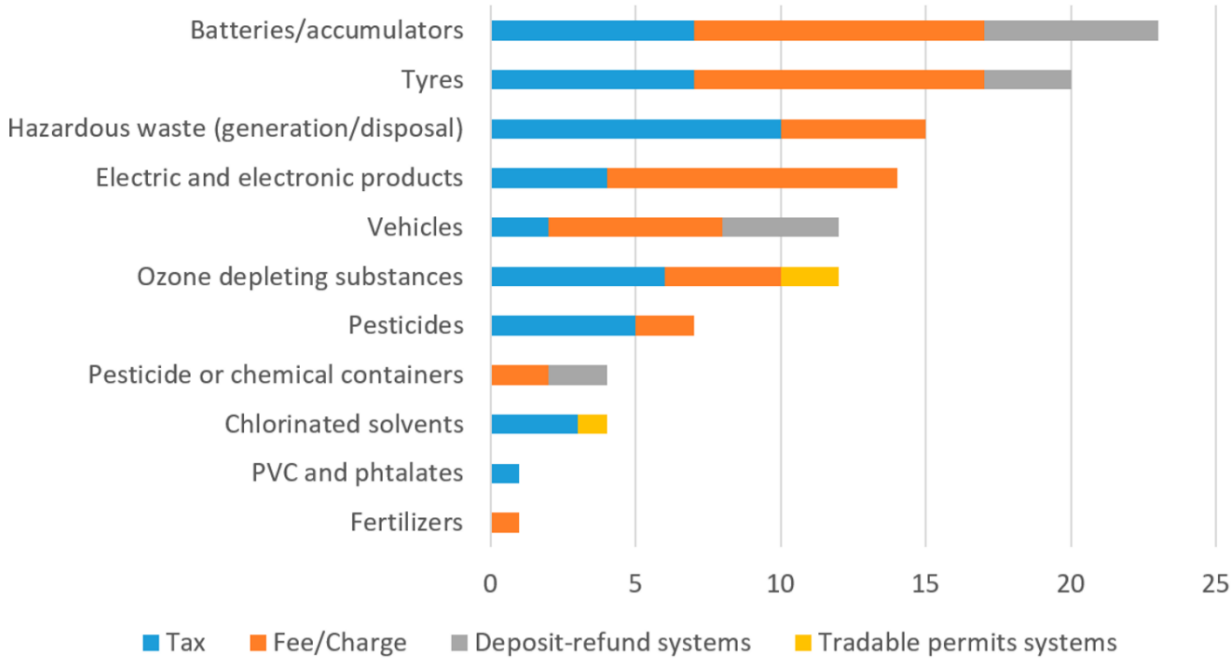


**Figure 1.** Number of countries using economic instruments in chemicals management, based on the Pine database (Slunge & Alpizar, 2019).

## *5.1 Taxes and fees*

This section provides examples of different types of taxes and fees without distinguishing between the two. These are different vehicles, however: fees are paid as compensation to cover costs of general or specific public administrative services, whereas taxes refer to a payment by law from persons, groups or companies in order to provide the state and municipalities with revenue (UNEP, 2019c). In essence, fees are earmarked for provision of certain services, whereas, taxes are not.

*Flame retardants*

Many consumer commodities contain flame retardants some of which are linked to serious health effects, including endocrine disrupting effects (UNEP, 2019a). Halogenated options based on chlorine and bromine compounds are considered more hazardous than non-halogenated options, like phosphorus compounds. In cases like these, taxation can help countries to transition to safer alternatives. For example, Sweden has pioneered a tax aiming to encourage the substitution of hazardous flame retardants in electrical and electronic products with less harmful alternatives. Although the tax has recently come into force so has not yet been evaluated, it arguably provides a strong incentive for substitution with less harmful additives and more sustainable product design.

**EXAMPLE 6: Tax on flame retardants in electronics and electrical products in Sweden**

In July 2017, Sweden introduced a tax on hazardous flame retardants in electronic and electrical products to incentivize their substitution with less hazardous alternatives. Producers and importers of electronics and electrical products pay a tax that is calculated on the weight of the goods amounting to EUR 1 per kilo for kitchen appliances and EUR 15 per kilo for other electronics. The tax is limited to a maximum of EUR 42 per item. Producers and importers receive a tax deduction based on two factors: which flame retardant compounds the product contains and if the compounds are additive or reactive. The tax deduction is 50 % if the products do not contain additive bromine and chlorine compounds. If the products are, in addition, free from additive phosphorus compounds and reactive bromine and chlorine compounds, the tax deduction is 90%. However, the tax has been questioned by industry as not being based on a comprehensive risk assessment and for being administratively burdensome (Slunge & Alpizar, 2019).

*Pesticides*

Taxes on pesticides can be efficient components of an optimal pesticide policy (Skevas et al., 2013). In 1984, Sweden introduced the world's first special flat tax on pesticides based on the volume sold (Böcker & Finger, 2016). Today, similar taxes on pesticides are in place in Belgium, Canada, Denmark, Finland, France, Italy, the Netherlands, Norway, Sweden, Vietnam, Mexico and the USA (Louisiana) (UNDP, 2017; VIDC, 2018; Slunge & Alpizar, 2019). Several countries (Denmark, Norway, France and Mexico) use risk-differentiated taxation of pesticides to incentivize farmers to use less hazardous pesticides (Slunge & Alpizar, 2019). Evidence from European taxation schemes shows that despite the fact that taxes have not reduced total quantities of pesticide use, they have led to targeted reductions of risks caused by pesticide use (Böcker & Finger, 2016). The use of revenues from taxes applied to pesticides can be used to internalize external effects of pesticides (e.g. to clean water from pesticide residues in France), which can help to reduce potential political conflicts and tensions, since farmers and agricultural companies are main taxpayers (UNDP, 2017; Finger et al., 2017)

**EXAMPLE 7: Pesticide tax in Norway**

In 1999, a new taxation system for pesticides was introduced in Norway. Pesticides were grouped into seven categories based on their health and environmental risks, with higher taxation placed on products in higher risk categories. Consequently, there has been a shift towards the use of less hazardous pesticides, however the tax has only led to a slight reduction in overall pesticide use (Kjäll, 2012). Further assessments have demonstrated reductions in both violations of maximum allowed water nutrient levels and the number of detected residues, but it is not clear whether the tax played a role in this reduction (Böcker & Finger, 2016). The government estimates the tax generated about NOK 50 million (EUR 6 million) in 2015, noting these revenues were not earmarked for environmental purposes (Böcker & Finger, 2016).

*Fertilizers*

Several countries, including Austria, Belgium, Finland, Denmark, Netherlands, Norway and Sweden, have applied taxes on fertilizers based predominantly on the weights of nitrogen and phosphorus (Slunge & Alpizar, 2019). However, many countries have abolished such fertilizer taxation schemes. For example, Austria and Finland abolished existing fertilizer tax schemes, arguing they had a negative impact on the competitiveness of their agricultural sector after they joined the EU in 1994. Sweden abandoned the tax in 2010 for the same reason (Slunge & Alpizar, 2019).

**EXAMPLE 8: Tax to address cadmium contamination in fertilizer in Sweden**

In 1994, Sweden introduced a tax based on the cadmium content of fertilizers. The aim was to raise the price of cadmium-containing fertilizers so that they were in line with the price of safer fertilizers. The goal of the tax was also to provide incentives for environmentally sound cultivation and to contribute to more rapid development of cleaner technologies (SOU, 2017). The tax rate was set at SEK 30 per gram of cadmium in the fertilizer. The tax was found to be very effective because the average cadmium content per ton of phosphorus was reduced from 25 grams in 1995 to less than 10 grams in 2000 (SOU, 2003). Following the peak of world market prices for mineral fertilizers and the financial crisis of 2008-2009, pressures from farmers led to the abolishment of the fertilizer tax in 2010 (Andersen, 2016). Proposals have been presented and discussed for its reintroduction, but challenges remain (Andersen, 2016).

*Lead*

Arguably one of the first and most important global environmental health success stories to date has been the phase out of lead in gasoline. The most expeditious policy for eliminating lead in gasoline is to ban it outright (OECD & UNEP 1999). However, as an interim measure prior to taking that final step, many countries chose to adopt a tax policy that assured that the price of unleaded gasoline was lower than leaded forms. This helped create a market drive, which stimulated the rapid increase in production of unleaded gasoline (OECD & UNEP 1999).

**EXAMPLE 9: Introduction of unleaded petrol in Singapore**

Unleaded petrol was introduced in Singapore in 1991. Its use was encouraged through a differential tax system making unleaded petrol about 10 cents per liter cheaper than leaded petrol. At the end of 1997, the sale of unleaded petrol constituted about 75% of total petrol sales. Availability of unleaded petrol enabled Singapore to rapidly adopt a more stringent exhaust emission standards for petrol-driven vehicles that required the use of catalytic converters. Oil companies voluntarily agreed to phase out leaded petrol by July 1998. (OECD & UNEP, 1999).

## *5.2 Subsidy removal*

Subsidies which encourage the unsound management of chemicals and waste form a category that should be addressed. Subsidies often emanate from unanticipated side-effects of policies designed to attain other objectives. Many countries heavily subsidize fertilizer and pesticide production and use to promote agricultural production and increase food security (Slunge & Alpizar, 2019). However, these subsidies can have a severe negative environmental impact and have a high fiscal burden (Slunge & Alpizar, 2019). Particularly, water quality has deteriorated due to excessive fertilization with nitrogen, which eventually enters in water bodies where it transforms into nitrates causing serious consequences for growth and brain development of exposed children (Damania et al., 2019). Excess nitrogen and phosphates applied to croplands also ends up in aquatic systems leading to eutrophication and largescale dead zones and thereby disrupting other key sectors such as tourism and fisheries.

**EXAMPLE 10: Reform of subsidy scheme for chemical fertilizer in India**

To increase agricultural production in India, the central government began subsidizing the use of chemical fertilizers in 1977 (Ravinutala, 2016). In 2015, the cost of fertilizer use in India was approximately USD 12 billion (Gulati and Banerjee, 2015). Large areas of farmland applying nitrogen (N) rich urea based fertilizers have significantly lost fertility due to excessive fertilization with urea(CBD, 2011). Reforms have been taken to balance the use of fertilizers, including a 10 percent increase in the price of N rich urea based fertilizers. In 2009, the Indian Cabinet decided to relax controls on the prices of fertilizers, with the exception of urea(CBD, 2011). It was hoped this would favor the use of potassic (K) and phosphate (P) based fertilizers in relation in place of N rich urea (CBD, 2011). In 2018, the subsidy programme was reformed once again to prevent overuse of fertilizers and reduce costs (Slunge & Alpizar, 2019).

**EXAMPLE 11: Removal of pesticide subsidies in Indonesia**

In the mid-1980s, a decrease in rice production was observed in Indonesia as a result of the overuse of pesticides. Overuse had wiped out natural enemies of many pests, including the brown rice planthopper. The economic loss to the rice sector from pest infestations was estimated to be USD 1.5 billion. In 1986, the Indonesian government removed pesticide subsidies. This led to pesticide applications being halved and a growth in rice production with three million tons over four years was observed. An additional benefit was the USD 100 million fiscal saving resulting from the elimination on these subsidies. The pesticide subsidy removal occurred at the same time with the adoption of integrated pest management programme and the decentralization of many government functions, including agricultural extension, which made it more likely to succeed. The experience suggests that subsidy removal is feasible even when there is strong opposition from some stakeholders (CBD, 2011).

## *5.3 Deposit-refund systems*

Deposit-refund systems are market-based instruments that give consumers an incentive for correct disposal of their hazardous waste. In traditional deposit-refund systems, consumers pay a deposit on top pf the price of a new product and then receive a refund when turning in the end-of-life or consumed product (Slunge & Alpizar, 2019).

## *5.4 Trade permits*

Trade permits appear to have few applications for promoting sound management of chemicals and waste compared to other categories. However, it can be considered as potentially powerful policy instrument to especially control agricultural pollution (Slung & Alpizar, 2019).

**EXAMPLE 12: Regulating nitrogen pollution from Agriculture in New Zealand**

In 2010, the Waikato regional government established a limit for environmental nitrogen levels, aiming at a 20% reduction by 2020. A system of nitrogen emission quotas has been set in place, so that those who need to increase nitrogen emissions beyond their allotted quota need to buy quotas from other producers. The program has been somewhat successful as evidenced by 25 transfers of emissions rights, for a total of 150 tonnes nitrogen from 2009 to 2014.

## *5.5 Extended producer responsibility*

The extended producer responsibility (EPR)—which extends manufacturers' responsibility beyond the production process throughout the wider product cycle—can be considered an extension of the Polluter Pays Principle (Honkonen & Khan, 2017). Under EPR, since the producer is responsible for organizing collection and recycling of waste, it encourages prevention of waste at source, promotes sustainable product design and supports the achievement of recycling and materials efficiency goals (OECD, 2001). Today, 400 EPR systems are in operation and legislation has been a key driver for their development (OECD, 2016b). Most applications can be found in high-income countries: e.g. 45% of product and packaging waste within the EU is covered by an EPR scheme (Zero Waste Europe, 2017). In the last decade, several low- and middle-income countries have introduced EPR schemes (Slunge Alpizar, 2019). For instance, both China and India have introduced EPR systems for electrical and electronic equipment (Gu et al., 2017; Awasthi & Li, 2017).

*Agrochemicals and empty containers*

Although some countries have introduced EPR schemes to ensure proper collection and recycling of used agrochemical containers and obsolete, inherited and unknown agrochemicals, this remains a significant problem in most countries. An answer could be to facilitate the introduction of take-back systems through block-chain technologies or levying a small tax on containers so that generated revenues could be channeled to fund proper collection and recycling.

**EXAMPLE 13: EPR scheme for empty agrochemical containers and obsolete agrochemicals in Australia**

In 1999, the drumMUSTER program was introduced in Australia to collect empty agrochemical containers in rural areas. It has helped to recycle over 34 million chemical containers equivalent to 38.000 tonnes of waste, enabling savings of USD 33 million in landfill costs (DrumMUSTER, 2019). In 2003, the ChemClear program was also initiated to prevent the storage of obsolete, inherited and unknown agrochemicals. Thanks to this program collect, 667 tonnes of hazardous chemicals have been collected so far (ChemClear, 2019). Both programs are funded by a 6c per lt/kg levy collected under a national Industry Waste Reduction Scheme (IWRS).

*Plastics*

**EXAMPLE 14: Single-use plastics directive in EU**

In January 2018, the EU adopted a European Plastic Strategy with a material-specific lifecycle approach to tackle plastic litter, including promoting the use of EPR schemes (EC, 2018c). In June 2019, the EU adopted the Single-Use Plastics Directive that expands EPR **schemes (by applying it to such products as tobacco filters and fishing gear) to** cover the cost of cleaning up litter (EU, 2019). This means that manufacturers of fishing gear, for example, and not fishermen, will be required to bear the costs of collecting fishing nets lost at sea. The directive is expected to bring about both environmental and economic benefits, by avoiding environmental damages which would cost the equivalent of EUR 22 billion by 2030 and save consumers a projected EUR 6.5 billion (EC, 2018d).

# 6. Examples from other areas

This section provides a short overview of the use of economic instruments in other areas, including pollution charges, biodiversity incentives and innovative market-based instruments.

## *6.1 Pollution charges*

Pollution charges provide a useful reference to understand economic instruments' potential in the context of chemicals and waste. Three main types of pollution charges are (World Bank, 1999):

1. **Emission charges**: charges on emissions into the environment (air, water, or soil) based on the quantity and toxicity of discharged pollutants
2. **User charges:** payments for the costs of collective or public treatment of effluents—are one form of emissions charges
3. **Product charges:** charges or taxes on products that are polluting in the manufacturing, consumption, or disposal phase

Nordic countries have pioneered the use of pollution charges, particularly on emissions of sulphur dioxide and nitrogen oxides, which have since expanded to many other countries and have proven to be successful in mitigating emissions (OECD, 2017). The role of national commissions mandated to oversee the development of economic instruments has been pivotal for driving new policies in many countries. For instance, Sweden's Environmental Charges Commission (ECC) (initially appointed in 1987) have resulted in the introduction of a number of new economic instruments, including taxes on sulphur dioxide, nitrogen oxides and carbon dioxide (OECD, 2013).

**EXAMPLE 15: Pollution charges for nitrogen oxide emissions in Sweden**

In the mid-1980s, forests and freshwater ecosystems dying from acid rain caused by industrial emissions promoted rapid action in many countries. In 1992, Sweden introduced a tax on nitrogen oxides emitted from large combustion sources (e.g. power plants, industrial plants, waste incinerators). The tax was accompanied by a refund according to the amount of energy generated to ensure that facilities with low nitrogen oxide emission intensities are net beneficiaries of the scheme. The tax was designed to accelerate and stimulate investment in advanced combustion and pollution-abatement technologies. Once the tax was implemented, a 35% reduction in nitrogen oxide emissions was observed within 20 months because industry was incentivized to develop cheaper, more efficient technologies (OECD 2013).

The first carbon tax was introduced in Finland, in 1990, followed by Norway, Sweden (both in 1991) and Denmark (1994) (OECD, 2017). As of April 2019, 46 national and 28 subnational jurisdictions are pricing carbon within a price range of USD 1-127 / $tCO_2$ (World Bank, 2019). This includes many low- and middle-income countries, such as South-Africa, Colombia, Argentina and Costa Rica. Research shows that carbon dioxide emissions have declined in

Finland, Denmark, Sweden and the Netherlands relative to those in other 13 European countries in which carbon taxes are not in place (Boqiang & Xuehui, 2011).

## *6.2 Biodiversity incentives*

Economic instruments are increasingly recognized as having an important role to play in the implementation of many multilateral environmental agreements (MEAs) (UNEP, 2004). The Convention on Biological Diversity (CBD) provides a useful example, since the role of economic instruments (referred to as incentives in the CBD) has gradually evolved over the past two decades and is now prominently featured in the work of the convention. For instance, the monitoring of the strategy for resource mobilization for the convention takes into account the use of incentives (CBD, 2010a). The types of incentives used by the CBD are illustrated in Figure 2.

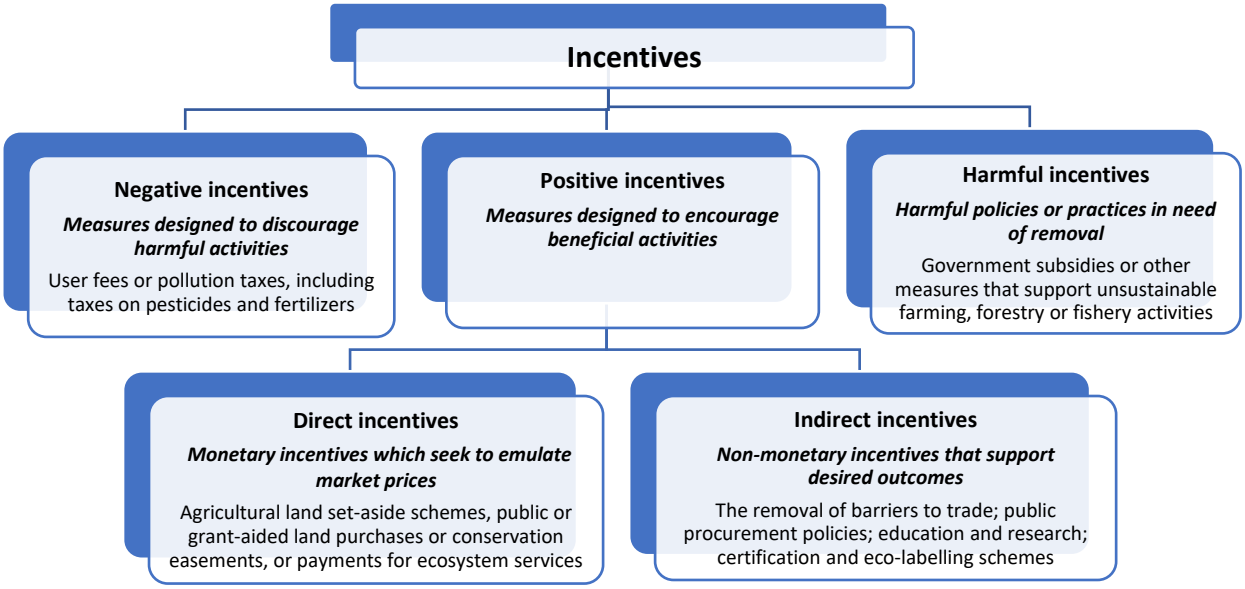


**Figure 2.** Categories of economic incentives in the CBD (CBD, 2019).

In 2010, the CBD adopted the Strategic Plan for Biodiversity 2011-2020, which includes 20 timebound Aichi Biodiversity Targets, including Target 3 specifically addressing the use of incentives (CBD, 2010b). Table 3 shows the indicators developed by the CBD to monitor the implementation of Target 3. From the chemicals and waste perspective it is worth noting that biodiversity-relevant negative incentives include taxes on pesticides and fertilizers, whereas, biodiversity-relevant positive incentives (direct) include subsidies for pesticide-free cultivation. In 2017, the OECD included biodiversity in the list of environmental domains, which has helped to track the use of incentives: OECD data shows that biodiversity-specific taxes alone generate USD 7.4 billion a year in revenue (OECD, 2017).

**Table 3.** Indicators used to monitor the use Aichi Biodiversity Target 3 that concerns the use of economic instruments (CBD, 2016).

| Aichi Biodiversity Target | Generic indicator | Specific indicator |
|---|---|---|
| **Target 3** - By 2020, at the latest, incentives—including subsidies—that are harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied | Trends in the number and value of incentives, including subsidies, harmful to biodiversity, removed, reformed or phased out | Trends in potentially harmful elements of government support to agriculture |
| | | Trends in potentially harmful elements of government support to fisheries |
| | | Agricultural export subsidies (indicator for SDG target 2.b) |
| | Trends in development and application of incentives that promote biodiversity conservation and sustainable use | No. of countries with national instruments on biodiversity-relevant taxes, charges and fees |
| | | No. of countries with national instruments on REDD plus schemes |
| | | No. of countries with national instruments on biodiversity relevant tradable permit schemes |

## *6.3 Innovative market-based mechanisms*

*Aviation solidarity tax*

The aviation solidarity tax on airline tickets—launched in Paris in February 2006 at the Ministerial Conference on "Solidarity and Globalization: Innovative Financing for Development"—was designed to channel funding to address health issues in developing countries. So far, 11 countries (Cameroun, Chile, Congo, France, Madagascar, Mali, Mauritius, Niger, Republic of Korea, Norway and the UK) have implemented the solidarity levy. This tax is essentially a series of national taxes that countries commit to levy voluntarily. There is no official definition of an aviation solidarity tax, and countries set tax rates as they see fit and also determine how to spend the revenue generated. For instance, France applies a progressive taxation that distinguishes between destinations and classes, ranging between EUR 1-45 per passenger (EC, 2019). The French solidarity tax is channeled to the International Drug Purchase Facility (UNITAID), hosted by the World Health Organization (WHO), and was created specifically to use aviation solidarity levies to provide developing countries access to quality drug treatment for diseases such as malaria, tuberculosis and HIV and AIDS.

*Global taxes or levys*

Given the urgent need for funding, vast untapped resources and the high cost of externalities caused by unsound management of chemicals and waste practices, it may be timely to explore and attempt unconventional approaches, such as global taxes or levys. For example in order to create a level playing field, a global multilateral taxation scheme could be considered on a global scale. However, no such precedent yet exist. Academics have proposed setting up a Multilateral Carbon Tax Treaty (MCTT) with a binding obligation for countries to apply a carbon tax (Falcão, 2016). Similarly, IPEN has proposed the

development of a global levy that could be 0.1 % of the global chemicals industry's annual turnover.

The development of a global levy or tax would be an extremely unusual commitment to be made internationally, because it would entail that countries come to an agreement on how to partition the tax (Falcão, 2016). Also, levying a tax is a State Act connected to the enforcement of a country's sovereign rights, thus international tax treaties seldom create an obligation to tax or identify the level at which the tax should be levied (Falcão, 2016). Another innovative solution could be to apply a solidarity to tax foreign exchange transactions associated with chemicals and waste.

# 7. Summary and conclusions

This review constitutes a preliminary attempt to identify successful mechanisms for cost recovery and implementation of the Polluter Pays Principle and examine possibilities for their further application for chemicals and waste. The report will be finalized for the 4th meeting of the intersessional process based on further input and analysis.

This review finds that good practices are emerging. However, the use of economic instruments and cost recovery measures are still underdeveloped, and successful examples limited predominantly to select high-income countries. This shows the difficulties of setting up the legal and institutional basis needed for sound chemicals management, including developing and overseeing effective implementation of economic instruments. Arguably, endemic societal challenges, such as the globalized nature of value chains, the lack of basic capacities to address the sound management of chemicals and waste at the national level in many countries and the lack of political will hinder progress in this regard.

The elaboration of the beyond-2020 framework provides a unique opportunity to increase understanding of and, ultimately, scale up the use of economic instruments and cost recovery measures for sound management of chemicals and waste. In light of the draft review, consideration could be given to the following:

- Continue to collect best practices and to provide guidance on cost recovery measures and use of economic instruments, coupled with provision of capacity support, building on and complementing existing guidance,
- A future study on market-based instruments and cost of inaction could help to mobilize political momentum for fiscal reforms,
- Explore the development a global cost internalization program to facilitate a more systematic approach to the implementation of the Polluter Pays Principle, utilizing best practices and exploring opportunities linked to innovative market-based mechanisms,
- Making reference to the use of economic instruments and cost recovery measures in designing strategic targets beyond 2020 in order to signal to all relevant stakeholders the need to internalize negative externalities arising from unsound management of chemicals and waste,
- Develop relevant indicators for beyond 2020 to track revenues generated from the use of economic instruments for sound management of chemicals and waste.

## References


Andersen, M. S. (1995). The use of economic instruments for environmental policy – A half hearted affair. Available online: http://bit.ly/2Ha9dlC

Andersen, M. S. (2016). Fertilizer tax in Sweden. Aarhus University-DCE. Available online: http://bit.ly/2HosGz7

Attina, T. M. and Trasande, L. (2013). Economic costs of childhood lead exposure in low- and middle-income countries. Environmental Health Perspectives 121: 1097–1102.

Awasthi, A. K. & Li, J. H. (2017). Management of electrical and electronic waste: A comparative evaluation of China and India. Renew. Sustain. Energy Rev 76: 434–447.

Böcker, T. & Finger, R. (2016). European pesticide tax schemes in comparison: An analysis of experiences and developments. Sustainability doi:10.3390/su8040378. Available online: http://bit.ly/2ZkLsxM

Boqiang, L. & Xuehui, L. (2011). The effect of carbon tax on per capita CO2 emissions. Energy Policy 39: 5137-5146.

CBD (2010a). The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Decision UNEP/CBD/COP/DEC/X/2. Available online: https://bit.ly/2Z8a2pu

CBD (2010b). Strategy for resource mobilization in support of the achievement of the Convention's three objectives. Decision UNEP/CBD/COP/DEC/X/3. Available online: https://bit.ly/2Zhidjd

CBD (2011). Incentive measures for conservation and sustainable use of biological diversity. CBD Technical Series No. 56. Available online: https://bit.ly/2KTjAeL

CBD (2016). Indicators for the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets. Decision CBD/COP/DEC/XIII/28. Available online: https://bit.ly/33GJvyW

CBD (2019). Economics, Trade and Incentive Measures. Accessed 18 August 2019. https://bit.ly/2z6Q7bO

ChemClear (2019). About Us. Accessed 31 August 2019. http://bit.ly/2ZM3ttb

Damania, R., Desbureaux, S., Rodella, A-S., Russ, J. & Zaveri, E. (2019). Quality Unknown: The Invisible Water Crisis. Washington, DC: World Bank. Available online: http://bit.ly/2zuM7lJ

DrumMUSTER (2019). Our Story. Accessed 31 August 2019. http://bit.ly/2LepNU7

EC (2018a). Commission working document accompanying the document (1/7): Communication from the commission to the European Parliament, the Council and the European Economic and Social Committee. Commission General Report on the operation of REACH and review of certain elements. Conclusions and Actions. SWD (2018) 58 final. Available online: http://bit.ly/2Hwt3b5

EC (2018b). Communication from the commission to the European Parliament, the Council and the European Economic and Social Committee. Commission General Report on the operation of REACH and review of certain elements. Conclusions and Actions. SWD (2018) 58 final. Available online: http://bit.ly/2NEozmw

EC (2018c). Communication from the commission to the European Parliament, the Council and the European Economic and Social Committee A European Strategy for Plastics in a Circular Economy. COM (2018) 28 final. Available online: http://bit.ly/2MQkf3V

EC (2018d). Single-use plastics: New EU rules to reduce marine litter. Press Release Database. Available online: http://bit.ly/2ZHoLnp

EC (2019). Taxes in the field of aviation and their impact. Final report. Available online: https://bit.ly/2ZijJ5m

EU (2019). Directive of the European Parliament and the Council on the reduction of the impact of certain plastics products on the environment. 2018/0172 (COD) LEX 1930. Available online: http://bit.ly/34fvgkZ

Falcão, T. (2016). A proposition for a multilateral carbon tax treaty. Doctoral dissertation, Vienna University of Business and Economics, 2016 (IBFD publication, forthcoming). Retrieved from http://permalink.obvsg.at/wuw/AC13710313

Financial tribune (2017). Call for Spending Pollution Tax on Iran's Environment Issues. Accessed 12 August 2019. http://bit.ly/2H1B5Zs

Finger, R., Möhring, M., Dalhaus, T. & Böcker, T. (2017). Revisiting Pesticide Taxation Schemes. Ecological Economics 134: 263-266

Gu, Y. F., Wu, Y. F., Xu, M., Wang, H. D. & Zuo, T. Y. (2017). To realize better extended producer responsibility: Redesign of WEEE fund mode in China. J. Clean Prod 164 : 347–356.

Gulati, A. & Banerjee, P. (2015). Rationalizing Fertilizer Subsidy in India: Key Issues and Policy Options. Working Paper 307, Indian Council for Research on International Economic Relations. Available online: http://bit.ly/2NFAu3C

Harchegani, M. A. T. & Dahmardeh, N. (2017). Investigating the effect of the green tax on Iran's health sector: A general equilibrium approach. Iranian Journal of Economic Studies 6: 251-270. Available online: http://bit.ly/2ZWB2W6

Honkonen, T. & Khan, S. (2017). Chemicals and waste Governance Beyond 2020: Exploring Pathways for a Coherent Global Regime. Nordic Council of Ministers, Copenhagen, Denmark. Available online: http://bit.ly/2NHFXXD

IPEN (2017). Beyond 2020: Financing chemical safety. Available online: http://bit.ly/2Ktw9hX

KemI (2018). Guidance on national chemicals control: Sustainable financing of institutional capacity for chemicals control. Guidance 1/19. Kemikalieinspektionen. Available online: http://bit.ly/34j921h

Khan, M. R. (2015). Polluter-Pays-Principle: The Cardinal Instrument for Addressing Climate Change. Laws 4: 638–653

Kjäll, K. (2012). Hur väl fungerar milijöskatter inom kemikalieområdet? Effekter av milijöskatter på växtskydd och klorerade lösningsmedel i Sverige, Danmark, Norge och Frankrike. KemI

Li, G. & Masui, T. (2019). Assessing the impacts of China's environmental tax using a dynamic computable general equilibrium model. Journal of Cleaner Production 208: 316-324.

Metcalf, G. (2019). Carbon taxes: what can we learn from international experience? Accessed 10 August 2019. http://bit.ly/2MQgo6l

OECD & UNEP (1999). Phasing Lead out of Gasoline: An examination of Policy Approaches in Different Countries. Available online: http://bit.ly/2Nr7Hjk

OECD (2001). Extended producer responsibility: A guidance manual for governments. Available online: https://bit.ly/2Z5sHlI

OECD (2013). The Swedish tax on nitrogen emissions: Lessons in environmental policy reform. OECD Environment Policy Paper 2013 No. 2. Available online: https://bit.ly/2Z56zIa

OECD (2016a). OECD Policy Instruments for the Environment: Database Documentation. Available online: https://bit.ly/2Z86CTD

OECD (2016b). Extended Producer Responsibility: Updated guidance for Efficient Waste Management. Executive Summary. Available online: http://bit.ly/2NOlv7H

OECD (2017). Policy instruments for the environment: database 2017. Available online: http://bit.ly/2KGUgtM

OECD (2019). OECD Pine Database. Accessed 17 August 2019. https://bit.ly/30cG7K9

Official Journal of the EU (2018). Commission implementing regulation COMMISSION (EU) 2018/895 of 22 June 2018 amending Regulation (EC) No 340/2008 on the fees and charges payable to the European Chemicals Agency. Available online: http://bit.ly/2PpizR4

Ravinutala, S. (2016). Redesigning India's urea policy. Available online: https://bit.ly/2KzxfJ1

SAICM (2006a). Overall Policy Strategy for SAICM. Annex II of the report of the International Conference on Chemicals Management on the work on its first session. Available online: http://bit.ly/32lZfGc

SAICM (2006b). Global Plan of Action for SAICM. Annex III of the report of the International Conference on Chemicals Management on the work on its first session. Available online: http://bit.ly/32lZfGc

SAICM (2015). Overall orientation and guidance for achieving the 2020 goal of sound management of chemicals. UN Doc. SAICM/ICCM.4/4. Available online: http://bit.ly/2Gzy0Jj

SAICM (2019). Executive Summary (Advance Version) – Independent Evaluation of the Strategic Approach to International Chemicals Management from 2006 – 2015. UN Doc. SAICM/OEWG.3/3. Available online: https://bit.ly/2YCKhy4

Skevas, T., Oude Lansink, A. G. J. M. & Stefanou, S. E. (2013). Designing the emerging EU pesticide policy: a literature review. NJAS-Wagening. J. Life Sci. 64–65, 95–103.

Slunge, D. & Alpizar, F. (2019). Market-Based Instruments for Managing Hazardous Chemicals: A Review of the Literature and Future Research Agenda. Sustainability 11, 4344; doi:10.3390/su11164344

SOU (2003). Skatt på handelsgödsel och bekämpningsmedel? Statens Offentliga Utredningar SOU 2003:9. Available online: http://bit.ly/2PdmMYe

SOU (2017). Skatt på kadmium i vissa produkter och kemiska växtskyddsmedel. Statens Offentliga Utredningar. SOU 2017: 102. Available online: http://bit.ly/2KSXFpg

Trasande, L., Zoeller, R. T., Hass, U., Kortenkamp, A., Grandjean, P., Myers, J. P., DiGangi, J., Bellanger, M., Hauser, R., Legler, J., Skakkebaek, N. E. and Heindel, J. J. (2015). *Estimating Burden and Disease Costs of Exposure to Endocrine-Disrupting Chemicals in the European Union*, The Journal of clinical endocrinology and metabolism 100: 1245 – 1255 doi: 10.1210/jc.2014-4324

UN (1992). Report of the United Nations Conference Environment and Development. Annex 1: Rio Declaration on Environment and Development. Available online: https://bit.ly/2H7Pzaw

UNDP (2017). Taxes on pesticide and chemical fertilizers. Available online: https://bit.ly/2zcPpd2

UNEP (2004). Economic instruments in biodiversity-related multilateral environmental agreements. Available online: https://bit.ly/2ZbT8SX

UNEP (2013a). Global Chemicals Outlook I: Towards Sound Management of Chemicals. United Nations Environment Programme. Available online: http://bit.l y/2PCLstg

UNEP (2013b). Consultative process on financing options for chemicals and wastes: implementation of Governing Council decisions SS.XI/8, 26/7 and SS.XII/4. Report by

the Executive Director. UN Doc. UNEP/GC.27/7. Available online: http://bit.ly/2GVDHYM

UNEP (2015). Lira Guidance om the Development of Legal Infrastructures and Measures for Recovering Costs of National Administration for Sound Management of Chemicals and Waste. United Nations Environment Programme. Available online: https://bit.ly/2KrG2Nf

UNEP (2019a). Global Chemicals Outlook II: From Legacies to Innovative Solutions. United Nations Environment Programme. Available online: https://bit.ly/2ZGOlu2

UNEP (2019b). Evaluation of the implementation of the integrated approach to financing the sound management of chemicals and waste. UN Doc. UNEP/EA.4/INF.16. Available online: http://bit.ly/2Kio1Jp

UNEP (2019c). UNEP Guidance: National authority for chemicals Control - Structure and Funding. Available online: https://bit.ly/2kloLuV

UNEP (2019d). UNEP Guidance: Risk Reduction Tools for Chemicals Control. Available online: https://bit.ly/2NjK248

UNEP (2019e). Enhancement of chemicals legislation. Available online: https://bit.ly/2lVTi2L

VIDC (2018). A climate of fairness. Environmental Taxation and Tax Justice in Developing Countries. Vienna Institute for International Dialogue and Cooperation. Available online: https://bit.ly/2NJpFxg

World Bank (1999). Pollution prevention and abatement handbook 1998: Toward Cleaner Production. Available online: http://bit.ly/2MeCCzs

World Bank (2019). State and trends of carbon pricing 2019. Available online: https://bit.ly/2QKt5j4

World Commission (1987). Report of the World Commission on Environment and Development: Our Common Future. Available online: https://bit.ly/30LjLQs

Zahar, A. (2018). Implementation of the Polluter Pays Principle in China. Reciel 27: 293-305.

Zero Waste Europe (2017). Extended Producer Responsibility: Creating the Frame for Circular Products. Position Paper. Available online: http://bit.ly/2ZLpHaF