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Commentary

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How chemicals can serve people sustainably without polluting the planet: through common objectives, integration, and more effective cooperation

Introduction

Humans have mastered quite some crises. And we will need to master global ones in the near and distant future. Common sense and lessons learned along the way consistently attest to the fact that proper and resolute cooperation, towards clear joint objectives, is key for successful crisis management.

The Executive Director of the United Nations Environment Programme UNEP, Inger Andersen, has delivered strong messages about the challenge of the triple planetary crisis of climate change, biodiversity loss and pollution (Andersen, 2020). Public and policy attention are already high on the urgency to tackle climate change. By contrast, awareness about the significance of biodiversity loss and pollution has still to catch up. Both policymakers and the broader public will perceive the obvious role of chemicals in pollution. However, closer inspection reveals that chemicals are janiform, having a truly cross-sectional role: while chemicals are in many ways required for societal well-being, the ways chemicals are globally produced, used and disposed of, still contribute to all three aforementioned crises. Thinking ahead, it has become clear that many if not most solutions for sustainable development will require a much more conscious use of chemicals.

It is therefore urgent to advance common understanding of how the production and use of chemicals serve people, ensuring wellbeing and sustainable development globally without polluting the planet. This commentary intends to foster discussions on several pertinent aspects on the road to such common understanding and towards apt global goals for joint action.

A serious global pollution situation and chemical intensification goes on

The basic and comprehensive document expanding on global chemical pollution is the second edition of the Global Chemicals Outlook GCO-II (UNEP, 2019). It assesses progress towards the 2020 goal (see below), explores the linkages between chemicals and waste, provides scientific input, and proposes measures to reach relevant Sustainable Development Goals (SDGs) and targets up to and beyond 2020.

GCO II delivers key messages as follows: Opportunities to advance sustainable consumption, production and product innovation do exist, but global megatrends in chemical-intensive sectors like construction, agriculture, electronics, cause ongoing growth of global chemicals production, and still result in too much releases of hazardous substances and other pollutants. These releases are often just temporarily postponed by accumulation of hazardous substances in material stocks and products being disposed

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Vol.19, Iss.3, October 2022
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of one day, many still ending up in the environment. Aptly denoted as chemical intensification, chemical production capacity and turnover double every 15 years, the number of new chemicals increases, further diversity and spread of chemical uses and combinations are on the rise.

This intensification has a tangible impact on human health: According to the Lancet Commission on Pollution and Health (Fuller et al., 2022), pollution causes more than 9 million deaths each year globally. Evidence suggests there is no improvement in sight. A decline in death rates from household air and water pollution among people living in extreme poverty is offset by other pollution like ambient air pollution and toxic chemical pollution. Deaths due to these modern forms of pollution have increased by 66% since 2000. They are driven by industrialisation, uncontrolled urbanisation, population growth, fossil fuel combustion, and absence of an adequate national or international policy for the safe management of chemicals. Pollution remains a major global threat to health and prosperity, particularly in low- and middle-income countries (LMICs). Some 1.8 million deaths per year from pollution, of which 90% occur in LMICs, are attributable to lead and other chemicals. The figure is a conservative estimate and the real figure is likely higher. Intensified efforts geared towards mitigation and prevention are sorely needed, which implies adequate capacity building particularly in LMICs on institutional, regulatory, governance, implementation, and research levels. The push should be globally integrated and synergic.

Common objectives: High ambition agreed, reshaped, and still not sufficiently effective

A common chemicals 2020 goal was originally formulated in the 2002 Johannesburg World Summit's implementation plan. It now appears in reworded shape as target 12.4 of the 2030 Agenda for Sustainable Development:

"By 2020, achieve the environmentally sound management of chemicals and wastes throughout their lifecycles, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their impacts on human health and the environment."[2]

While this time-bound target is ambitious, both the GCO-II as well an independent evaluation of the Strategic Approach to International Chemicals Management SAICM[3] concluded that the international community missed the 2020 goal (SAICM, 2019). The critical analyses also pointed out that solutions do exist, which nevertheless urgently need to be implemented and scaled up with more ambitious worldwide action by all stakeholders ("business as usual is not an option").

At the UN level, there are at least some dedicated Multilateral Environmental Agreements (MEA) focussing on specified problems in the chemicals and waste cluster: the Stockholm, Basel, Rotterdam and Minamata Conventions and just a few more. Most recently a Plastics Convention is under preparation, with a full life-cycle approach stretching from design to production to circularity to reducing, managing and preventing waste. An essential basis for all chemicals management is the Globally Harmonized System GHS for classification and labelling of chemicals, i.e. substances and mixtures. SAICM includes a global agreement on specified issues of concern, such as lead in paint and highly hazardous pesticides.[4] While these are proven tools, effective implementation is still missing in many regions.

Prominent regional instruments include the European Union's CLP and REACH Regulations, the latter being a model for several countries in other regions, including South Korea and Türkiye. There are also flagship initiatives like the European Union's Zero Pollution Ambition with its Action Plan[5] and the recently launched European Partnership for the Assessment of Risks from Chemicals (PARC).[6]

While all these efforts are desperately needed, they are by no means sufficient to re-orient the machinery of chemicals and waste handling towards sustainability at the global level. The list of shortcomings in managing chemicals sustainably is endless: trade in products of unknown composition, wild waste dumping, regrettable substitution, resource extraction

[2] See https://sdgs.un.org/2030agenda, accessed 18 Sep 2022
[3] www.saicm.org, accessed 18 Sep 2022
[4] See http://saicm.org/Implementation/EmergingPolicyIssues/tabid/5524/language/en-US/Default.aspx, accessed 18 Sep 2022
[5] https://environment.ec.europa.eu/strategy/zero-pollution-action-plan_en, accessed 18 Sep 2022
[6] Further information available at https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc

Vol.19, Iss.3, October 2022
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from fossil raw materials, lack of institutional capacity, regulation, and effective cooperation, as well as major funding gaps. Those gaps cannot be closed by state budgets alone, including sources like the Global Environment Facility (GEF)[7] and thus also require significantly increased financial support from the private sector.

Overall, the GCO-II analysis of existing reporting schemes and indicators reveals a fragmented landscape of the mechanisms developed under multilateral treaties, SAICM and the 2030 Agenda for Sustainable Development and other regulatory and voluntary instruments. In spite of the availability of many proper instruments, tools and solutions, neither disrespecting all commendable existing efforts in chemicals and waste management, it still holds true that they fall short of the 2020 ambition.

Objectives towards sustainability: green and sustainable chemistry, chemicals and sustainable development

There is broad agreement that an overall policy concept and cohesive technical criteria are necessary to provide clear orientation if we want to reshape the way we produce, consume and use chemicals.

In 1998, Anastas and Warner have described a Green Chemistry[8] by twelve principles. These are not only important for the synthesis of chemicals, but have added urgency to the issue of responsible chemistry. In an International Workshop on Sustainable Chemistry 27-29 Jan 2004, UBA and OECD developed in-depth criteria for sustainable chemistry, combining ecological, social and economic attributes of sustainability in chemistry (UBA, 2009). More than ten years later, UNEP's Sustainable Chemistry Initiative developed ten objectives and guiding considerations for green and sustainable chemistry as part of the UNEP Green and Sustainable Framework Manual to inspire and guide relevant stakeholders (UNEP, 2020). They range from green molecular design to safeguarding that the use of chemicals to fulfil societal needs are void of pollution or other adverse impacts. In this respect, UNEP provides a blueprint for orienting chemistry innovations towards sustainability. Complementing the UNEP efforts, e.g. the International Sustainable Chemistry Collaborative Centre (ISC3)[9] pushed fulfilment of basically the same need for common understanding, by developing ten key characteristics of sustainable chemistry as result of a stakeholder process completed in 2020.[10] The ISC3's ten key characteristics extend the UNEP perspective by general sustainability principles such as sufficiency, consistency, efficiency, resilience. Precaution and respecting the planetary boundaries are core principles. Chemistry is addressed as a scientific and economic asset spanning its supply chains and whole life cycle. In consequence, the ten key characteristics seek to create new economic opportunities that are not purely economy-driven.

Additionally, various tools exist for accelerating and implementing sustainability on the ground. The assessment schemes collected in the Substitution and Alternatives Assessment Toolbox[11] of the OECD are mostly concerned with the avoidance and coping of hazardous properties. Some tools span a broader view on sustainability, like the UBA Guide on Sustainable Chemicals (UBA, 2016) and its corresponding IT tool SubSelect (UBA, 2020). Innovative and sustainability-oriented business models like chemical leasing[12] are complementing such tools in practice. Despite successful efforts, we believe it is overdue to mainstream and scale-up solutions for sustainable transformation.

For the strategic goal to advance Green and Sustainable Chemistry, three elements are important: At first, gaps need to be filled in terms of technical, management and political descriptions of Green and Sustainable Chemistry. Second, complementing the definitional efforts, existing and future building blocks on Green Chemistry and Sustainable Chemistry indicators, criteria and descriptions have to be structured and interlinked. Third, communication capabilities are needed to convey the ambitious topic appropriately among the technical, management and policy levels.

[7] Cf. https://www.thegef.org/what-we-do/topics/chemicals-and-waste, accessed 18 Sep 2022

[8] For reference and more information see https://www.acs.org/content/acs/en/greenchemistry/principles/12-principles-of-green-chemistry.html, accessed 18 Sep 2022

[9] www.isc3.org, accessed 18 Sep 2022

[10] https://www.isc3.org/page/sustainable-chemistry/who-we-are/key-characteristics-of-sustainable-chemistry, accessed 18 Sep 2022

[11] https://www.oecd.org/chemicalsafety/risk-management/substitution-of-hazardous-chemicals/, accessed 18 Sep 2022

[12] For more information see https://chemicalleasing.com, accessed 18 Sep 2022

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To illustrate the broad landscape of the necessary definitional work that needs to be accomplished, two initiatives are noteworthy: (1) As element of the EU Chemicals Strategy for Sustainability[13], the Safe and Sustainable by Design approach (SSbD) currently develops technical criteria and indicators (European Commission, Joint Research Centre, 2022). SSbD refers to the aforementioned guiding instruments and aims at steering innovation towards green industrial transition. In this regard, it strives to substitute or at least minimise production and use of substances of concern, as well as to minimise the impact on climate and the environment throughout the life cycle of chemicals and materials. However, its current structure just offers recommendations limited to research and innovation (including for SMEs) and is by no means a regulatory instrument. SSbD addresses the entire life cycle of a chemical or material, and also considers its functionality. However, evaluation of the product's sustainability is outside the scope. (2) As response of the Sustainable Chemistry Research and Development Act in the USA in 2019[14], efforts are underway to develop descriptive attributes of sustainable chemistry.

As another contribution to the reviving dynamic discussion, the German Environment Agency UBA held its second international sustainability transformation conference in November 2021, entitled "Socio-ecological Transformation: Production, Use and Management of Chemicals to serve People without Polluting the Planet". As a conclusion of the conference, UBA summarized six major objectives, all pertaining to the sustainable production and use of chemicals.[15] These objectives, all a condensation of Green and Sustainable Chemistry, have been re-iterated in the public discussion as priorities which all stakeholders and chemical-reliant sectors have to tackle, namely:

1. preference of low-hazard chemicals where possible,
2. limitation of the most hazardous chemicals to essential uses (while 1 and 2 in any case imply, but significantly disburden the resources needed for, the use of appropriate risk assessment methodology to confirm safe use conditions),
3. adequate conditions for circular economy with pollutant-free material flows,
4. a sustainable measure for chemicals demand including sustainable energy and resource consumption,
5. life-cycle climate neutrality of chemicals, and
6. clear sustainability criteria and indicators to enable transparent trade-off analyses as essential basis to deliver the necessary significant push in globally achieving the 2030 Agenda Sustainable Development Goals.

Cooperation across sectors at all levels from local to global is of particular relevance for effectively achieving any of these goals. Such bold and overarching endeavours inevitably need intense discussion. This journal alone published several pertinent contributions in its issues since June 2021 (Heck and Winters, 2021a; Gosalia, 2021; Franz and Kircher, 2021; Heck and Winters, 2021b; Paulus, 2021; Holthaus and Hemmati, 2022). Most recently in May and June 2022, the G7 ministerial meeting[16] and the Stockholm+50 conference[17] put noteworthy focus on the nexus of pollution, chemicals, and sustainable development. Yet urgency is needed to transform discussions and declarations into concerted and effective actions.

Integration for more effective cooperation: The SAICM multi-sector, multi-stakeholder approach to advance chemicals management with supporting UNEA resolutions

In the context of negotiations under the UN Strategic Approach to International Chemicals Management (SAICM), the fourth session of the International Conference to International Chemicals Management (ICCM4[18]) launched in 2015 an Intersessional Process (IP) "to prepare recommendations regarding the Strategic Approach [SAICM] and the sound management of chemicals and waste [SMCW] beyond 2020", inter alia "informed by the

[13] https://ec.europa.eu/environment/strategy/chemicals-strategy_en, accessed 18 Sep 2022
[14] https://www.congress.gov/bill/116th-congress/senate-bill/999, accessed 18 Sep 2022
[15] https://www.umweltbundesamt.de/en/press/pressinformation/chemicals-better-protection-of-environment-health, accessed 18 Sep 2022
[16] G7 Climate, Energy and Environment Ministers' Communiqué 27 May 2022: https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Europa___International/g7_climate_energy_environment_ministers_communique_bf.pdf, accessed 18 Sep 2022
[17] Stockholm+50: a healthy planet for the prosperity of all – our responsibility, our opportunity. https://www.stockholm50.global/, accessed 18 Sep 2022
[18] http://saicm.org/About/ICCM/ICCM4/tabid/5464/language/en-US/Default.aspx, accessed 18 Sep 2022

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2030 Agenda for Sustainable Development".[19] At ICCM4, the aforementioned sustainable chemistry considerations received their initial explicit reference, when Germany announced its plan to establish the ISC3 at a Special Event "ISC3 – Moving sustainable chemistry forward!".[20]

Gibson (2021) identifies SAICM with its unique characteristics and in its ongoing renewal process as an ideal case study. His analysis of SACIM's strengths and weaknesses as transnational public-private partnership (TPPP) explores how findings about actors, processes and context of SAICM are in line with prevailing theories on the effectiveness of such partnerships. This analysis has the potential to inspire the design of SAICM and SMCW beyond 2020. With regard to goal setting of the existing SAICM, Gibson (2021) concludes in his research, that "evidence paints a bleak picture", i.e. work needs to be done in particular on stringent goal setting, progress monitoring and reporting structures.

The SAICM IP has recently regained track with its postponed forth meeting (IP4) in Bucharest, Romania[21] - three years after the previous face-to-face meeting IP3. Finally, also with an expected delay of three years due to the pandemic, the ICCM5, 25-29 Sep 2023 in Bonn, Germany, will have to agree on four major threads: 1) a coherent and ambitious set of strategic objectives and targets, 2) adequate governance and effective mechanisms for implementation, 3) how to identify and tackle issues of concern, and 4) most challenging as ever, on finance. In a nutshell, SAICM's existing and already ambitious Overarching Policy Strategy (OPS)[22] has to be amended and reinvigorated in ways that seek to belatedly achieve the 2020 goal in combination with maximized contributions to the 2030 Agenda SDGs. This endeavour deserves utmost policy attention as well as best efforts of all stakeholders involved, because the ICCM5 outcome will be the next most relevant and global reference for how chemicals can serve people sustainably without polluting the planet.

In support of the future SAICM and all aspects of SMCW beyond 2020, the United Nations Environment Assembly UNEA 5.2 approved several future-oriented landmark resolutions in March 2022.[23] Most notable are Resolutions UNEP/EA.5/Res.7 on the Sound Management of Chemicals and Waste, and UNEP/EA.5/Res.8 on the establishment of a Science-Policy Panel to contribute further to the sound management of chemicals and waste and to prevent pollution. Further to this, and of major relevance with a view on how chemicals can serve people without polluting the planet, Resolution UNEP/EA.5/Res.11 on enhancing circular economy as a contribution to achieving sustainable consumption and production was adopted, as well as Resolution UNEP/EA.5/Res.14 to end plastic pollution. As to the latter, the way is paved to developing an international legally binding instrument in the coming years. Noting the challenge of the triple planetary crisis mentioned at this commentary's outset, a recent review even argues for a global binding chemicals and materials framework, as a third pillar of global governance on a par with the ones on climate and biodiversity (Steinhäuser et al., 2022) – certainly a long way to go.

Like the aforementioned holistic approaches of green and sustainable chemistry already implicate, the potential of more systematic integration is receiving new attention in several discussions. With a focus on SMCW, several IOMC[24] partner organisations sketch this out in their information document for IP4, referring to three core dimensions of integration: 1) establishing basic national chemicals management systems with adequate institutional, skill and regulatory capacities, 2) integrating chemicals and waste management in specific key industry sectors and product value chains, and 3) integrating these efforts within sustainable development.[25] With their recent perspective, Blumenthal et al. (2022) provide notable arguments in particular for integration of the first two dimensions. The third dimension of integration receives particular attention as potential success factor by

[19] Cf. ICCM4 Report, Decision IV/4 (http://saicm.org/Portals/12/documents/meetings/ICCM4/doc/K1606013_e.pdf, accessed 18 Sep 2022)

[20] http://saicm.org/Portals/12/Documents/meetings/ICCM4/ICCM4%20Side%20Events%20Schedule.pdf, accessed 18 Sep 2022

[21] http://saicm.org/Beyond2020/IntersessionalProcess/FourthIntersessionalmeeting/tabid/8226/language/en-US/Default.aspx, accessed 18 Sep 2022

[22] http://saicm.org/Portals/12/Documents/saicmtexts/New%20SAICM%20Text%20with%20ICCM%20resolutions_E.pdf, accessed 18 Sep 2022, OPS on pages 10-23

[23] https://www.unep.org/environmentassembly/unea-5.2/proceedings-report-ministerial-declaration-resolutions-and-decisions-unea-5.2, accessed 18 Sep 2022

[24] The Inter-Organization Programme for the Sound Management of Chemicals, run by nine Partner Organizations, see https://partnership.who.int/iomc, accessed 18 Sep 2022

Vol.19, Iss.3, October 2022
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Gibson (2021) stating "the need to integrate the SDGs in a SAICM [and SMCW] Beyond 2020 agreement in order to develop active meta-governance".

As interim appraisal, it might still be impossible to draw reliable conclusions on how to mitigate the health and environmental impacts of chemical pollution and intensification: just capacity building and effective implementation, or much more resolute progress towards mainstreaming sustainability into all aspects of dealing with chemicals? Given the extent of key challenges to be tackled, we are convinced it is justified to fully consider both approaches in finding the most effective measures on the ground. Collaborative, evidence-driven and case-specific prioritisation will by all means be more promising than to play one off against the other.

Common objectives reloaded: The value of global goals and the challenge to develop and agree such goals for joint orientation

Obviously, several bold initiatives, like those described in the previous subsection, provide evidence for broad recognition of the challenges. While these initiatives spark and intensify discussions, there is a lack of a common understanding of how to boldly implement the goals on the ground, how cooperation gets most effective and how to get the necessary funding.

A global goal could be seen as a promising way to provide orientation; its value is best explained with the climate goal limiting global warming to the science-based numerical value of 1.5°. This goal is a reference in the public domain at all levels: It is the result of empirical studies on the relation between greenhouse gas emissions and climate change, on drivers for and impacts of climate change. In this way, a numerical figure for a very palpable physical variable presents a handy tool for setting targets, timelines and reduction goals which are to be addressed jointly by all stakeholders, like governments, industries of multiple sectors, farmers, academia, NGOs, to name just the key actors involved. So, overall, a global goal appears to be an ideal vehicle to stimulate discussion of trade-offs and adequate measures, agree on action and force implementation. Thus, the global 1.5° goal proves very beneficial to gain broad attention, for communication, and for basic orientation in managing activities and cooperation to address the climate crisis.

An UBA Thought Starter (Stolzenberg et al., 2021) sought to start a discussion on how it might be possible to find a commonly agreed extent of chemical intensity that respects all guard rails in a comprehensive understanding of sustainability. We believe that the basic idea, i.e. that chemical intensity could and should be sustainable, deserves much more attention and further in-depth development, since it well reflects the ambiguous nature of chemicals mentioned at the outset of this commentary. Even discussions about how to scale up circularity, at the same time overdue and progressive, do not yet explicitly address the obvious need to limit the per capita use of chemicals to a sustainable measure. Put in a nutshell, we need to additionally and seriously consider sufficiency.

This need is obvious, since chemicals production capacity is going to increase globally by a factor of 3.7 in absolute terms and 2.3 per capita, just in the forty years from 1990-2030.[26] Basically, the idea of a sustainable chemical intensity is inspired by the Doughnut Economy Approach (Raworth, 2017) seeking to find a corridor, confined by the essential needs of societal wellbeing and the planetary boundaries (Stolzenberg, 2021; Heck and Winters, 2021b). Admittedly, it will still require quite some research and discussions before this idea could be developed in ways how the 1.5° goal serves the implementation of climate protection. Major reasons are various: At first, it appears impossible to find a likewise plain and tangible measure for consequences of our use of chemicals; in contrast to myriad potential chemical pollution impacts, the link between greenhouse gas emissions and global warming is clear and therefore easy to explain. Secondly, a measure of chemical intensity has to consider a number of complex aspects. Like number and quantities of chemicals used, portions of chemicals with toxic and otherwise critical properties, extent of inextricably blending or entropy, and quite some more. At third, already less globally designed life-cycle-oriented measures for chemicals like carbon footprint or environmental footprint

[25] SAICM/IP.4/INF/18, Strengthening integrated chemicals and waste management: An IOMC contribution to the intersessional process on the "Strategic Approach and sound management of chemicals and waste beyond 2020". 17 pages, available at http://saicm.org/Portals/12/documents/meetings/IP4/2022/SAICM_IP4_INF_18_IOMC%20Integrated%20chemicals%20and%20waste%20management__.pdf

[26] UNEP, 2019: Global Chemicals Outlook II (full report, cf. figure 3.1 + related text)

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imply demanding data requirements and assumptions. These assumptions remain, as a matter of principle, debatable, whereas a global average temperature is not (apart from the models calculating it). For these reasons, the resulting proxy of chemical intensity might not clearly enough guide trade-off considerations, at least on a global level. If not yet as global goal, the basic idea of a sustainable chemical intensity could however firstly be applied to specific sectors, chemical uses or applications. Fantke and Illner (2019) undertook already a foray themed "Goods that are good enough" with a focus on consumer products, and concluded the "need to move from eco-efficiency indicating relative improvements to eco-effectiveness linking chemical-related impacts to absolute sustainability limits, considering entire chemical and product life cycles".

As to the world of chemical pollution, Persson et al. (2022) made a brave attempt to establish a planetary boundary for this "novel entity". However, for the time being the concept may not be fully usable for analytical purposes; for example, the model or concept behind the term "system", and in this connection the terms "function" and "process" that are used in various places in the publication would need to be clarified. Yet there are clear merits of this attempt in establishing a planetary boundary for pollution, namely that it alerts to the fact that more pollution is a dead end and that "business as usual is not an option", which closes the loop to the GCO-II (UNEP, 2019). After all, Persson et al. (2022) advanced the highly demanding discussion, namely whether establishing a planetary boundary for novel entities including pollution would be methodologically possible (cf. Diamond et al., 2015, Fenner and Scheringer, 2021).

While some clarity on carrying capacities for pollution can be achieved at local or regional levels, drawing a global picture is much more challenging. In particular it is difficult to locate and trace substances, mixtures and products on global markets, track their movements in environmental compartments, products and trade, and what impacts they have at the local, regional and global levels. Overall, it is challenging to establish cause-effect relations between chemical hazard and global pollution levels and impacts. It is also a fact that, due to the overall complexity of issues involved, even the vast amount of data and information which is available in dedicated databases, e.g. at OECD and ECHA, is insufficient to produce the necessary knowledge. So far, both the global goal and the knowledge where we are making progress require more clarity.

Bottom line

Chemical intensification and the multiplicity of its impacts are deeply threatening to both human health and our planet's capacity to absorb pollution. While a range of regulatory and non-regulatory tools are available at local, regional and also global scale, their overall governance is fragmented. Moreover, their existence as such is ineffective in making chemical intensity sustainable and abandon pollution. Gaps still exist in many respects, including insufficient state capacity, knowledge, risk management, regulation, sustainability-orientation and funding.

SAICM is not a regulatory tool on a par with conventions. Rather it is a cooperation framework which is dedicated to creating a worldwide community devoting attention and resources to SMCW, the sound management of chemicals and waste. In fact, this is the aim of the ongoing intersessional process and the ICCM5 conference in 2023. Just as much, the real implementation work is to be done between conferences. Since goal-oriented cooperation is a key lever of change, we believe that much more effort should be invested in effective multi-stakeholder and multi-sector partnerships across yet existing borders. In any such effort, industry and entrepreneurship are the protagonists, and their actors and sectors have to follow the economic paradigm. This implies needs like level-playing fields, respect of business confidentiality and an economy of scale, to name just a few important aspects. Thus, while cooperation initiatives and partnerships need to consider the specific needs of industry, any action will have to be embedded in a regulatory and conceptual frame ensuring a sustainable pathway. This in turn requires true dialogue and collaborative efforts among all affected stakeholders and sectors.

Despite all challenges to specify the details, we believe that necessary discussion of details must no longer prevent significant advancements in the right sustainable direction. Ultimately this means that resolute cooperation is key between regulators, industry with its sectors, academia, and civil society, to successfully re-orient the mega-machinery of production and consumption towards future-proof sustainability.

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