Tackling Water Pollution and Promoting Efficient Water Use in Industries

INTRODUCTION

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) undertook a project to strengthen national capacities in designing policies for water treatment and use in key industrial sectors in seven countries in the region: Bangladesh, Cambodia, Indonesia, Lao PDR, Myanmar, Pakistan, and Viet Nam. Due to their booming industrialisation, these countries present high-water consumption and water pollution potential.

The project started by taking stock of key policy lessons and recent case studies from the region. Examples used for this project include the People’s Republic of China’s (PRC) Water Ten policy reform, which captures proven and effective measures to limit water pollution and promote sustainable water use in the industrial sector. Building on such examples, this project emphasizes the role of legislation, an integrated approach towards policy formulation founded on a theory of change, and the need for enforcing the polluter pays principle.

In February 2019, in an effort to disseminate these findings, ESCAP held a workshop to build stakeholder capacity and identify challenges and opportunities in the region for addressing water pollution by industries and promote more efficient water usage. This policy brief provides an overview of the policy landscape in addressing water pollution in countries, then summarises the key challenges to water use...
and management under three broad categories of information, incentives and institutions. It then discusses the existing policy to address these challenges and also highlight some emerging solution approaches. The brief concludes with some proposals for enhanced regional cooperation and recommendations for future work.

OVERVIEW

National governments are aware that industrialisation can lead to environmental degradation. In fact, policymakers across the region have made substantive efforts to introduce policies that curb environmental impacts, many of which are specifically targeted at industrial water pollution (see Annex, Table 1).

These efforts are also demonstrated through water and environmental legislation aimed at protecting the environment in the face of rapid industrialisation. In Bangladesh the National Water Policy (1999) and the Bangladesh Water Act (2013) delineate policy principles regarding industrial water use. In Cambodia the Strategic Development Plan (NSDP) for 2014–2018 states the importance of protecting natural resources and sustainable development and outlines tangible policies to address water pollution. In Lao PDR the Water Resources Law was updated in 2017, aiming to improve the sustainability of Lao PDR's water resources. It is expected to influence the monitoring, management and planning of the country's vast rivers. Myanmar’s 2012 Environmental Conservation Law established ambient water quality standards for surface water, marine water and groundwater. In Pakistan the 2018 National Water formulates projects and master plans for water conservation, water development and water management. In Indonesia the Environmental Protection and Management Law (2001) encompasses a green industry standard, punishment against intentional water pollution, subsidies on preserving environmental functions and water pollution sanctions. Finally, in Viet Nam the Law on Environmental Protection (2014) established special funds to support pollution control, an effluent permit system, mandatory compensation and remediation of environmental damages.

However, despite these efforts, pervasive patterns of water pollution and inefficient water usage are still observed. Moreover, common polluting industries exist in amongst numerous countries in the region and contribute to the pollution of many

Figure 1. Rating the success of key policies across the region

Source: UNESCAP Stakeholder Survey
transboundary water resources, suggesting the need for regional cooperation for pollution control. Across targeted countries, top polluters include the textile industry, iron and steel, food and beverage production, agriculture and construction (see Annex, Table 2). These top polluting industries are not only water polluters but also water users, making them contributors to both water quality and water scarcity. These concerns raise questions about the success and failure of policy implementation across the region.

Key stakeholders in target countries were asked to identify the most important tools in limiting adverse water impacts from industrialisation. The top four policies were wastewater recycling, pollution treatment, discharge policies and ecological policies. This feedback demonstrated a pattern in public policy thinking, preventing polluted water from entering water ways is at the forefront of water pollution prevention for many countries.

However, stakeholders tend to view these policies as unsuccessful. When asked to rate their perception of already implemented policies based on a five-point scale for implementation, transparency and effectiveness, most policies averaged 1 or 2 across all three criteria with only few policies scoring above 2 (see Figure 1). This called for deeper exploration of the critical challenges facing policy implementation.

CHALLENGES

Based on research and consultation with relevant stakeholders, the main challenges faced by policymakers when addressing water pollution from industry can be divided into three distinct categories: information, institutions and incentives.

Information: The low availability and dissemination of data surrounding industrial water pollution is an obstacle to sustainable industrial water management. To build and monitor sustainable industrial systems, the impact of industry on water needs to be more accurately and regularly quantified.

1) Data gathering:
   a. Inadequate environmental impact assessments
   b. Unsustained water quality monitoring
   c. Lack of decentralized data generation and participatory data gathering involving all stakeholders

2) Data dissemination:
   a. Low public awareness on the state of water quality and pollution
   b. Poor communication with industry and other stakeholders

Institutions: Industrial water issues often stem from institutional failure and fragmented approaches. Investing efforts in internal and external institutional coordination and building strong enforcement framework are therefore crucial channels to control water use and pollution.

1) Policy framework:
   a. Lack of clear and appropriate policy tools
   b. Insufficient policy coherence across ministries and levels of government
   c. Low collaboration and buy-in from private sector
   d. Lack of strategy for transboundary water resources management

2) Policy coordination:
   a. Low political will to protect the environment and enforce the existing policies
   b. Inadequate capacity to carry policy commitments, especially monitoring and enforcement.

Incentives: The ability to adopt sustainable production practices and the drive to reduce water pollution are determined by incentives. Often, industrial water issues are the result of a choice architecture that fails to push industries towards greener behaviours and fails to deter them from polluting.
The following section reflects on the potential solutions to address some of the challenges identified in the previous section. Recognizing the need to prioritize issues, the solutions presented here do not offer a mirror image of the challenges previously identified. Rather, they highlight some of the most promising solutions available regionally. This section is divided between existing solutions (A), comprising the low-hanging policy tools, and emerging solutions (B), that sheds light on more innovative and exploratory solutions.

A. EXISTING SOLUTIONS

Information
In order to strengthen public information and participation, two aspects of public policy need to be strengthened: information and engagement. Improving information on environmental policy requires that government spearhead two particular information tools, support efforts and benchmarking efforts:

1) Support efforts: This type of information tool is used to direct or justify particular programme activities, such as the establishment of specific regulatory requirements or the introduction of new practices to better abide by industry standards. This type of information tool is designed to provide information to companies seeking to understand regulations. Examples can include flyers regarding environmental regulation and best practices or posters demonstrating compliance methods, which can be accompanied by many other forms of communication and information.

2) Benchmarking efforts: This type of information tool informs constituents and policymakers on the status or trends associated with environmental conditions and/or activities. These kinds of efforts seek to define benchmarks that can be used to inform debate, to aid setting priorities for future policies or actions based on accurate environmental status, or to help evaluate progress in achieving previously specified goals, providing clarification on the nature and status of environmental problems and challenges. Examples can include public information campaigns on emissions and water use, such as Malaysia’s awareness campaign among riverine populations, or the release of statistics and case studies each year.

These information tools act on two levels to inform government, industry and the public. First, they inform private companies to understand and engage with new environmental measures. Second, they inform the public on the status of the environment and consequential policies, empowering the public to make hold the government and private companies accountable. However, engagement with the public is an important prerequisite in the process to ensure information in disseminated.

In order to ensure engagement, governments must give platforms that companies and constituents can engage in. For example, PRC’s Water Ten enabled public reporting of environmental crimes. As a result, private companies committing environmental mismanagement are now exposed in the public media and required to issue televised...
apologies. This type of action enables public awareness of environmental issues, in turn fostering ‘environmental conscience’ in society. Consequentially, clear information distribution or exchange between public institutions and the general public drives public engagement with broader environmental issues.

However, public institutions do not solely drive public awareness. Non-governmental organizations and civil society play a major role in increasing information circulation on environmental issues and hold governments and the private sector accountable. An example of this is the International Water Association (IWA) initiative on creating “Water Wise Cities”. Through this initiative, IWA has developed a shared understanding towards sustainable urban water in resilient and liveable cities among urban stakeholders. “Water Wise Cities” cover levels of action, knowledge and capacity, governance and tools for planning and implementation.6 Similarly, GIZ’s Best Available Technologies Reference (BREF) compiles information on best available technologies to inform decision-making within specific industries (see Case Study 1). Another example, is multi-stakeholder processes.

In order to address the improvement of monitoring activities the following improvements are required:6

1) Improved access to monitoring technologies: With monitoring technologies becoming increasingly affordable, adoption by private and public actors must be eased by ensuring marketplace availability and low taxes on technologies.

2) Improved understanding of appropriate monitoring methodologies: Training and distributing up-to-date educational information on standardized monitoring methods to the private and public sector is central to support monitoring compliance and the establishment and maintenance of data centralization.

**Case Study 1: Best Available Technologies Reference (BREF)**

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) has developed a method to assist government officials and other stakeholders to index available procedures and processes to be followed, helping to streamline sustainable practices inside companies. BREFs can be developed for any country and industry.35

The BREF document can be initiated by forming a Technical Working Group (TWG) consisting of technical experts representing industry associations, companies, non-governmental organizations (NGOs) and permitting authorities.36 TWG members are nominated to participate in the information exchange primarily based on their technical, economic, environmental or regulatory expertise (especially in permitting or inspecting industrial installations) as well as on their ability to include end-user perspectives of BREFs. The information exchange within the TWG forms the fundament of any BREF document for a given sector. A BREF is a potential information tool to disseminate information on best available technologies to support sustainable transformations. The contents of the BREF include scope and structure of the selected industry; key environmental issues; main process steps that contribute to the environmental burden; the type and format of the plant-specific data that should be collected; and techniques to consider in the determination of BAT as well as “emerging techniques” and processes, the implementation of which would bring environmental and/or economic benefits to the chosen sector.37

This method was used in India to develop best available techniques reference documents for textiles, tannery, and chemicals (dyes and pharmaceuticals) industry sectors for supporting improved environmental compliance. For more information please visit: [http://seip.urban-industrial.in/e63552/e65250/e65251/](http://seip.urban-industrial.in/e63552/e65250/e65251/)

Source: Raghu Babu Nukala (2019)38
Case Study 2: The Role of Multi-stakeholders Platforms in the Policy Development Process

Global Water Partnership Southeast Asia and its partners in Indonesia successfully formulated a position paper on the inclusion of community-based water and sanitation programme for the Water Resources Law Draft of the Republic of Indonesia. The paper was presented and accepted by the Parliament after series of meetings and workshop co-organized by GWP-SEA together with UNICEF Indonesia, Centre for Regulation Policy and Governance (CRPG) and Jejaring AMPL (Indonesia’s Water and Sanitation Networks). The discussions that were held in September 2018 involved civil societies, non-governmental organizations, government representatives, academics, related partners and mass media.

The outputs of the workshops were several suggestions and revision to the articles on the Law Draft. These outputs were the results of series of smart discussions, cutting through many noises that might have deviate the efforts along the way. Especially the noise of political issues.

Similar multi-stakeholder position papers help the decision-makers understand the multi perspectives of stakeholders and prioritize issues to be addressed.

Source: Fany Wedahuditama (2019)

3) Improved data collection: Once monitoring is achieved, national data tracking and data centralization is extremely important to inform policy choices. This extends to effective and continual environmental impact assessments to ensure policies reflect current trends.

4) Improved education on access, development and interpretation of data: Strengthened capacity for data collection and analysis can enable stronger data collection and more accurate monitoring practices. Further, training local communities on environmental monitoring enhances their involvement, resulting in more efficient implementation and an improved environmental conscience.

5) Streamline business reporting on environmental performance: Environmental monitoring for compliance is usually a costly and time-consuming activity for business to establish. Simple, clear and effective guidelines for business will enable better environmental monitoring and reporting and foster stronger cooperation between the public and private sector (see Case Study 3).

Monitoring efforts need to be complemented by effective enforcement, presenting the following characteristics:

1) Clear roles and responsibilities: In order to coordinate nation-wide effective governance, individual ministries and local government actors need to have clear directives on actions and responsibilities. This ensures institutional ownership over national goals.

2) Integrating water into broader policy frameworks: Building broader policy

Figure 4. Multi-stakeholders

Source: Global Water Partnership
frameworks across industry and ministries enables more integrated and stronger management systems for combating pollution along watersheds. Integrated “source-to-sea” approaches can be effective solutions to preserve the health of widely shared watersheds like the Mekong.\(^7\)

3) **Institutional accountability**: Effective and accountable institutions are important to curb corruption, strengthen the rule of law and enforce regulation. Corruption, lack of monitoring capacity, and weak legal frameworks can be significant obstacles to effective environmental enforcement.

4) **Intra-governmental cooperation**: Ensure that ministries are working towards similar goals to avoid the development of policies that conflict with larger environmental objectives. Industrial water use policies should seek alignment with a country’s overall industrial strategy. To successfully shift towards a more sustainable industrial water use, the water policy cannot be taken in isolation and must be inscribed in a larger transformation of economic structure. For instance, China’s Water Ten policy package has a specific segment on “transformation and updating of economic structure” which aligns the policy package with national industrial development vision.\(^8\)

5) **Accountability**: Develop monitoring plans to hold every level of government accountable. Developing a method to monitor the implementation of environmental standards at every level of government can mitigate corruption and encourage the consistent enforcement of environmental regulation. To strengthen accountability, Article 33 of China’s Water Ten policy stipulates that in case of severe water pollution or environmental

### Case Study 3: Co-operative Regulation

New approaches to law and regulation try to use private managerial capacity to advance sustainable development goals.

An OECD study shows that a “co-operative form of regulation is gradually emerging that attempts to induce companies to use their private compliance expertise to advance public enforcement objectives”.\(^4\) The study makes the following example:

OECD governments have integrated private compliance efforts into their regulatory and law enforcement strategies in such areas as environment and food safety. Although they are often referred to as co-operative regulation, these new approaches rely on more than just trust and good faith. They can create powerful incentives for companies to adopt initiatives in support of corporate responsibility while allowing them the flexibility they need to adapt their management system to their own business situation.\(^4\)


### Case Study 4: PaCT, Effective Public Private Platform to Tackle Water Pollution

PaCT is a project run by the International Finance Corporation in Bangladesh playing a leading role in driving the long-term competitiveness and environmental sustainability of the textile wet processing sector by addressing high water, energy, and chemical use through the adoption of best practices in the textile sector. These best practices lead to declining resource consumption, soaring profits, and an enhanced image in the global apparel market. The programme activities encompass working with leading global brands to adopt environmentally sustainable buying practices, promoting best practices in textile factories, addressing sector transformation and regulatory policy gaps, and financing resource efficiency projects in textile factories.\(^4\)

For more information please visit: [https://www.textilepact.net/about-us/what-is-pact.html](https://www.textilepact.net/about-us/what-is-pact.html)
damage, appropriate officials are to be held liable, even after retirement also their performance evaluations are strongly linked into environmental outcomes.\textsuperscript{9}

6) Cost effective enforcement measures: literature shows that regulatory enforcement measures are often hindered by low cost effectiveness.\textsuperscript{10} Conversely, market-based solutions, such as environmental taxes, offer reduced enforcement costs and lower the need for government intervention.\textsuperscript{11}

**Incentives**

Shifting to a circular economy or towards more sustainable practices demands an enabling environment for industry change. While water pollution control is predicated on private companies upgrading their practices,\textsuperscript{12} the breadth and speed of these changes are influenced by the broader environment: economic, cultural, social, legal and political.\textsuperscript{13} In that sense, government and society have the power to influence industrial practices in purposeful and subtle ways, from government-led initiatives to consumer behaviour.\textsuperscript{14}

In order to incentivize change, several policy tools can be utilized:

1) **PublicPrivateDialogue:** Developing forums for the public and private sector to communicate environmental challenges enables a greater understanding of the barriers to compliance for the private sector, allowing policymakers to design environmental regulation accounting for industry capabilities. It is important for governments to work together with industry associations so that membership to such associations can be subject to compliance
with environmental standards. This can motivate higher compliance

2) **Environmental rating systems**: Environmental rating systems such as PROPER (see Case Study 5) incentivizes companies to comply with environmental regulation by signalling to consumers positive messages about their sustainability efforts. This, in some cases, can create competition between firms and induce consumer driven change by redirecting consumers to more environmentally responsible products.

3) **Improved human capital**: If governments are going to lead the development of management and reporting standards, they further need to promote this area of expertise through their systems of higher education, which should offer special course work and degree programmes in various fields of environmental management, science, technology and compliance.¹⁵ Further, strengthening capacity of workers in industries can deliver significant efficiency gains in terms of promoting cleaner production (see Case Study 6).

4) **Financial incentives**: These can be of two types: positive incentives, which pull individuals and institutions towards greener behaviours, and negative incentives, which sanction pollution. Positive incentives such as subsidy programs for green technology allow companies to overcome the financial impediments to cleaner practices. For example, in China the government invested heavily in centralized water treatment facilities, which provided an indirect financial incentive for firms. Negative incentives follow the polluter pays principle, taking a toll on the pollution produced in the form of taxation. These two types of incentives are closely related as environmental taxation can have the double effect of discouraging environmentally harmful behaviour and increasing public funding for environmental initiatives.

The revenues of environmental taxation are not, in many instances, systematically directed towards environmental investment. For some governments, the opportunity cost of incentives and subsidies appears too high and resources are allocated in priority to non-environmental action. However, the UNIDO TEST programme has shown that spreading information on the financial upsides of environmentally friendly practices can be an effective tool to move towards cleaner production practices (See Case Study 8).

**B. EMERGING SOLUTIONS & APPROACHES**

While the previous segment presented some of the ways to directly address our current challenges, the following emerging solutions aim to go beyond these

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**Case Study 6: Impact of Skill Development Programmes**

Skills development for operators/technicians in effluent treatment plants is critical in ensuring more efficient use of existing technologies and facilities. GIZ developed skills development programmes in India, training over 500 technicians, leading to clear improvements in five pilot industries.

Results indicated:

1) Reduction in excess sludge generation in the aeration tanks,

2) Improved clarifier performance leading to reduction in Total Suspended Solids (TSS) and Chemical Oxygen Demand (COD) by about 19 per cent,

3) Reduced water consumption, reduced COD and Ammoniacal Nitrogen, reduced sludge,

4) Reduced sludge generation at the effluent treatment plant, and

5) 20 per cent reduction in sludge generation and reduced moisture content.

This programme demonstrated the effectiveness of simple capacity building programmes in improving water quality.

Source: Raghu Babu Nukala (2019)²²
challenges and shift the paradigm from which we approach industrial water policy.

Nature-Based Solutions
Nature-based solutions take advantage of naturally occurring ecosystem services and seek to solve pollution issues using those ecosystem services. For example, Australia’s water policy sheds light on wetlands’ effectiveness in removing pollutants from industrial runoffs. While wetlands only cover about 2.6 per cent of the planet, they play a disproportionately large role in hydrology. Wetlands “directly impact water quality by filtering toxic substances from pesticides, industrial and mining discharges.” There is evidence that wetlands alone can “remove 20 to 60 per cent of metals in water and trap 80 to 90 per cent of sediment from runoff. Some countries have even created wetlands to treat industrial wastewater, at least partially.” However, wetlands cannot filter out all types toxic substances discharged into the water and their capacity has limits. Exceeding these limits could cause irreversible damage to the ecosystem, hence the need to recognize limits accordingly.

Case Study 8: Low Carbon Development for Productivity and Climate Change Mitigation through the Transfer of Environmentally Sound Technology (TEST) Methodology
UNIDO has developed a programme with the Government of Cambodia, titled ‘Low carbon development for productivity and climate change mitigation through the Transfer of Environmentally Sound Technology (TEST) methodology’ in order to reduce the long-term risk of climate change through the transfer of environmentally sound technologies in Cambodian industries, targeting the garment industry and food & beverage production.

According to UNIDO, the programme works in the following way:

TEST supports the sound management of resource use at priority industrial hot spots to minimize use of resources, maximize productivity, and promote zero discharge through demonstration of best practices, application of clean technologies, and capacity building. The methodology demonstrates that industries can achieve economic benefits through the application of best environmental practices and resource efficiency. The programme does this by (1) revealing the “total costs” of resource use inefficiencies within production, (2) assessing industry resource efficient & environmental performance against sector benchmarks and international best practice, (3) understanding root causes of inefficiency and, (4) installing an effective information system on priority material and energy flows.

Source: Sooksiri Chamsuk (2019)
Source-to-Sea Management System

Current approaches to environmental protection in rivers, coastal zones and marine environments struggle to promote sustainability due to a limited understanding of ecosystems and linkages. This is partly due to poor or fragmented governance along the continuum from source to sea. This shortcoming demands cooperation and strategic overview to accommodate the needs of all stakeholders.20

The aim of the S2S approach is to systematically consider and target context-specific governance structures and integrated management practices to address strategic resource flows - water, sediments, pollutants, environment goods and services, biodiversity - vital to effectively sustaining ecosystems and socio-economic development in a given river basin or watershed. S2S explicitly recognizes complex upstream-downstream connections, supply and demand linkages and the increasing interconnectedness of resources and resource users as we reach natural resource limits.

S2S provides a collaborative platform to identify and strategically address multiple users and needs and for mainstreaming multiple national-global environment benefits and their management within wider (e.g. production) landscapes. S2S permits a high degree of flexibility to focus on the key priorities of critical basin landscapes, and to include all strategic actors to develop and implement governance frameworks.

The S2S method can support governments and key stakeholders to identify a small number of the most urgent challenges in a river basin and develop the frameworks required to address these. Examples of activities could include addressing upstream over-consumption of water to benefit downstream stakeholders (from farmer households and businesses, to the needs of growing cities) and functioning/healthy ecosystem flows; transforming unsustainable land-use practices to reduce erosion and removing incentives to over-use agricultural inputs such as pesticides and fertilizers. All S2S work is preceded by a comprehensive account of the water balance to determine the specific impacts of any intervention in the water cycle.

Successful use of the S2S platform includes Myanmar, which established a high-level platform bringing together institutions in the source-to-sea continuum, including fishery and forestry ministers to address the problem of institutional fragmentation across river basins. Through this platform, Myanmar hopes to improve coastal and marine conversation.21

Water Reuse and Resource Recovery

Reusing and exchanging water across sectors can lower the cost of water supply and wastewater treatment for the private sector and industry and promotes more efficient use of water.22 This can be achieved through means of industrial symbiosis where by water discharged from one industry or entity can be used and recycled by others.23 This practice can greatly reduce the amount of clean or fresh water being consumed by industry, as well as increasing water availability and improving

Source: IWMI[56]
community relations, increasing productivity per water input, lowering waste water discharges and their pollutant load, reducing thermal energy consumption and potentially processing cost”. 24

Separating wastewater streams as early as possible alleviates resource recovery and facilitates the treatment process. In particular, the separation of greywater promises new ways of reusing water. Compared with wastewater reuse, greywater involves smaller cleanliness concerns and demands less treatment effort. Not only water, but energy and nutrients are also more easily recovered from source-separated wastewater. Examples of source separation include the 40 million domestic biogas reactors in China. 25

Symbiosis can be achieved within a business or between businesses with the potential to reduce water bills as well as wastewater treatment costs. 26

A business can reuse wastewater that is clean enough for the purpose for which it is being reused. Rainwater and process water can be reused for purposes such as: 27

- Irrigation (see also reuse of wastewater in agriculture, optimisation of water use in agriculture or WHO guidelines on reuse of wastewater in agriculture)
- Washing
- pH adjustment
- Fire protection

Towards Smart and Sustainable Industrial Parks 28

In response to the complex nature of water management, many countries across the region have adopted industrial parks or eco-industrial parks as part of the management solution. By grouping industry in one place, government is more able to manage, promote and build capacity of private entities, as well as quickly adopt new solutions and improve and strengthen the overall water management capacity of industry. However, there are debates about the strengths and weaknesses of central and decentralized waste water management or water pollution management. On the one hand centralized parks offer easier management, and entities are able to combine efforts in managing waste, on the other hand, the environmental carry capacity required for an industrial park is high and costs of moving industry into one location are also high. These are two highly important considerations for countries seeking to adopt this method.

In China, the government has rolled out many initiatives and supporting policies for the development of eco-parks. There are three industrial park pilot programs currently running in PRC: circular transformation industrial parks, eco-industrial parks and low carbon industrial parks/green parks/smart parks.

These parks have key characteristics, namely:

- Government as key enabler
- Central management systems
Case Study 9: Resource Recovery and Water Sensitive (Urban) Design (IWA)

A range of new initiatives are underway to promote and accelerate the development and uptake of resource recovery science and technologies. The key has become how to move from research to practice, while also taking into account (a) the market potential for the resource recovered, (b) appropriate public policy, regulation and institutional arrangements to support and accelerate resource recovery and (c) stakeholders' needs well integrated with technologies, markets, policy, new initiatives, current research and practice. Within this light, IWA has developed a Resource Recovery Cluster. The core issues of the Resource Recovery Cluster are to innovate science, technology and business which promote the recovery of resources from the drinking and used water treatment facilities.

For more information on the Resource Recovery Cluster please visit: https://iwa-network.org/groups/resource-recovery-from-water-cluster/

Source: Katharine Cross (2019)

Case Study 10: Retrofitting Industrial Parks

In order to achieve these outcomes GIZ has developed a tool box on retrofitting industrial areas which can be found at https://www.sia-toolbox.net/phase-intervention/retrofitting:

Many existing industrial areas which have been established years ago were planned and implemented without any sustainability considerations. Some of them developed organically without a proper planning at all. Old industrial areas are often too densely constructed with no proper or only an inappropriate sewage and waste collection system, and no facilities for wastewater treatment. The results are often environmental pollution, and growing conflicts with neighbouring communities.

Improving the infrastructure can make already a great difference to the previous situation. Open sewage drains which are often filled with waste need to be cleaned, repaired and covered. Regular maintenance and a gradual implementation of an underground sewage system should make sure that surface and wastewater is managed properly. The sewage of the park should either be fed into the communal sewage system or treated in a central wastewater treatment plant at the periphery of the industrial area. Scattered waste and informal waste dumps need to be removed and a reliable waste collection system introduced.

Source: Raghu Babu Nukala (2019)
The application of Zero Discharge standards is being extended to a large variety of industries with highly promising results. Closed loops have been successfully implemented in the meat industry in China, where pigs are fed the chlorella green water fermented liquid generated as a by-product of wastewater treatment, another example is energy generation in the Philippines. In similar vein, Zero Discharge of Hazardous Chemicals (ZDHC) standards are adopted by the textile and leather industries in Bangladesh. There, major ready-made clothes manufacturers including H&M, Nike and Asos have been following the ZDHC Roadmap to develop a list of Manufacturing Restricted Substances to ban from their facilities. ZDHC seems to kindle increasing industry buy-in as a significant share of companies having adopted such lists have reported to find their benefits to largely outweigh their costs. In India Zero Liquid Discharge (ZLD) Zero Liquid Discharge (ZLD) guidelines were recently introduced for four industrial sectors (textile (wet processing), distilleries, pulp and paper and tanneries) in India to promote uptake of ZLD practices in these industries.

**Case study 11: Zero Discharge Policies**

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Zero Discharge

Zero discharge refers to strategic wastewater management systems that ban the discharge of industrial wastewater into the environment — following a zero liquid discharge model (ZLD) — or ensure that hazardous chemicals are not released in the environment. According to the World Bank, zero discharge measures could reduce water abstractions by up to 75 per cent. They do not, however, affect non-consumptive use and have the potential to reduce return flows to the environment. Their implementation must therefore be considered carefully in a local, location specific, context. To best harness zero discharge standards, it is crucial to first implement water use reduction programs. When paired, these two measures can drastically reduce the water costs and the average water abstraction.

between government and the private sector that can be integrated into new models of industrial water management.

**Living Rivers**

An interesting legal tool worth noting in the plight for stronger enforcement of environmental compliance is the case for living rivers, granting legal rights to rivers. The concept of granting legal rights to non-human entities is not new, but it has only recently begun to be implemented for nature conservation. There have been many instances of rivers being granted legal rights, including in Ecuador 2008, in Bolivia 2010 and more recently in New Zealand and India. These are the first examples of legal rights being applied to a specific, identifiable, bounded natural feature and have opened a new pathway for water resources management.

The High Court (HC) in Bangladesh recently delivered a historic judgement on 3 February 2019, declaring rivers as legal entity and assigning the National River Protection Commission (NRPC) as the legal guardian to act as their parent in protecting the rights of waterbodies, canals, beels, shorelines, hills and forests. It stands to be the most comprehensive verdict by any court in the world to give such specific directions to protect the rights of rivers or any other natural entity.

The High Court verdict in Bangladesh regarding the legal rights of rivers goes beyond just recognising rivers as legal entities; it outlines a mechanism to implement the rights of rivers. The HC provided detailed directions to several government agencies to take steps to enlist the land grabbers and to publish the names of perpetrators, not to provide loans nor to allow them to run for public offices, to treat river grabbing as a crime, to remove illegal structures from rivers, and to amend the laws to punish criminals responsible for the deterioration of the natural flow of rivers. This move in Bangladesh is monumental, and hopefully a positive step forward towards cleaner water resources.

However the conditions to grant or enforce legal rights have historically been lacking and, as a result, legal rights for nature have been difficult to enforce. In the examples of Ecuador and Bolivia, “few legal cases advocating for the rivers legal rights have been successfully upheld and even when the rights have been recognized in court, local actors responsible for enforcement have lacked capacity to translate the legal decision into effective outcomes on the ground.”
While considering the target countries of this study, transboundary river basins and regional water bodies must be discussed. Between Bangladesh, Cambodia, Indonesia, Lao PDR, Myanmar, Pakistan, and Viet Nam exist 24 transboundary water bodies. The need for regional cooperation in the region stems primarily from the fact that pollution occurring upstream affects downstream users. In South and South-East Asia, this need is first amplified by the pressure of the global value chain, as well as the urgent need to establish regional cooperation for transboundary water bodies. The challenges of upstream users cannot be separated from the issues of downstream users. The need for a basin-wide approach was clearly expressed by workshop participants, who requested that analytical studies be made on the region as a whole. Given the water endowment and distribution of the region, policymaking must integrate the needs and issues of all stakeholders along transboundary river basins and water bodies. With a better understanding of river stakeholders and the water demands of the region, countries will be able to better develop more comprehensive river basin management strategies and will be able to better evaluate the environmental carrying capacity of these water bodies.

Due to the difficult nature of regional cooperation for transboundary rivers, a more pragmatic approach to transboundary water bodies or water pollution should shift focus towards benefits and regional solutions, while also finding the balance between political and technical outputs. Regional bodies could work either at the country level with commissions or at the business level at multinational business councils to identify mutual interests and move towards achieving environmentally positive outcomes together.

Possible Regional Initiatives

1) Regional effluent standards: To synchronize policies regarding industrial effluents, regional governments could consider developing common standards for effluents, industrial water treatment and reuse. The European Union (EU) offers an example of regional benchmarking of industrial effluent standards. To control industrial emissions, the EU has developed a general framework based on integrated permitting: the Industrial Emission Directive (IED). In order to be granted permits to operate, industries covered by the IED must comply with the Best Available Techniques (BATs). Permitting is called “integrated” because the permits must take account of a plant’s complete environmental performance to avoid pollution being shifted from one medium - such as air, water and land - to another. The directive includes provisions on regular inspection and public participation in the permitting process. Similar efforts to ensure common minimum effluent standards for industrial sector at the regional level could pave way for greater regional collaboration.

2) Regional green technology and innovation platform: A regional initiative on green technology and innovation to control water pollution could greatly assist the regional efforts in combating water pollution by enabling exchange of knowledge and promote mutual learning. Cooperation to disseminate green technologies already exists at the global level in various forms, as exemplified by the International Environment Technology Centre (IETC) of UN Environment. There is, however, need to further promote the accelerated transfer of environmentally sound technologies in areas of water use, management and control of pollution including monitoring. Technological and informational cooperation could also compile information on best available technologies to inform decision-making within specific industries following the model of Best Available Technologies Reference (BREF) documents developed by the EU for specific industries. Given the pace of technological change, such knowledge exchange platform should aim to keep track of and constantly update such documents in collaboration with industry associations and...
other relevant stakeholders.

3) Regional green investment guidelines:
Regional green investment guidelines, which includes minimum standards on pollution control, would help regional economies set higher environmental standards without reducing their economic competitiveness. The idea would be for the region as a whole to raise environmental standards together through effective regional collaboration. As mentioned, emerging economies often face the pressure to prioritize economic growth over environmental protection. Much of this reluctance towards regulation comes from competition to attract foreign direct investment (FDI) or foreign buyers. In this race for economic growth, countries want to maintain their market competitiveness and reduce costs for FDI as well as domestic investments. However, regional cooperation could help harmonize investment guidelines for environmental impact across the region and eliminate concerns over competition. For example, in a spirit of attracting foreign investments while promoting a sustainable use of natural resources, the Association of Southeast Asian Nations (ASEAN) has developed a set of guidelines on responsible investment in food, agriculture and forestry. The guidelines are aimed mainly at governments and agencies in South-East Asia, with the ambition of joining forces to integrate environmental concerns in their international trade policies. They include recommendations to support technologies that “improve efficiency in the sustainable management and use of raw material, natural resources, energy and waste.” Similar guidelines at the regional level that can act as minimum standards for national level investment policies can be helpful for the region as a whole to improve environmental performance of the industrial sector.

To implement regional solutions, countries could set up committees overseeing cooperation or information exchange and nominate representatives from civil society, industry or their ministries to facilitate this exchange. Existing regional

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**Case Study 12: Mekong River Commission**

The Mekong River Commission is the most established transboundary river commission in effect in the Asia region. The Mekong was one of the first international rivers for which there was recognition of the need to manage the river equitably and as a whole system. Established in 1957 under the auspices of ESCAP (the then UN Economic Commission for Asia and the Far East (ECAFE)). The Mekong Committee was a development organization consisting of representatives of the four lower Mekong riparian countries which coordinated a series of investigations to assess the potential of the basin for hydropower, irrigation, and flood control projects. In 1970 the Mekong Committee produced the 1970 Indicative Plan for the basin, which identified 180 possible projects to promote basin-wide development, including a cascade of seven mainstream dams. However, the political situation in the region, and the reluctance of potential donor countries to support large infrastructure projects, meant that none of the mainstream projects were built, which remains the case today for the Mekong below China.

The Mekong River Commission has implemented six notable initiatives pertaining to navigation, fisheries, hydropower, basin development, water utilization and environmental protection. Management of large international river basins in developing countries is often hampered by both a lack of technical capacity as well as a lack of political consensus. In the case of the Mekong, there has been substantial technical achievement. However, success in the politics and governance of international river basins is a far greater challenge. The Mekong River Basin is not yet in a generally degraded condition, although the trends are alarming. In many of the large river basins where governance appears to be more strongly developed than in the Mekong, political agreement was only achieved after the river became so degraded that politicians and senior bureaucrats were forced to act. Examples include the Rhine and the Colorado, and a similar story for national rivers can be told for the Murray–Darling in Australia, the Thames in the UK, and the Mississippi in the USA, among others.
mechanisms such as ASEAN, the South Asian Association for Regional Cooperation (SAARC) and the ESCAP Sustainable Business Network could play key roles in the development of these initiatives. However, most important for a regional approach is finding common interests and mutually beneficial issues to focus attention, and as seen from the case study on the Mekong River Commission, the balancing of political and technical priorities.

CONCLUSION

There are significant overlaps between the challenges confronted by countries in addressing water pollution and promoting efficient water management in industrial sectors. These challenges mainly fall under three broad categories: information, institutions and incentives. Transboundary water bodies add a layer of complication to already complex systems of water management. However, target countries are enthusiastic about the prospect for regional cooperation to develop regional standards for water quality and foreign direct investment. While the region suffers due to substantial water pollution challenges, the future looks positive with emerging efforts at top levels of government to develop comprehensive plans of action.

Key takeaways:

1) Governments in the region have made great strides in addressing environmental degradation in the face of rapid industrialisation by developing policy frameworks, however implementation needs to be strengthened.

2) Better water management demands greater circulation of information to and from institutions. Incoming data on water quality must be trusted, decentralized and continuous to inform institutional decisions. Outgoing information regarding water regulation and pollution must be clear and systematically disseminated to achieve policy goals.

3) Cross-ministry collaboration and clear division of responsibilities and accountability can improve effectiveness of policy implementation.

4) Incentive schemes such as environmental performance ratings that facilitates credit access, financial subsidies and tax breaks could be used selectively to nudge industry towards compliance and adoption of cleaner production practices.

5) Emerging approaches such as nature-based solutions, source-to-sea management approaches, enhanced water reuse and resource recovery approaches, smart and sustainable industrial parks, recognizing the rights of rivers and zero-discharge standards need to be promoted and scaled-up.

6) Regional cooperation is highly important in the region. Mutually beneficial interests offer an opportunity to develop and facilitate transboundary cooperation on water pollution issues in the region. Beyond transboundary river management issues, regional cooperation can also cover areas such as regional effluent standards, green investment guidelines and technology cooperation.

The real costs of environmental degradation are too high to delay action any further. Stakeholders in the region are aware of the problems and key solutions. Stronger means to take action and stronger will from society as a whole, will enable more effective environmental governance at the national and regional level.
<table>
<thead>
<tr>
<th>Group</th>
<th>Brief Description</th>
<th>China</th>
<th>Bangladesh</th>
<th>Cambodia</th>
<th>Indonesia</th>
<th>Lao PDR</th>
<th>Myanmar</th>
<th>Pakistan</th>
<th>Viet Nam</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Industrial Development Policies</td>
<td>Policies that regulate, restrict and enforce environmental regulation on developments</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Discharge Policies</td>
<td>Policies that restrict and enforce fees and permit systems to regulate water discharge</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Ecological Policies</td>
<td>Policies that assess the environmental impact of industrial production and evaluate costs and benefits to adjust future and current policies and taxes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Emissions Trading</td>
<td>Emissions trading, a market-based approach to controlling pollution by providing economic incentives for achieving reductions in the emissions of pollutants.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Environmental Tax</td>
<td>Policies that provide offsets and incentives through the taxation system for sustainable practices</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Wastewater Treatment</td>
<td>Policies that regulate and enforce the treatment of water pollution, restrict water pollution and monitor water pollution</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Alternate Water Resources</td>
<td>Policies that encourage and subsidise the use of alternate water sources other than fresh water i.e. Sea Water</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Green Production</td>
<td>Policies that incentivise greening the supply chain of production, including technology upgrades and better product sourcing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Water Pricing</td>
<td>Policies that regulate the price of water to manipulate consumer behaviour and compensate on environmental impacts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Waste Water Recycling</td>
<td>Policies that encourage, subsidise and enforce wastewater recycling</td>
<td>✓</td>
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<tr>
<td>Water Withdrawal</td>
<td>Policies that regulate the acceptable limits of water withdrawal for use in different contexts</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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Source: ESCAP desk review
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<thead>
<tr>
<th></th>
<th>Bangladesh</th>
<th>Cambodia</th>
<th>Indonesia</th>
<th>Lao PDR</th>
<th>Myanmar</th>
<th>Pakistan</th>
<th>Viet Nam</th>
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<tr>
<td>1</td>
<td>Textile</td>
<td>Iron and Steel</td>
<td>Iron and Steel</td>
<td>Iron and Steel</td>
<td>Food and Beverage</td>
<td>Sugarcane</td>
<td>Construction</td>
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<td>Leather</td>
<td>Sporting and Athletes Goods</td>
<td>Nonferrous Metal</td>
<td>Non-ferrous metal basic industries</td>
<td>Distillery</td>
<td>Leather</td>
<td>Agriculture, fishery and forest</td>
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<tr>
<td>3</td>
<td>Sugar</td>
<td>Drugs and Medicines</td>
<td>Chemical Products</td>
<td>Pulp, paper and paperboard</td>
<td>Others</td>
<td>Textiles</td>
<td>Food, beverage and tobacco</td>
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<tr>
<td>4</td>
<td>Agriculture</td>
<td>Jewellery and related articles</td>
<td>Metal Products</td>
<td>Basic Industrial Chemicals except fertilizer</td>
<td>Textile and Dyeing</td>
<td>Trace and repairing services</td>
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<td>5</td>
<td>Paper</td>
<td>Spinning, weaving, fishing textiles</td>
<td>Sugar Factories and Refineries</td>
<td>Distilling, rectifying and blending spirits</td>
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<td>Mining and quarrying</td>
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<td>6</td>
<td>Construction</td>
<td>Rubber Products, NEC</td>
<td>Tobacco Manufactures</td>
<td>Jewellery and related articles</td>
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<td>Textile, wearing apparel and leather industries</td>
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<td>7</td>
<td>Transport</td>
<td>No Data</td>
<td>Shipbuilding and Repairing</td>
<td>Drugs and Medicines</td>
<td>No Data</td>
<td>Manufacturing of fabricated metal products, machinery and equipment</td>
<td></td>
</tr>
</tbody>
</table>

Source: ESCAP desk review
FOOTNOTES

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46 Information shared by workshop participants.


51 Information shared by workshop participants, see also http://documents.worldbank.org/curated/en/770561468038722316/Indonesia-program-for-pollution-control-evaluation-and-rating-PROPER


55 Sooksiri Chamsuk, UNIDO Regional Hub Office in Thailand. Presentation at the ESCAP Workshop on strengthening national policies for improving water use and limit water pollution in key industrial sectors in Asia, 21 February 2019, available here: https://www.unescap.org/sites/default/files/05.%20UNIDO%20TEST%20ppp%20for%20ESCAP%202019.pdf


58 GIZ. (2017). RETROFITTING. Available at: https://www.sia-toolbox.net/phase-intervention/retrofitting


The EU BREFS are available here: http://eippcb.jrc.ec.europa.eu/reference/


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