

Focus Area: **POLLUTION CONTROL**

Market Segment: **SOLID WASTE MANAGEMENT**

ISIC: 3900 (Waste Mgt), 3830 (Materials Recovery/Recycling)

Segment Score: 17

Sample Investments:

- **Private:** Circulate Capital Ocean Fund; Waste recycling firms
- **Public:** Waste infrastructures

1. Relevance to ADB Ocean Action Plan (Score: High=3)

- a. Solid waste management is an important problem and mainly stems from the lack of proper infrastructure through South Asia and South-East Asia. According to [Circular Capital](#) and [AVPN](#), about 60% of land-based plastic waste leakage originates in five countries: China, Indonesia, the Philippines, Thailand, and Vietnam. This also represents 50% of the plastic pollution in the ocean. Plastic is the main source of marine litter (80%) followed by fisherman nets. Therefore, dealing with solid waste in Asian rivers, especially plastic, is the key solution to this segment.
- b. Because of the lack of environmental regulation, cross-countries cooperation and simply funding, the waste infrastructure across this region are deficient. One solution is the Circulate Capital Ocean Fund who aims to attract foreign institutional capital in an impact fund to finance this gap.
- c. Other initiatives such as the [Plastic Bank](#) who aims to turn plastic collection as a commodity of value through Blockchain technology and the [Ocean Clean Up Initiative](#) with its fleet of boats in Asian rivers to pick up garbage are contributors to the challenge. Regarding fishermen nets, they are collective initiatives in ports and education measures that can fix the problem. Ballast water and thermal pollution are finally also considered as sources of pollutions and can be effectively dealt with industrial technology.
- d. Most of the social and environmental impact stems from having clean water that is a natural and invaluable service. Clean water has a direct impact on the health of local communities as they use it for drinking purposes, household activities, and playground for kids. This will become ever more relevant to the virus now where proper hygiene will be paramount to face it. Reducing this pollution also restores the health of eco-systems which are the source of income for fishermen and farmers.

2. Positive Social Impacts? (Score: High=3)

- a. *Poverty:* Initiatives like the Plastic Bank or other recycling companies such as [Lutro](#) or [Tridi Oasis](#) also empowers local communities and women to collect plastic by rendering it economically valuable. They can exchange their collection against a monetized token which they can redeem for various services through the local economy.

- b. *Gender*: This initiative is particularly favourable for women to get an independent activity on their own and provide for their own livelihood.
- c. *Health*: The increase in waste in the region is anticipated to be 70 percent from 2.01 billion tons in 2016 to 3.40 billion tons in 2050. Developing countries, especially in South-East Asia, will face the greatest challenges, including adverse public health impacts of uncollected waste, such as gastrointestinal and respiratory infections. Beyond health, uncollected waste is also an urban problem as it blocks waste and aggravates floods, directly affecting rural communities. Reducing pollution in the water has also direct health impact that will be better covered in segment VIII. and IX.

3. Positive Environmental Impacts? (Score: Medium=2)

- a. Plastic pollution is a challenge to the health of the eco-systems as it enters the food chains through the fish eating the (micro-)debris. The full extent of the problem and its impact down the line has been a challenging topic for scientists to figure out but many estimates that the amount of plastic in the ocean can become more than the amount of fish by 2050. Fortunately, most of the plastic ends up in mid-ocean gyres that are fortunately neither especially rich in fauna nor particularly biodiverse. Even if it is not the most pressing issue for the oceans, it still affects the health of the river's eco-system and can effectively be dealt at its source; preventing it to find its way to the ocean in the first place
- b. Fishermen nets are also a source of worries for marine species as they can get entangled in abandoned nets and die. According to [the Dodo](#), 650'000 marine animals die because of it.

4. Potential for Market Scalability? (Score: Medium=1)

- a. Circular Capital is an impact fund that has been so far committing USD 100 mn to financing the gap in the solid waste management and aim to attract more foreign institutional capital. This was only supported by local and impact investors in the past decade.
- b. Whilst this is a growing challenge, it is not obvious how successful will this strategy be. Much depends on local regulatory framework and political will. The economics don't seem to be aligned and rely on philanthropic impact schemes.

5. Capacity for Innovation & Growth? (Score: Medium=2)

- a. Financial innovation seems true to be the key to solid waste management where the economics are not aligned to finance the gap. As previously said, Circulate Capital relies on philanthropic impacts schemes where a donor agrees to pay foreign investors for their contribution to the challenge. This impact is "paid" with a premium making the investment attractive.
- b. Given the billions of dollars of investment required for solid waste management in Asia, the current trajectory of investment is not capable of addressing the magnitude of financing needs. Blended finance vehicles have hence a role to play, but more

innovative structures like social impact bonds (SIBs)/ results-based financing (RBFs), as well as products to tap regional capital markets, need to be explored.

- c. Another innovation is Plastic Bank that is offering blockchain token in exchange for garbage people can collect. They can later redeem these tokens to buy other daily commodities. Whilst this will probably not solve the plastic issue alone, it can play its part and contribute to improve the issue and can be a source of independent income for local people.

6. Benefit from Regional Governance Frameworks? (Score: Low =1)

- a. There are a couple of institutions working towards finding a solution to solid waste challenges: [Ocean Conservancy](#), [The Closed Loop Initiative](#), and [Partnerships in Environmental Management for the Seas of East Asia \(PEMSEA\)](#). They all work towards finding the extent of the plastic problem and how it can be solved through the inclusion of the private sector.
- b. But the bulk of the problem is a lack of proper solid waste infrastructure. It stems from heterogeneous local governance, lack of enforcement, and underfunding. This makes the investment theme difficult and dependent on political will, which is a risk for investors. They further estimate that without FDIs or Government support, 55-60% of the infrastructure project is not bankable.
- c. Further according to Circulate Capital, China Sword's Policy, or its desire to no longer accept foreign waste, has reshaped the theme's landscape in Asia and has increased the flows of waste towards South East Asia. To remedy this challenge, a consortium of Chinese companies ([China Scrap Plastics Association](#)) has invested in Southeast Asian waste supply chains for a total of US\$1.54 billion (or RMB10 billion).

7. Opportunity for SMEs? (Score: High=3)

- a. The theme is really attractive for people that didn't have a source of income and can become independent by picking up plastic and exchange it for money, either through Plastic Bank or through the companies supported by Circular Capital.
- b. Reducing pollution in the waterways is also a source of opportunity for fishermen and farmers whose income depends on healthy eco-systems. This point will be covered in greater detail in section VIII and IX.

8. Attract Private Investment? (Score: Medium=2)

- a. Turning waste and more generically plastic into a value is attractive but it is unclear how it can be institutionalized. Circular Capital is trying this challenge but is unclear yet whether they will be able to provide financial attractive returns. They are providing impact and are a great opportunity for impact investors, the currency and political risk associated with their strategy does not make them an obvious golden opportunity. More needs to be researched in that direction.

Focus Area: **POLLUTION CONTROL**

Market Segment: **RESOURCE EFFICIENCY AND CIRCULAR ECONOMY**

ISIC: 3900 (Waste Mgt), 3830 (Materials Recovery/Recycling)

Segment Score: 20

Sample Investments:

- **Private:** Public equities with circular models. Water efficiency technology.
- **Public:** Water infrastructure; efficient pipe systems

1 Relevance to ADB Ocean Action Plan (Score: High=3)

- a. This segment is relevant to ADB's mission as it concerns removing the source of marine litters at its source through circular economic models or efficient resource management. In this segment, two important types of sectors need better circularity and efficiency in their management: Consumer Staples and Water itself.
- b. As previously discussed in the last segment, 80% of marine litters are composed of plastic from consumer staples products. Any companies striving to reduce its litter or waste throughout its supply chain is relevant to the mission of keeping the ocean healthy. There are two sides further to this challenge with the current Covid-19 situation. On the one hand, plastic consumption is increasing for sanitary reasons and some companies are already disposing of their recycling guidelines. On the other hand, a looming economic crisis will make them even more cost-conscious and making the economics of circularity more compelling. Difficult to say which will prevail. As in the last segment, plastic is not the top issue in the hierarchy of marine pollution, and efforts should be prioritized to other types of pollution later covered in this part of the analysis.
- c. The other part of the segment concerns the management of water itself within utilities and industries using water as a resource in their operations. According to the Ellen MacArthur Foundation, the opportunity for circular models of water use is to align it with its natural cycle. It is about going away for the mentality of "Extract-Use-Dispose" towards a more regenerative model with efficient and recycling measures along the water supply chain. This is very relevant for the mission as every drop of water that is not consumed will stay within the water cycle and will not have a chance to be contaminated in the first place.

2. Positive Social Impacts? (Score: High=3)

- a. *Health:* [According to Seas at Risk](#), the impact on human health and safety from marine litter are multiple: risk of entanglement and injury, health risk resulting from degradation of the quality of marine waters due to hazardous waste items on tourist beaches. Plastics also can act as a sponge for harmful pollutants already present in the marine environment. Many fishes eat up this plastic that can eventually find his way to the human food chain.

- b. *Poverty*: uncollected waste leads to water pollution that readily affects rural communities and whose source of income depends on healthy water eco-systems.
- c. *Gender*: Same argument goes for gender issues where women are usually tasked with household activities that depends on water quality.

3. Positive Environmental Impacts? (Score: High=3)

- a. [Still from Seas-at Risk](#), marine animals and birds ingest plastics, become entangled, suffer injuries, or even die because of marine litter. It is estimated that 100 000 marine mammals and 1 mn birds die every year because of marine litter. Marine litter damages and impairs habitats, in particular the seabed where the majority of litter sinks. It also serves as a vehicle for invasive species. It has, therefore, a considerable impact.
- b. Similar to the last comment, proper water efficiency and circular use reduces the chance of pollution and have many positive environments that will be covered in greater detail in segment VIII and IX.

4. Potential for Market Scalability? (Score: high=3)

- a. The circular economy is an “en vogue” theme within sustainability and finance and more companies have been pursuing circular models to reduce their waste throughout their value chain. It is about moving from a “waste-management” mentality to a resource management's one, valuing every piece of the chain. The potential for scalability is therefore high as it turns economics around.
- b. According to the Water and Circular Economy White Paper from the [Ellen MacArthur Foundation](#), here are a couple of companies already involved in the water circular economy and investing in their water efficiency: Danone, Dell, Microsoft, Arup. See the Appendix for the whole table.
- c. There are many industries using water as a primary resource without properly considering its right value; disposing of it with any regard for its cleanness. Water is an important resource for or modern way of life and is necessary for construction with cement, in textile and for dyeing, for ore extraction, and finally for agriculture to feed the crops. Hence many industrial companies can benefit from water efficiency and circular technique to reduce their use, cost, and impact.
- d. Water efficiency is also a great theme for utilities to address the problem of Non-Revenue water. This is the amount of water that is lost every day, similar to food waste, because of deficient hardware, inexact monitoring, or simply theft. According to this [ADB's report](#), utilities can lose up to 65% of daily production for an average of 30%. This is also a point the mission can address to a greater scale.

5. Capacity for Innovation & Growth? (Score: High=3)

- a. Regarding circular models for consumer staples, its potential for growth is great as previously discussed as the economics are getting attractive from a strategical point of view for companies. When incentives are aligned, that is usually the inflection point when things start to change. Furthermore, with a looming global economic crisis, any source of added value will be welcome by companies facing financial challenges. The incertitude is how plastic will play its part in the present sanitary crisis.

- b. Regarding water efficiency and its circular use, its potential is enormous considered its wide use we previously discussed. The capacity for growth is therefore great and the capacity for innovation has its set of solutions that includes:
 - I. Optimization for water reuse and energy use from wastewater
 - II. Using water to capture chemicals and nutrients from agricultural runoff or waste biomass.
 - III. Reuse of treated effluent from industrial use as a source of energy
 - IV. Using water to carry capture nutrients from livestock effluents generate of energy through anaerobic digestion
 - V. Extracting value or thermal energy through water greywater byproducts.
 - VI. Continuous process treatment of sludge to form biogas.

6. Benefit from Regional Governance Frameworks? (Score: High=2)

- a. Other initiatives or institutions are working in the direction of the circular economy both regarding water and consumer staples.
 - I. ReSolve / [McKinsey](#) / [Ellen McArthur Foundation](#)
 - II. [International Water Association](#)
 - III. [Arup](#)
 - IV. [Alliance for Water Stewardship](#)
 - V. [Beverage Industry Environmental Roundtable](#)
 - VI. [Carbon Disclosure Project](#)
 - VII. [International Water Stewardship Program](#)
 - VIII. [Natural Capital Project \(NatCap\)](#)
- b. Whilst this is plenty, it is difficult to quantify the impact of these initiatives and how big of a role they will play. They however definitely support the issue.
- c. Regarding Water Stewardship, through water efficiency and circular use, one of the most important is Non-Revenue Water: According to this [ADB's report](#), reducing Asia's NRW is essentially a governance issue. Illegal connections can only be eliminated when utilities have autonomy and discipline, and especially when they are accountable to regulators and the public. Furthermore, utility employees need genuine incentives to do their jobs right and replace the old perverse and loose initiatives.

7. Opportunity for SMEs? (Score: Low=2)

- a. Most of the initiatives and companies involved in the circular economy through the Ellen MacArthur Foundation and Circular Capital do not involve SMEs and regard the waste and resource management of big companies and water utilities. However, these types of models are attractive for SMEs to better manage their resources, cost, and increase their impact.

8. Attract Private Investment? (Score: Medium=2)

- a. There are more and more companies using circular models and ever more funds constructing portfolios looking for these attributes. Whilst the economics are going in favor of circular models, it is still too early to properly assess the performance of these

young strategies. They are however driving on societal drivers such as growing lack of resources, increasing regulations for externalities, and deglobalization. Their outlook is promising but it is yet lacking a track-record.

Focus Area: **POLLUTION CONTROL**

Market Segment: **NON-POINT SOURCE POLLUTION MANAGEMENT**

ISIC: 9511 (Pollution Control), 3822 Hazardous Waste Treatment

Segment Score: 21

Sample Investments:

- **Private:** Industrial and Healthcare technology for water quality
- **Public:** Water utilities
- **Public/Private:** General CO2 reduction investments; regenerative agriculture.

1. Relevance to ADB Ocean Action Plan (Score: *High=3*)

- a. This segment considered of high importance to ADB's mission. It concerns the pollution society produces but cannot be pinpointed to a single source. The main are chemical, organically, and salinity pollutions from agriculture, ore extraction, and industrial use of water. Their effluents are usually not under control and end up in the river waterways through precipitations or simply run-offs. This is impacting the health of the eco-systems and fisheries, on which local communities depend as a source of food, water, and income. This pollution further damages the oceans as this is increasing the level of phosphorus and nitrogen, leading to eutrophication in the coastal zone and eventually to algae pollution. Several technologies in water efficiency and quality can help to deal with these challenges (through better hardware, software, and green chemistry) or simply with nature-based solutions which have also good carbon storage properties, striking two challenges at once.
- b. The second type of pollution is air-borne with the absorption of CO2 by the oceans. This leads to ocean acidification and is a source of many worries for their general health. This alters the pH level of the water and the survivability of many species. It impacts the entire food chain and the natural services the oceans are providing to the human population and nature. This challenge can be addressed through policy frameworks to instore blue carbon trading in the same vein than other carbon systems, as well as carrying carbon CO2 reducing/-ed investments in general.
- c. Another source of pollution to consider is proper stormwater discharge so that inland pollution does not goes end up in the oceans and becomes more difficult to deal with. This can be dealt with better infrastructure and green areas in cities to soak up the water, or "green roof" technologies for households' settlements to recuperate the water. Finally, pollution from aquacultures such as invasive species and fish waste that are deteriorating seabed is another source of concern. Land-based aquaculture is a solution in that regard.
- d. Water quality (and its related efficiency) is, therefore, a challenge that is affecting many waterways linked to the oceans and critical to ADB's mission. It is furthermore one of the key issues that can solve many others in health, food, and social down the line. From an economic perspective, this segment can be considered with high potential for impact given the resources given. This is hence particularly suited for finance to play its part.

2. Positive Social Impacts? (Score: High=3)

- a. *Poverty*: according to the UNEP Report Snapshot on Water quality (hereafter UNEP Report), the number of people that are likely to come into contact with contaminated surface water in rivers is estimated to 134 mn. The report further states that inland fisheries provide 21 mn jobs for fishermen and 38.5 mn more in post-catch activities. Salinity is also a source of concern for local farmers as this water cannot be reused for agricultural purposes and grow topsoil.
- b. *Gender*: most of these jobs are occupied by low-income people and more than half of them by women. Fixing this issue has the potential to ignite a positive chain of events that can reduce pollution, improve the health of the water, the fish, and eventually the local communities over time. This gives them back a healthy source of income to sustain their livelihood and the opportunity for women to gain more independence.
- c. *Health*: the issue of polluted water also readily impacts health considerations. It alters the safety of the water for drinking purposes, causes health risks on contact, and impacts the quality of the fisheries (both inshore and offshore), on which the livelihood of rural communities depends.

3. Positive Environmental Impacts? (Score: High=3)

- a. As previously discussed, the various types of pollutions affect the health of the fish and ecosystems. Organic pollution occurs when an excess of biodegradable matter enters the water's surface. Its decomposition consumes and depletes oxygen from the water. This has very negative effects on aquatic fauna, especially the fishes. Another pollution is salinity, where agricultural use alters the salt levels in the water and is impacting the eco-system of the river.
- b. Eutrophication happens large loads of nutrients from domestic and agricultural sources end up in the waterways and overstimulate the growth and kills the fauna and the flora of the coastal areas.
- c. Finally, invasive species from aquacultures run-off and their related waste are deteriorating the underneath seabed.
- d. Addressing the various sources of water pollution has, therefore, a high potential to restore ecosystems that have a significant environmental impact.

4. Potential for Market Scalability? (Score: Medium=2)

- a. [According to Rabobank](#), the development challenges in agriculture are enormous. Asia's growing population needs will continue to drive demand for food & water solutions. Limited arable land and inadequate water management in Asia form a challenge to make regenerative agriculture a very compelling solution. Regenerative agriculture is the management of the entire eco-system of the agricultural process and its environment to regrow the wealth of the soil and have a sustainable source of food. Many experiments have been showing promising results in other parts of the world and big food companies such as Danone and General Mills are early adopters. It is also

proven to increase [a farm's profitability](#) and is also a [good carbon storage solution](#). It is however unclear yet how this solution can be adopted by Asian farmers.

- b. Demand for better water quality and stewardship through industrial and healthcare solutions will also drive market growth to satisfy this increasing demand for water. Businesses providing such solutions in the water sector as well as agribusiness are likely to grow in size and scope. There a sizeable universe of investment that can contribute to ADB's mission and becoming a growing opportunity to allocate institutional and private capital to foster change in these developments' challenges.

5. **Capacity for Innovation & Growth? (Score: High=3)**

- a. Many issues in water quality, efficiency, and stewardship, in general, have led to a wealth of innovation. It is for example through smart metering who monitor in real-time the water flows through sensors or through "Green chemistry" which aims to avoid the release of hazardous substances into the water cycle. These technologies are also linked to wastewater and will be further discussed in the next session IX.
- b. As previously discussed, agriculture is an important area. First-hand solutions are nutrient and pesticide management, changing crop rotation and improving irrigation and better draining. Regenerative agriculture has a great capacity for growth with its potential to strike many birds at once, reducing chemical use, improving soil nutrition, and storing carbon.
- c. Regarding stormwater management, runoff is collected in large conduits and is either delivered to a treatment plant or discharged directly to the waterways. An alternative growing solution is "rainwater harvesting" through which water is stored on the urban landscape then is used to water parks and for other non-potable purposes. This also prevents pollutants from ending up in the waterways.
- d. For developing areas, constructing "green roofs" made up of plants that absorb and retain rainwater has become a simple and popular way of dealing with this issue. Besides, green roofs make houses cooler in the summer and warmer in the winter and the roofs act as small habitats for a wide range of flora and fauna.

6. **Benefit from Regional Governance Frameworks? (Score: Low=2)**

- a. Recognizing the improvement of water environmental governance is essential to solve water pollution problems in the Asian region. The Water Environmental Partnership in Asia (WEPA) was launched in 2004 by the Ministry of the Environment, Japan. [WEPA](#) mainly operates through legal, policy, and strategies vectors. Its constituents can be seen in the Appendix). Most of these countries implement regular water quality monitoring and publicly disclosing their results. According to the UNEP Report previously introduced, monitoring plays an important to assess the quality of the water and its evolution over time.
- b. Another organization active in this domain is [NARBO](#). The Network of Asian River Basin Organization is working to bring Integrated Water Resources Management in river basins throughout the Asia-Pacific region.
- c. Whilst there is cooperation amongst countries, it is still the responsibility of each and every one of them to define its own rules and apply them. Still, according to the same

UNEP Report, this is usually the first barrier water pollution faces. There is thus support to this cause but to which extent they can contribute is difficult to quantify.

7. Opportunity for SMEs? (Score: High=3)

- a. As previously discussed, proper water quality is paramount to the health of ecosystems, inshore as well as offshore fisheries and the land. This is a source of income for many rural communities, independent or small-scale fishermen and farmers. Restoring the natural order in those regions by addressing these water challenges will secure the future of their entrepreneurship and the sustainment of their livelihoods.

8. Attract Private Investment? (Score: Medium=2)

- a. The water investment theme has been an interesting investment opportunity for 20 years and many funds have been riding on these drivers and provided [substantial returns](#) to investors. These funds invest globally across the water supply chain. Their allocations, therefore, contribute to the manufacturing of the tools (industrials and chemicals) that will help address water development challenges. How much these funds contribute to health, food, and water challenges needs however to be further quantified. Single-stock picking of relevant companies is also an attractive avenue.
- b. There are otherwise many interesting impact projects that can be compelling for impact investors and philanthropist such as: in Vietnam, agricultural experimenters have created a stable, “closed-loop” ecological system producing fruit, fish, vegetables, and sought-after edible snails without the use of pesticides, fertilizers, and antibiotics. In north-eastern Thailand, irrigation projects have been designed to preserve wetlands and expand educational eco-tourism.

Focus Area: **POLLUTION CONTROL**

Market Segment: **WASTEWATER MANAGEMENT**

ISIC: 3600 (Water Treatment)

Segment Score: 24

Sample Investments:

- **Private:** Wastewater industrials and sectors as well as start-ups providing specific sanitary solutions
- **Private/ Public:** *Water and Waster Chinese Infrastructure, Singapore NEWater*

1. Relevance to ADB Healthy Ocean Action Plan? (Score: High=3)

- a. This segment is considered a high priority to the mission and the main source of pollution. There are many types of bacteria-induced by human waste but they are usually regrouped under the name of fecal coliform. Whilst, not direct pollution itself, it is an indication of a high level of pathogens in the water. In Asia, only half is severed and a third is treated. The lowest treatment rates are in South Asia (about 7%) and Southeast Asia (about 14%). The critical part is, therefore, the treatment of the wastewater, so its discharge does not contaminate the waterways and the ocean downstream.
- b. The main risks are health-related but are also obviously linked to social and environmental issues. According to the UNEP Report, more than 1 billion people have no access to proper sanitation facilities in Southern Asia. The report further states that 4 bn people suffer from diseases related to these types of pathogens globally, of which 1.4 mn are fatal.
- c. The main solution is wastewater treatment through proper infrastructure (hardware and software), along with the various type of treatments (hardware and healthcare) and nature-based solutions. Waste can also become a new source of value or energy. Its potential and relevance for the mission are therefore high.

2. Positive Social Impacts? (Score: High=3)

- a. *Poverty:* this issue readily impacts rural communities have less sophisticated if not no waste systems at all. They are hence more prone to suffer diseases from this sort of pollution.
- b. *Gender:* as discussed in the last segment, these issues readily affect children and women who use the waterways in their daily lives as well as farmers and fishermen for their source of income.
- c. *Health:* this type of pollution particularly affects the health of people. Many diseases are associates with the presence of human waste in the water such as cholera, typhoid, infectious hepatitis, polio, cryptosporidiosis, ascariasis, and diarrhoeal.

3. Positive Environmental Benefits? (Score: High=3)

- a. Untreated wastewater has a direct impact on the biological health and diversity of ecosystems. These are important services to the natural balance of the region. [According to the UN](#), this pollution creates dead zones where the natural flora and fishes cannot survive. It thus impairs the health of the fisheries and the livelihood of local communities. Addressing this issue by treating the wastewater has the potential to reduce and eventually eliminate this pollution; leaving room for nature to heal itself and restore its ecosystems. The wastewater further emits an increasing amount of methane (CH₄) and nitrous oxide (N₂O) emissions which have more potency than CO₂ in terms of global warming and will further increase ocean acidification and its problems discussed in Chapter VIII.

4. Potential for Market Scalability? (Score: *Medium=3*)

- a. According to the UN WWDR Wasterwater the Untapped Opportunity of 2017 (hereafter WWDR), the opportunities from exploiting wastewater as a resource are enormous and there is an increasing recognition that it has much versatile use. The market for this new commodity is split between developed and developing Asian countries. The developed countries have increased their infrastructure and improved the efficiency and quality of their treatment. This market can be seen as a big piece of machinery that requires many components along its supply line to properly function. It is through industrials that produces all type of tools that controlling the (waste-)water (valves, pump, filters, sensors, etc.), healthcare (coagulants, flocculants, disinfectants, etc.), information technology that is providing the software managing the lot and finally utilities taking the responsibility of this stewardship. [According to Meticulous Research](#), the global water and wastewater treatment market is expected to grow at a rate of CAGR of 6.5% from 2019 to reach \$211.3 billion by 2025; with Asia leading this opportunity.
- b. Regarding developing countries, the challenges are more scattered and locally specific. This opens the opportunities for low-cost and low-tech solutions to chip in to have wider growth in impact and scale. According to the same WWDR report, many components of the waste such as salt, nitrogen, and phosphorus have potential economic value and can be used to improve the livelihood of rural communities in the region. People have further the opportunity to gain energy independence by using their waste as a source of energy, reducing the cost of their consumption as well as reducing health and environmental impact as an example seen in Cambodia, China, Thailand, Viet Nam, and the Pacific. Recycled biomass can also be used as a fertilizer in agriculture as it was once done in Central Asia. This reduces the pollution at its source and turns something that was once disposable as a new resource. Analyses of case studies in South-East Asia have shown that revenues from wastewater by-products, such as fertilizer, are significantly higher than the operational costs of wastewater systems that harvest by-products.

5. Capacity for Innovation and Growth? (Score: *High=3*)

- a. The potential for growth and innovation is great as the challenges in water will be a defining moment for this century, and just became even more relevant with the outbreak of the virus. Proper sanitation and hygiene will be paramount in the fight against the virus. The water sector in the developed market is already solid with

established companies providing the necessary tools for more than a hundred years. The technology is in constant improvement to address water quality and efficiency; these being the two main challenges to wastewater according to the same UN report.

- b. [According to Globenewswire](#), the key drivers are the growing manufactory industry with innovations such as Zero Liquid Discharge (ZLD), membrane technology, and also in healthcare with coagulants and flocculants. These are expected to be the commanding technology in the field.
- c. Regarding developing countries, one recommendation from the UN report is compost toilets such as the [Ecosan systems](#). There are many other technologies available and this field has an eco-system of start-up thriving for solutions. They differ in sophistication and costs and can serve specific demands for local challenges.
- d. China and Singapore have been ramping up their infrastructure to deliver water and wastewater services since the last decade. Singapore does not have groundwater resources and has thus built a supply line from different sources: mainly their [NEWater](#) program (high-grade reclaimed water) and desalinated water. Both [NEWater](#) and desalinated water have allowed Singapore to become more resilient towards weather variability and keep up with the growing demand for water resources. By 2060, the total water demand could almost double, with the non-domestic sector accounting for nearly 70%. The need for efficient waste treatment technology will hence be growing and is supporting the investment theme. The story in China is similar but is not covered in detail here for the lack of space.

6. **Benefit from Regional Governance Frameworks? (Score: High=3)**

- a. According to the same WWDR report, the effective management of wastewater requires the support of institutions, including greater support for local authorities. Municipalities and local governments often lack the resources necessary to enforce environmental regulations and maintain water infrastructure. As a result, maintenance problems are usual and exacerbated by the lack of resources. More needs to be done across the region to support local governments in managing urban wastewater.
- b. Regarding infrastructure, Singapore's water regulatory body [Public Utilities Board \(PUB\)](#) has been implementing energy recovery systems. They strive for energy independence (they are still important to water from Malaysia) or even net energy sales from water treatment plants. The aim is to keep the costs of these plants down to alleviate the pressure on water bills. Achieving these savings requires further upfront and ongoing investments into more energy-efficient water and wastewater solutions. This regulation will boost the growth of the investment opportunity.
- c. In China, the policy has been addressing water accessibility challenges over the last ten years and has achieved 80-100% delivery to T1 and T2 cities and 70% of its population according to the [Allianz Global Water Fund](#). As the challenge moves from water accessibility to water quality, the theme is ought to be supported by great institutional needs.

7. **Opportunity for SMEs? (Score: Medium=2)**

- a. The main opportunities for SMEs are through the improved use of water (in terms of efficiency) for any companies using it as a resource in their operations. This will result

in driving their costs down, improving their profitability as well as increasing their contribution to societal and environmental challenges. [SWITCH-Asia](#) is implementing a project that aims to promote water-efficient production and consumption. According to a report of [WE & B](#), 675 high water-consuming SMEs have increased their water management capacity and sustainability and that 25 SMEs are currently implementing BWMPs.

- b. The second opportunity for SMEs is fishermen and farmers who will benefit from the restoration of eco-systems through water pollution reduction. Inshore and offshore fisheries represent an invaluable and often non-substitutable source of income and food to many of people in rural communities. Independent fishermen and related local companies can greatly benefit from a restoration of the eco-systems and the fisheries to sustain their livelihoods.

8. Attract Private Investment? (Score: Medium=3)

- a. The wastewater allocation is also part of the water funds' portfolios discussed in the last segment (VIII). Whilst they invest globally, many of their resources are redirected to finance the tools needed to address the challenges in water pollution. The industrial segments who are prevalent in developed nations are most likely to continue performing in the following decades as water challenges become ever more important. This can be a solid allocation for institutional investors. But again, more research needs to be done to measure their exact contribution.
- b. Conversely, other start-ups who aim to find local and specific solutions, as well as Nature-Based Solutions, might struggle to provide comparable return but their potential contributions in many SDGs can be very compelling to impact investors or other philanthropists.

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[GLOBAL WATER: ASIA UNDER THE INVESTMENT RADAR](#), Allianz Global Water Strategy.
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[The known unknowns of plastic pollution](#), The Economist
[Water and Circular Economy](#), Ellen MacArthur Foundation

Charts:

Challenges:	Best Solutions
VI Plastic	Semi-private waste utilities (CCOF), Blockchain plastic (Plastic Bank).
VI Fishnet	Harbour Collect Binds, partnerships and prevention with fishermen.
VI Ballast Water	Naval / Water Industrials (Alfa Laval).
VI Thermal Water	Water industrials.
VII Consumer Staples	Circular economy / Resources Management (Ellen McArthur Foundation's list).
VII Water Efficiency	Utilities and Water industrials (e.g. Xylem).
VII Non-Revenue Water	Utilities and Water industrials (e.g. Xylem).
VIII Organic Water Pollution	Industrial/Healthcare (e.g. Ecolabs), Regenerative Agriculture (Danone, GM), NBS, Water Start-Ups.
VIII Salinity Water Pollution	Industrial and chemical water treatment, regenerative agriculture.
VIII Eutrophication/Chemical/Alga Bloom/ Red tide	Wetlands NBS, Industrial and Chemical to reduce.
VIII Ocean Acidification	Blue Carbon Trading; General climate mitigation investments.
VIII Stormwater discharge	Industrial infrastructure, "Green Roof" household rainwater recuperation.
VIII Aquaculture waste	Restoring fisheries in general through other vectors sectors as well as inland fisheries.
IX Wasterwater bacterial pollution (developed nations)	Infrastructure China; NewWater Singapore, industrial, chemicals, utilities.
IX Wasterwater bacterial pollution (developing nations)	Compost toilets, other innovations through start-ups.

Figure 1: Summary of the challenges and solutions

Water and Circular Economy Steering Group

#	Organisation	Name	workshop
1	Antea Group	Tristan Steichen, Peter Penning, Nick Martin	Reykjavik, Chicago, London,
2	AquaEnviro	Paul Lavender	London
3	Arup	Kristian Steele, Siraj Tahir, Martin Shouler	Reykjavik, London
4	Avespa	Philippe Bois	Chicago
5	Cranfield University	Fiona Charnley	Reykjavik
6	Danone	Khaoula Essoussi, Ewelina Szopinska	Reykjavik
7	Davines	Paolo Goi	Reykjavik
8	Dell	Jonathan Perry, John Pflueger	London
9	Government of Catalonia	Maitte Ardevol	Reykjavik
10	Grundfos	Louise Schjoett Nielsen	Reykjavik
11	Hera Group	Filippo Bocchi, Enrico Pirancini	Reykjavik
12	Low and Behold / WRc	Philippa Roberts	London
13	Loyola University, Chicago	Nancy Landrum	Chicago
14	McDonald's Corporation	Townsend Bailey	Chicago
15	Metropolitan Water Reclamation District of Greater Chicago	Barbara Scarpardine	Chicago
16	Microsoft	Jim Hanna	Chicago
17	Suez	Frederic Grivel, Ywann Penru	Reykjavik / London
18	The Plant Chicago	Jonathan Periera	Chicago
19	University of Bradford	Amir Sharif	Reykjavik
20	University of Chicago	Carolyn Amadon	Chicago
21	Veolia	Gary Crawford	Reykjavik

Figure 2: List of companies involved in water efficiency

Source: [Water and Circular Economy](#), Ellen MacArthur Foundation

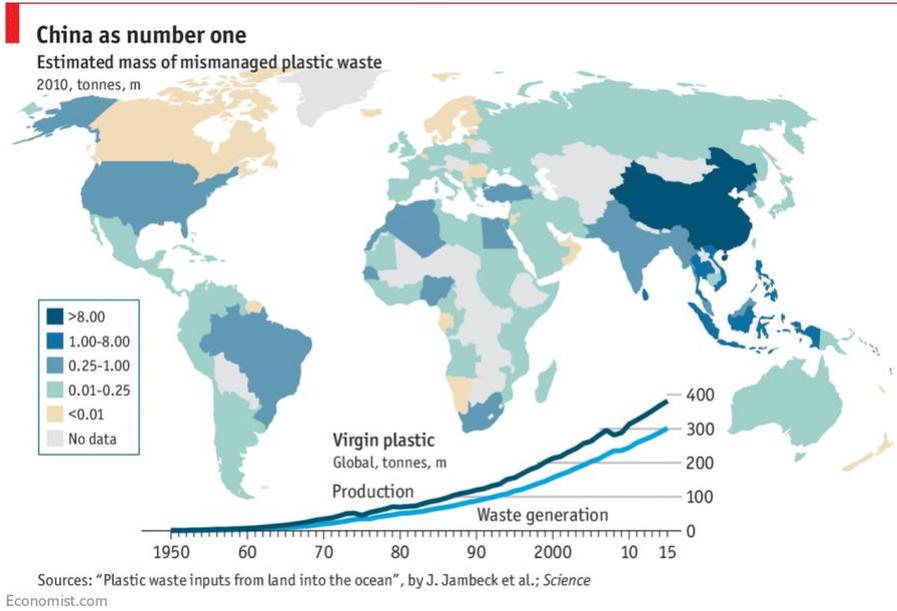


Figure 3: Estimated mismanaged plastic around the world

Source: [The known unknowns of plastic pollution](#)

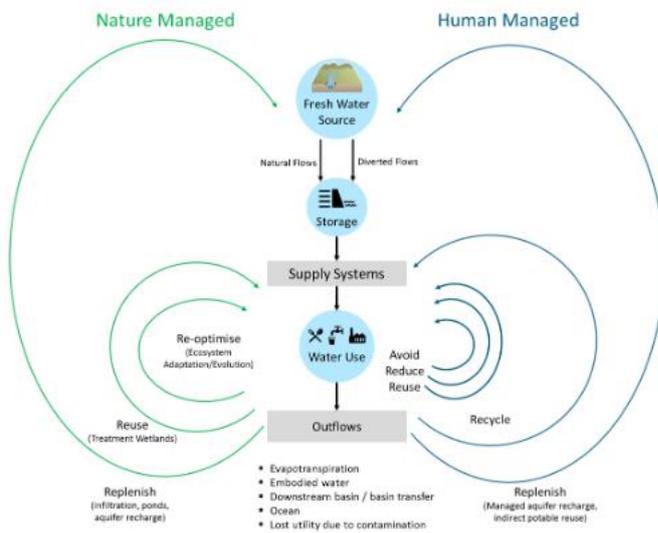


Figure 4: Example of a sustainable water supply chain

Source: [Water and Circular Economy](#), Ellen Macarthur Foundation

Figure 1: Segments of the Plastic Value Chain Assessed

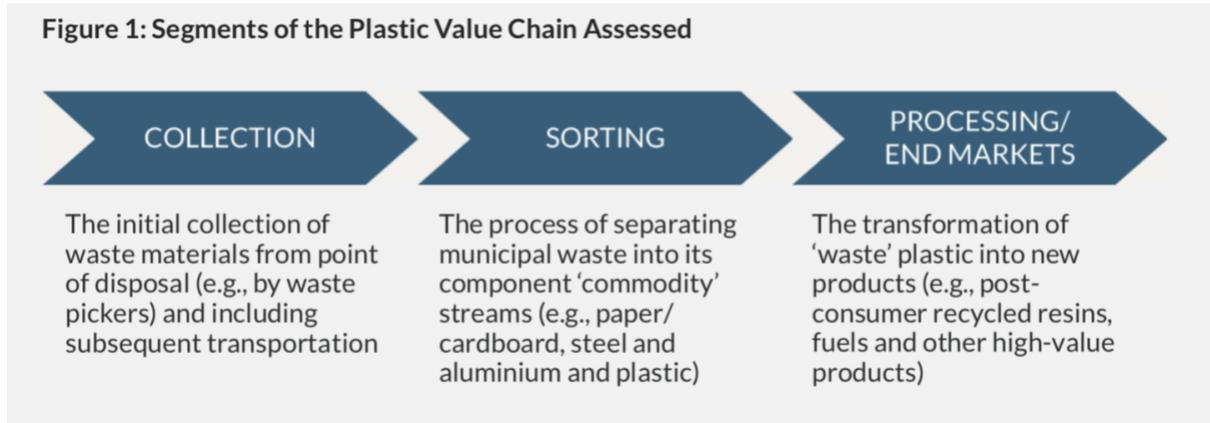


Figure 5: Example of plastic supply-chain

Source: [Investing to reduce plastic pollution in South & Southeast Asia : a handbook for action](#)

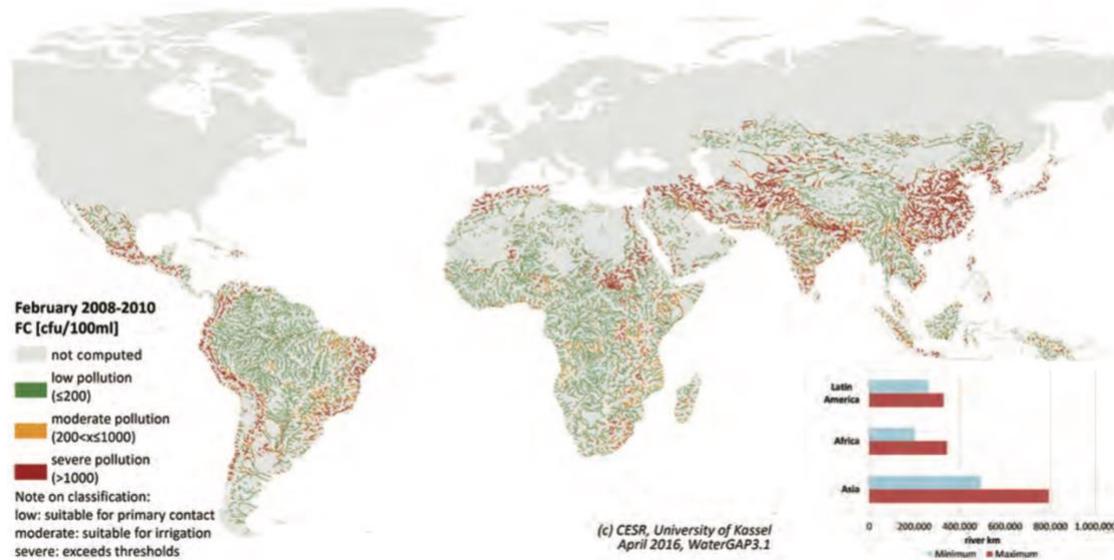


Figure 6: Estimated in-stream concentrations of fecal coliform bacteria (FC) for Latin America, Africa, and Asia for February 2008–2010. Bar charts show the minimum and maximum monthly estimates of river stretches in the severe pollution class per continent in the 36 months from 2008–2010.

Source: [UN WWDR Wastewater Untaped Resource](#)



Figure 7: Trend in fecal coliform bacteria levels in rivers between 1990–1992 and 2008–2010. River stretches marked with orange or red have increasing concentrations between these two periods. The river stretches marked red have an “increasing trend of particular concern”

Source: [UN WWDR Wastewater Untaped Resource](#)

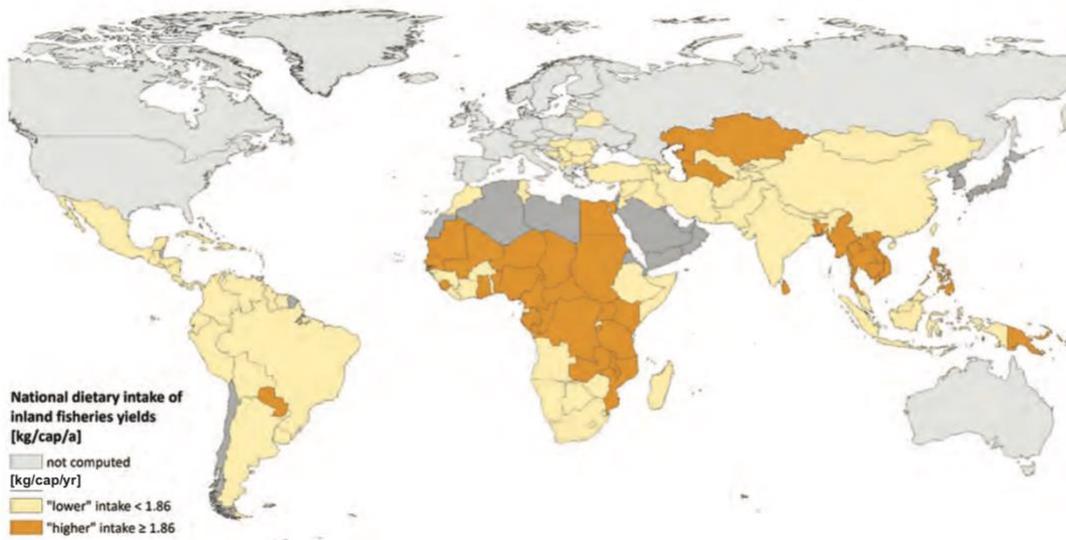


Figure 8: National dietary intake of inland fisheries yields (kg/capita/2010).

Source: [UN WWDR Wastewater Untaped Resource](#)

Establishment of Water Environmental Standard in WEPA Countries

Country	Surface Water	Groundwater	Marine Water
Cambodia	Water Quality Standards in Public Water Areas	Water Quality Standards in Public Water Areas	Water Quality Standards in Public Water Areas
China	Environmental Quality Standards for Surface Water	Quality Standard for Ground Water	Sea Water Quality Standard
Indonesia	Water Quality Criteria	Water Quality Criteria	Standard Quality of Seawater
Japan	Environmental Quality Standards for Water Pollution	Environmental Water Quality Standards of Groundwater	Environmental Quality Standards for Water Pollution
Republic of Korea	Environmental Standards for Water Quality and Aquatic Ecosystem	Environmental Standards for Water Quality and Aquatic Ecosystem	Environmental Standards for Water Quality and Aquatic Ecosystem
Lao PDR	Surface Water Quality Standard	Groundwater Quality Standard	
Malaysia	National Water Quality Standards		Marine Water Quality Criteria and Standard
Myanmar			
Nepal			
Philippines	Water Quality Criteria for Fresh Surface Waters		Water Quality Criteria for Coastal and Marine Waters
Sri Lanka			
Thailand	Surface Water Quality Standards	Groundwater Quality Standards	Marine Water Quality Standard
Vietnam	National Technical Regulation on Surface Water Quality	National Technical Regulation on Ground Water Quality	National Technical Regulation on Coastal Water Quality

Figure 10: Establishment of Water Environmental Standard in WEPA Countries

Source : [Challenges and Targets of South East Asian Water Environment - Insights from WEPA Activities -](#)

Implementation of Ambient Water Quality Monitoring

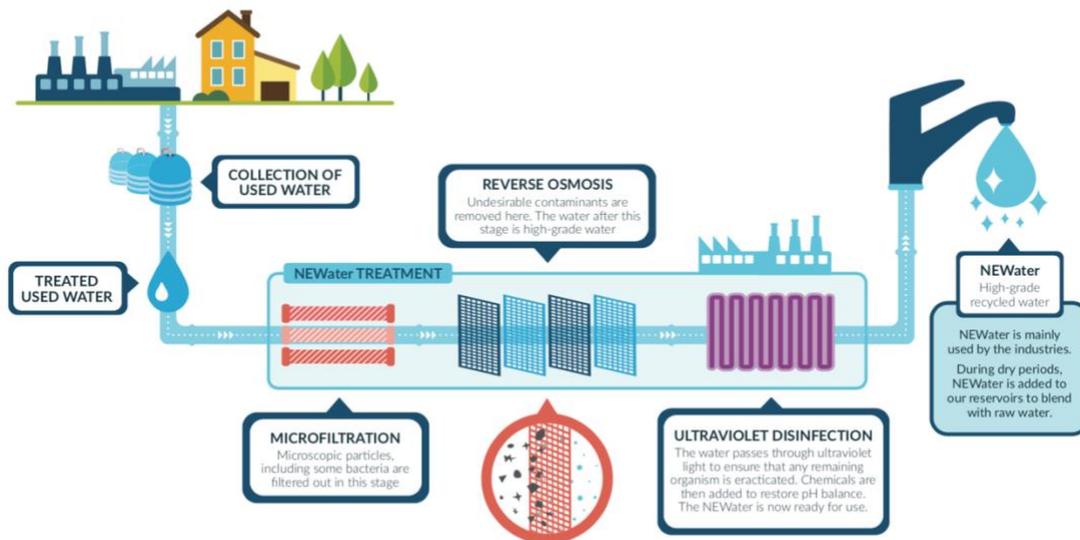
Country	No. of Monitoring Stations	Frequency	Year
Cambodia	10 (rivers)	Monthly	2011
China	469 (rivers), 26 (main lakes and reservoirs), 4 (Three Gorges Dam), 4100 (Groundwater), 279,225 km ² (marine water)	Unknown	2011
Indonesia	Unknown (40 rivers)	At least twice a month	2011
Japan	4,550 (rivers), 475 (lakes and reservoirs), 2,044 (sea), 3,680 (Groundwater)	Monthly	2013
Republic of Korea	697 (rivers), 185 (lakes), 2,499 (groundwater)	Monthly for rivers and lakes (48 times/year for key locations) 2 times/year for Groundwater	2008
Malaysia	901 (rivers), 105 (groundwater), 321 (marine water)	Unknown	2013
Philippines	192 (rivers), 4 (lakes), 88 (groundwater), unknown (marine water)	Monthly or 4 times/year (rivers) unknown (groundwater, marine water)	2001-2015
Thailand	366 (rivers and lakes), 170 (marine waters), 620 stations (groundwater)	4 times/year (rivers and lakes) 2 times/year (marine water)	2012
Viet Nam	248 (surface water)	4 times/year	2007

10

Figure 11: Implementation of Ambient Water Quality Monitoring

Source : [Challenges and Targets of South East Asian Water Environment - Insights from WEPA Activities -](#)

Figure 11.1 General technical scheme of NEWater in Singapore



Source: Courtesy of Singapore's National Water Agency (PUB).

Figure 12 : Singapore's NEWater System

Source: [UN WWDR Wastewater Untaped Resource](#)

Water Environmental Partnership in Asia (WEPA)

Recognizing the **improvement of water environmental governance** is essential to solve water pollution problems in the Asian region, the Water Environmental Partnership in Asia (WEPA) was launched in 2004 by the Ministry of the Environment, Japan. WEPA conducts its activity on a 5-year cycle and the third phase started in April 2014

WEPA consists of partners in **13** Asian countries

1. Democratic Socialist Republic of Sri Lanka (Sri Lanka)
2. Federal Democratic Republic of Nepal (Nepal)
3. Japan (Japan)
4. Kingdom of Cambodia (Cambodia)
5. Kingdom of Thailand (Thailand)
6. Lao People's Democratic Republic (Lao PDR)
7. Malaysia (Malaysia)
8. People's Republic of China (China)
9. Republic of Indonesia (Indonesia)
10. Republic of Korea (Republic of Korea)
11. Republic of the Philippines (Philippines)
12. Socialist Republic of Viet Nam (Viet Nam)
13. Union of Myanmar (Myanmar)



Figure 13 : Water Environmental Partnership in Asia

Source : [Challenges and Targets of South East Asian Water Environment - Insights from WEPA Activities -](#)