

TOP 10  
IDEAS

INVESTING FOR IMPACT

# WASH (Water, Sanitation, Hygiene) and Waste Management

— Impact Future Project —

HOST



COMMISSIONER



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#### ASPIRE IMPACT

Aspire Impact is a social enterprise focused on leadership and ecosystem development in social and environmental impact. Aspire Impact is India's first Impact Rating system, awarding Green Leaf, Silver Leaf, Gold Leaf or Platinum Leaf to corporations using a proprietary 4P (Product, People, Planet & Policy) framework. It is also the Commissioner of the Impact Future Project (IFP).



#### ASPIRE CIRCLE

Aspire Circle promotes enlightened social leadership. It builds and scales Fellowships, Scholarships and Internships, to catalyse India's Impact leadership capabilities. Since inception in 2007, Aspire Circle has engaged 200 Fellows and awarded 33 scholarships. It is also the Secretariat of the Impact Future Project, engaging business and investment leaders for the imminent impact economy.

## Impact Future Project

#### IMPACT FUTURE PROJECT (IFP)

The Impact Future Project (IFP) is a thought-leadership platform and an appreciative enquiry about the imminent Impact Economy. IFP will generate bold, transformative investment ideas for 2030 with 200+ business and investment leaders, in sectoral communities of 20-30 each, to create new research, knowledge, awareness and advocacy for an era of impact measurement & reporting.



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#### INDIA SANITATION COALITION, KNOWLEDGE PARTNER

India Sanitation Coalition (ISC), launched in June 2015, at Federation of Indian Chamber of Commerce and Industry (FICCI), enables safe and sustainable sanitation by forging partnerships with governments and private sector players both national and international. These include WASH financing, leading the discourse on sustainable sanitation; convening and disseminating best practices in the sanitation advocacy space and providing policy inputs.

# — Impact Future Project —

TOP 10 IDEAS

#### INVESTING FOR IMPACT

## WASH (Water, Sanitation, Hygiene) and Waste Management



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## Founder's Preface



Visionary voices for a century, from Mahatma Gandhi to recent Nobel Laureates such as Muhammad Yunus and Al Gore unequivocally support the idea of a sustainable Impact Economy. The world's social and sustainability challenges have accelerated protests over the last decade, from Occupy Wall Street to Extinction Rebellion. Impact Economies provide a solution to address these challenges and achieve the UN's Sustainable Development Goals (SDGs), as we embed Impact, alongside Risk and Return, in every business, investment, policy & consumption decision. The imminent Impact Economy requires us to envision the future, so that India may chart her path with confidence.

The Impact Movement, which has grown globally to \$59 trillion, as per GSIA, is an unstoppable trend. We estimate that India has attracted only ~1% of this global capital pool. India Inc. must enhance its embrace of the Impact movement. The environment cost alone of India's 35 large companies at \$200 billion, is three times their net profit, rendering them uncompetitive in this new era of Impact Capitalism. The root cause is a lack of corporate alignment with impact, as there is no mandatory Impact Reporting. The recent Government decision to increase mandated Business Responsibility & Sustainability Reporting (BRSR) from the top 500 to the top 1000 companies is a welcome step, but just not enough. We need distinct ESG (Responsibility), Sustainability & Impact standards and strategies.

Aspire's Impact Future Project (IFP) set up in 2020, ten Impact Communities of ~20

leaders each, with representatives of different stakeholder groups. These IFP groups have held quarterly conversations to spark an appreciative enquiry about our shared Impact Future. IFP seeks to grow the knowledge & research, awareness & advocacy, education & training for the Impact Movement.

We are proud to release the third of our ten research reports, on "WASH and Waste Management". Our research highlight the Top 10 emerging investment themes in the sector- Drinking Water, Desalination Plants, Liquid Waste Management: Blackwater Treatment, Liquid Waste Management: Greywater Treatment, Faecal Sludge Collection & Transportation, Waste to Energy, Solid Waste Management: Recycling, Solid Waste Management: Collection & Transportation, Communal Facilities, Sanitation Workers Skilling & Safety Equipment- can collectively attract \$8 billion investment by 2030, up from \$3 billion in 2020 and create revenues of \$75 billion, up from \$30 billion in 2020. This is the promise of Impact in WASH and Waste Management.

I thank all our Impact Leaders, our Co-Chairs, our Knowledge Partners, our Industry Partners, our Event/Convening Partners and Capgemini, our sponsor, for their support. I hope this comprehensive research across 10 sectors and 1000 start-ups is compelling for your own Impact journey.

Sincerely,

**Amit Bhatia**  
Founder & CEO- Aspire Circle & Aspire Impact

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## Messages

### Co-Chairs



Dear Readers,

“Cleanliness and order are not matters of instinct; they are matters of education, and like most great things, you must cultivate a taste for them”. Benjamin Disraeli’s words are apt when we consider India’s Swachh Bharat engagement and the urgent push to make the country zero waste by 2030. While the program has pushed us to ensure an Open

Defecation Free environment, innovation and technology is critical in building sustainable and long lasting infrastructure, good habits and strong communication models. Building entrepreneurs in sanitation and replicating success stories will help secure a healthy and clean India.

**Naina Lal Kidwai**  
Chair  
ISC, FICCI



Dear Readers,

WASH and waste management are areas which urgently require investment, not only to meet our SDG commitments but also because there exists a compelling business opportunity. Market centric solutions, driven around what are essentially public goods, needs one to carefully evaluate the role that Government may play along the value chain. The uncertainty around the

availability and accessibility of water and waste services will only exacerbate in the years to come due to climate change. I hope the various discussions at IFP focused on finding actionable points on WASH will offer a timely opportunity to strengthen the industry’s contribution to improving the health of the community at large through sustainable business models.

**Nikhil Sawhney**  
VC & MD  
Triveni Turbine



Dear Readers,

Avishkaar Group is delighted to partner with Impact Future Project and anchor key discussions around WASH. Significant progress needs to be made to increase access to clean drinking water and sanitation. The pandemic has further demonstrated the critical importance of sanitation, hygiene and adequate access to clean water for preventing and containing diseases. One of

the key targets under SDG 6, is that by 2030, we must expand cooperation, collaboration and capacity-building support to developing countries in water- and sanitation-related activities including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies. Through this report we have tried to take a significant step in achieving this target.

**Vineet Rai**  
Founder  
Avishkaar Group

## Messages

### Sponsor



Dear Readers,

Capgemini is delighted to support and sponsor the Impact Future Project (IFP). We believe the time has come when the idea of an “Impact Economy” must be mainstreamed. The pandemic has reminded us on the sustainable balance we must maintain with the planet and amongst the people. This will only be possible when all organisations, for-profits and non-profits,

corporations and funds, transparently measure and report their impact. We believe the IFP is a significant thought leadership initiative in helping build this awareness and a greater imperative to act. IFP not just resonates our values and pursuits of a purposeful existence, but takes us a step forward towards this envisioned impact future.

**Anurag Pratap**  
Vice President, Digital Inclusion & Sustainability  
Leader, Capgemini

### Knowledge Partner



Dear Readers,

The focus of SBM1 was on infrastructure build and India declared itself ODF free in 2019. Therefore under SBM 2, starting 2020, the complete focus of the next 5 years is on achieving sustainability and treatment. In government’s terms, the role of the private sector in accomplishing ODF++ goals is critical. Innovation, strong

operational processes, and timely commercialization of projects is the private sector’s strength. Both public and private entities need to work together to create successful WASH value chains under SBM Phase II. ISC and its partners are focused on working with the government in this direction.

**Natasha Patel**  
CEO  
India Sanitation Coalition

## Quotes from Community Leaders



I truly believe WASH is one of the most daunting SDGs to be achieved, which certainly cannot happen without the power of private enterprise. I applaud Amit and Aspire Circle team on this brilliant initiative.



**Abhinav Akhilesh**  
Partner, KPMG



In a world full of initiatives, IFP WASH in India is soliciting to accomplish basic but crucial needs for the mass. Exhilarated to be a part of this journey.



**Ambar Mitra**  
Regional Leader, Microsoft India



WASH sector is at cusp of exponential growth with SMEs playing a key role to meet the demand for safe sanitation & clean water ecosystem. IFP WASH Impact report is a catalytic step towards identifying opportunities for Indian market.



**Manoj Gulati**  
MD, Water.org



IFP is a great initiative addressing pressing needs of the general public in India. Thoughtful leaders, diverse industries, passionate in contributing innovative investment ideas, helps build a good social ecosystem for future generations and their livelihood



**A L N Rao**  
CEO, Exigo Recycling



There's an urgent need to shift the focus from infrastructure provision to service provision in the WASH space. The private enterprises can play a major role in filling the gaps in service provision while the Government contributes in creating the enabling environment. Aspire Impact is a unique platform which acts like a catalyst for these private enterprises.



**Bhitush Luthra**  
Principal Consultant, Athena Infonomics



Waste is a mirror. Now is the time to re-imagine our relationship with it. While we reflect, emergent action is mushrooming. Let's strengthen it!



**Manik Dhingra**  
Co-Founder, Shoonya



Congratulations Aspire, ISC & Capgemini for a vision that is balanced smartly with implementable ideas. The publication outlines an ambition that has the potential of leapfrogging India into a global SDG 6 success story



**Nimish Shah**  
MD, IAPMO



The time for action is now. We need to be all in and do all that is possible in this 'Decade of Action'



**Pranshu Singhal**  
Founder, Karo Sambhav



Through resource recovery and a circular economy we can look to address management of waste across India. For this nature, people and technology will have to work together.



**Wilma Rodrigues**  
Founder & CEO, Saahas Zero Waste



India needs to get out of the "Wholesale Problem-Retail Solution" mindset. For example, home-based filters are not a solution for lack of faith on piped water quality. Government is indeed the biggest impact investor of scale because it is armed with policy tools.



**Pawan Sachdeva**  
Director, Avendus Capital



Sanitation at scale can deliver not only transformative impact to communities worldwide, but also create critical momentum in health access, food security, and clean energy



**Venugopal Gupta**  
Director- Accelerator Program, Toilet Board Coalition

## Introduction

Safe water, adequate sanitation, hygiene education and proper waste management (WASH) are essential for preventing the spread of infectious diseases such as Covid-19 and to protect human health during such diseases. Better waste management practices in public surroundings such as schools, marketplaces, community places, and hospitals remove breeding grounds for mosquitoes and viruses that develop in unhygienic places and spread from individual to individual. The Sustainable Development Goals (SDG) envisions universal access to WASH services for all its member countries by 2030. The mission of SDG 6 is to ensure availability and sustainable management of clean water and sanitation for all.

With 56 per cent of the population lacking access to basic sanitation, India ranked number one in the list of the 10 worst countries with regard to basic sanitation facilities in 2017.

On 2 October 2014, the Government of India launched one of the most historic WASH management programs in the country by introducing the Swachh Bharat Mission (SBM). The primary aim of SBM was to eliminate open defecation by building toilets in every village and rural pocket of the country. Encouraging the use of toilets, eradicating manual scavenging, improving overall sanitation coverage, developing safe hygiene practices, introducing scientific waste management practices and bringing behavioural changes in WASH management were the key focus areas of the SBM. In 2014, there were 111 million rural and 10 million urban households in India without a sanitary toilet. With a staggering 564 million people practicing open defecation, India represented 60 percent of open

defecation globally. Now it is claimed that over 48 million household toilets were constructed under the SBM within three years of its launch and as many as five Indian states declared themselves open defecation free.<sup>1</sup> By 2019, the number of people without access to toilets fell to an estimated 450 million in India. In the same time period 100 percent of rural areas and 97 percent of urban areas were declared open defecation-free.

However, India has an estimated financing gap of USD 123 billion to meet universal access to WASH services.<sup>2</sup> To meet this daunting goal, private sector engagement is of utmost importance. By 2023-24, the SBM is projected to result in annual savings amounting to 7.74% of GDP. India's sanitation economy, including toilet construction and upgrading, circular sanitation and smart sanitation, was worth USD 32 billion a year in 2017 and has doubled to an estimated USD 62 billion in 2021.<sup>3</sup>

This book focuses on private sector interventions in WASH and lays out investment ideas that can help resolve not only the rural and urban problems of sanitation but also provide opportunities for financial growth and prosperity. A survey identifying the potential of top 10 impact investment ideas in WASH on various impact parameters is given on the next page.

<sup>1</sup><https://thelocalindian.com/story-feed/awareness/india-worst-sanitation-toilets-open-defecation/?infinitescroll=1>

<sup>2</sup> USAID, Water for the World Country Plan

<sup>3</sup> [https://www.toiletboard.org/media/38-The\\_Sanitation\\_Economy\\_in\\_India.pdf](https://www.toiletboard.org/media/38-The_Sanitation_Economy_in_India.pdf)



## WASH (WATER, SANITATION, HYGIENE) AND WASTE MANAGEMENT SURVEY RESULTS OF THE TOP 10 IDEAS

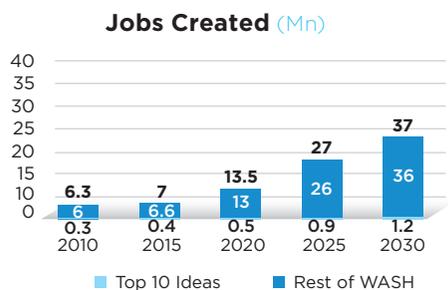
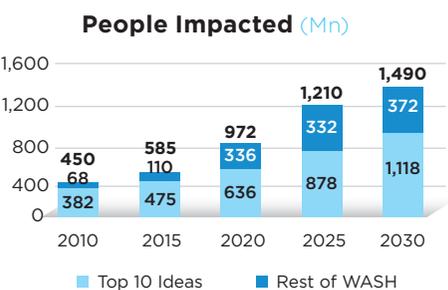
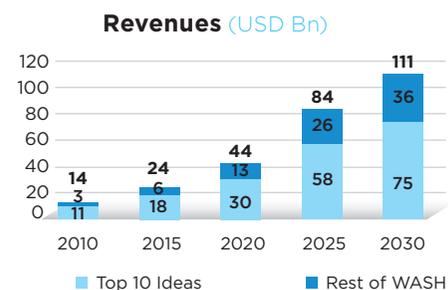
| Investment Idea  | Investment Stage | Business Model Validation | Impact on People | Impact on Planet | Need for policy support | Need for investment potential | Technical Maturity | Ease of Scalability |
|--|------------------|---------------------------|------------------|------------------|-------------------------|-------------------------------|--------------------|---------------------|
| IDEA 1<br><b>Drinking Water</b>  |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 2<br><b>Desalination Plants</b>                                     |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 3<br><b>Liquid Waste Management: Blackwater Treatment</b>           |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 4<br><b>Liquid Waste Management: Greywater Treatment</b>            |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 5<br><b>Faecal Sludge Collection &amp; Transportation</b>           |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 6<br><b>Waste to Energy</b>   |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 7<br><b>Solid Waste Management: Recycling</b>                       |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 8<br><b>Solid Waste Management: Collection &amp; Transportation</b> |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 9<br><b>Communal Facilities</b>                                     |                  |                           |                  |                  |                         |                               |                    |                     |
| IDEA 10<br><b>Sanitation Workers Skilling and Safety Equipment</b>       |                  |                           |                  |                  |                         |                               |                    |                     |

## Lifting the social and financial future of millions by investing in WASH (Water, Sanitation, Hygiene) and Waste Management

The WASH sector is predominately served by investments from the central and state government. Since it requires large working capital investments, the sector is traditionally considered as risky and expensive. However, the return potential is evident from the fact that for every USD 1 invested in global sanitation efforts, USD 4.3 of economic value is returned. Moreover, estimates suggest that more than half of the global population lacks access to safe sanitation. To add to that, over 2.2 billion people still lack access to safe drinking water. The world suffers a monetary loss of USD 260 billion annually due to inadequate WASH services.<sup>4</sup>

Providing basic facilities for hygiene practices such as washing hands with soap and water can go a long way towards achieving SDG 6. Globally 2.3 billion people lack a facility or washing their hands with soap and water at home. Similarly, 818 million students lack such facilities at their schools and 1 out of 3 health facilities lack hand washing facilities for health workers at the point of care. Over the last five years, 300,000 people per day have gained access to hand hygiene. At this rate only 78 percent of the world population would get access to universal hand hygiene by 2030, leaving an estimated 1.9 billion people without hand hygiene facilities. This rate needs to quadruple if the world is to achieve universal access to hand hygiene by 2030. Allocating only 2.5 percent of average government healthcare expenditure to creating awareness and promoting behavioural changes around hand hygiene could lead to 92-fold return in India.<sup>5</sup>

India continues to struggle with WASH management despite recent initiatives such as the SBM. The country has the highest health burden in the world due to



inadequate WASH services. In 2015, more than 321 children died every day due to diarrhoea-related illness. India loses over 5.2 percent of annual GDP, amounting to almost USD 106 billion, larger than any other country in the world due to poorly managed or unavailable WASH facilities.<sup>6</sup>

India has just 4 percent of global water resources. With an increasing population, natural resources such as ground water are under tremendous pressure. Coupled with this, rapid urbanisation and rampant migration of rural populations to urban areas are rapidly depleting ground water. Around 70 percent of all sewage generated by the country is randomly dumped without being treated. This sewage results in water pollution of more than two-thirds of water bodies in the country. As per a World Bank study, whereas 56 percent of the top quintile population of the country has access to piped water, only 6 percent of the bottom quintile does. The SBM focused on providing these basic amenities to common households. Within the first five years of its launch, the SBM claims to have provided access to an improved source of drinking water to 95 percent of households.

As per the National Urban Sanitation Policy, India plans to make all its cities and towns totally sanitised, and ensure sustainable public health and environmental outcomes for all its citizens with a special focus on hygiene and affordable sanitation for the urban poor and women.<sup>7</sup> The policy envisions 100 percent open-defecation-free cities, integrated city-wide sanitation with 100 percent and safe disposal of human excreta and liquid wastes, and effective operation and maintenance of sanitary installations, among other things.

At the current growth rate, the country's urban population is expected to double by 2050. The World Bank estimates that India would need to invest at least USD 131 billion over the next twenty years to meet its urban sanitation goals.<sup>8</sup>

According to the World Bank the present value of additional investments needed in the WASH sector to achieve SDG 6 globally would be around USD 1.7 trillion. This level of funding cannot be achieved by the traditional methods of financing for WASH— taxes, tariffs and transfers. There is a need to mobilise local commercial investment in the WASH sector.

However, progress in the WASH sector is predominantly hampered by the inability to attract private sector investments, lack of alternative sources of finance, mismatch between supply and demand of finance, ineffective anti-corruption policies, lack of central government interests in the local administrative affairs, etc. Also, investors have traditionally shied away from WASH because of limited experience in the sector. Finally, projects undertaken under WASH have had a history of low revenues, insufficient to cover the cost of borrowings.

Blended finance coupled with domestic lenders diversifying into WASH with some incentives can pave the way for greater investments in the sector. There are opportunities to attract more investments and domestic players in the sector through the public private partnership (PPP). Models such as hybrid annuity payment allow private sector companies to design and build a facility such as a waste-water treatment plant and continue to operate it over the period of concession. Such models allow private companies to build expertise in WASH projects and recover their costs over time.

<sup>4</sup> Universal Access to Water, Sanitation and Hygiene, UNICEF

<sup>5</sup> State of the World's Hand Hygiene, UNICEF-WHO

<sup>6</sup> Water for the World Country Plan, USAID

<sup>7</sup> National Urban Sanitation Policy, Ministry of Urban Development- Government of India

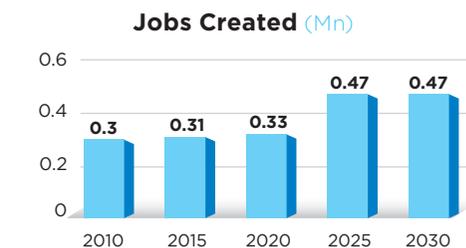
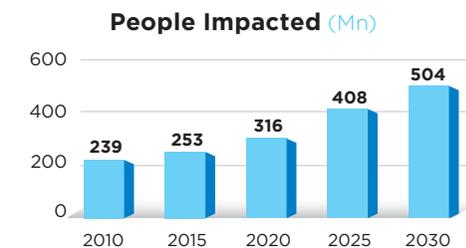
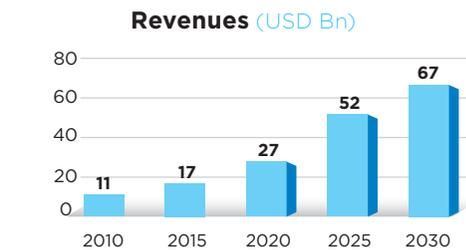
<sup>8</sup> [https://www.globalwaters.org/sites/default/files/mission\\_approved\\_india\\_water\\_priority\\_country\\_program.pdf](https://www.globalwaters.org/sites/default/files/mission_approved_india_water_priority_country_program.pdf)

## INVESTMENT IDEA **1**

# Drinking Water

Growing concerns and awareness of water-borne diseases have led to the tremendous growth of the bottled water industry over the years. The global bottled water market was valued at USD 217.66 billion in 2020 and is expected to grow at a compound annual growth rate (CAGR) of 11.1% between 2021 and 2028.<sup>9</sup> The market is dominated by the Asia Pacific region, which held a 42 percent share in 2020 and will continue to maintain its lead throughout this period. Ease of portability, changing consumption habits, availability of bottled water, and introduction of innovative products by organised players have resulted in the growing popularity of bottled water across the globe. The global flavoured water market is expected to reach USD 29 billion growing at a CAGR of 10.3 percent over the same period.<sup>10</sup> The search for new alternatives to sugary soft drinks has aided the growth of flavoured water which dominated the market with the largest revenue share in 2020.

The water industry is one of the most promising sectors in India because of the unavailability of tapped drinking water in households. In 2014, more than 170 million Indians lack access to safe and clean drinking water. According to Niti Aayog, more than 75 percent of Indian households do not have access to tapped drinking water and 70 percent of the remaining receives contaminated water. To add to that, more than 7 people die and about 36,000 Indians suffer from waterborne diseases on a daily basis, accounting for USD 600 million annually in lost production and medical treatment.<sup>11</sup> Hence the country has a very high prevalence of electric water purifiers, accounting for one-fifth of urban households. The water purifier market was valued at USD 1.1 billion in 2015 and is



expected to reach USD 4.1 billion by 2024 at a CAGR of 15.4 percent.<sup>12</sup> This mode of water purification is not only expensive but also unsustainable as it discards 3 litres

of wastewater for every litre of purified water. Overall, the mineral water industry was valued at USD 2.1 billion in 2018 and is expected to grow at a CAGR of 20.75 percent to reach USD 5.4 billion by 2023.<sup>13</sup> In volume terms, the bottled water industry is expected to reach 35 billion litres by 2023 at a CAGR of 18 percent between 2018 and 2023.

Bottled water accounts for 90 percent of the water industry, with as many as 5,735 licensed bottlers for packaged drinking water, along with uncountable unbranded ones. PET packaging constitutes 98 percent of the India bottled water market.<sup>14</sup> The ease of portability, high pressure resistance, less weight compared to glass bottles, and high transparency, among other factors, make PET packaging the preferred choice for water packaging.

India account for more than 18 percent of the world's population and the country's urban population is expected to double by 2050. Growing awareness along with a growing population provides a readymade platform for private investors in the Indian drinking water industry. Further, the increasing number of tourists visiting the country, growing at a rate of 6.7 percent between 2015 and 2025, is also expected to boost the bottled water industry.

The drinking water industry has been a priority segment for the current central government, with an estimated USD 262 billion expected to be invested in the next three decades under the 'Nal Se Jal' program which envisions availability of tapped water to every Indian household. The program provides a billion-dollar opportunity for private sector investment considering that the government is likely to invest only USD 70 billion of the total funding required between the financial years 2019-20 and 2023-24.<sup>15</sup> The fact that, more than 67 percent of the Indian

population lives in rural areas where the penetration rate is significantly low adds to the opportunity of serving packaged water in unpenetrated territories. Several impact investors have focused their investment on water-based operations. Some prominent names include Aavishkaar with an investment in Waterlife, Acumen investing in Waterhealth International, Advantage Ventures investing in Sarvajal, Khosla Impact investing in Driptech and Matrix Partners investing in Waterlife and Chetas Control Systems.

The main risk of investing in the mineral water industry is the intense competition. The household water purifier market is dominated by established players such as Eureka Forbes and Kent RO, capturing approximately 65 percent of market share. In the bottled water segment, the market already has global and local giants such as Bisleri, PepsiCo, Coca Cola Company, Danone and Patanjali. Further, indiscriminate disposal of PET bottles is one of the biggest drawbacks of investing in the bottled drinking water business.

<sup>9</sup> <https://www.grandviewresearch.com/industry-analysis/bottled-water-market>

<sup>10</sup> <https://www.prnewswire.com/news-releases/flavored-water-market-worth-29-56-billion-by-2028--cagr-10-3-grand-view-research-inc-301306563.html>

<sup>11</sup> <https://www.slii.in/water/>

<sup>12</sup> [https://www.business-standard.com/content/b2b-manufacturing-industry/indian-water-purifier-market-to-reach-4-1-bn-by-2024-study-117010900558\\_1.html](https://www.business-standard.com/content/b2b-manufacturing-industry/indian-water-purifier-market-to-reach-4-1-bn-by-2024-study-117010900558_1.html)

<sup>13</sup> <https://www.businesswire.com/news/home/20190322005165/en/The-Bottled-Water-Market-in-India-2018-2023-Anticipating-a-CAGR-of-Approx-20.75-by-Value---ResearchAndMarkets.com>

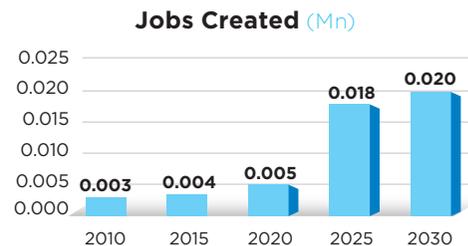
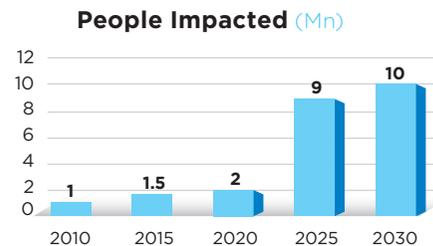
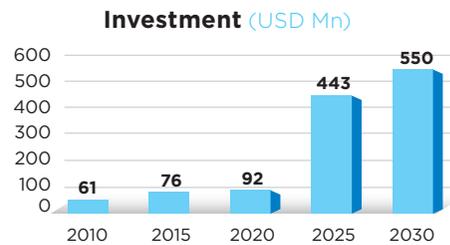
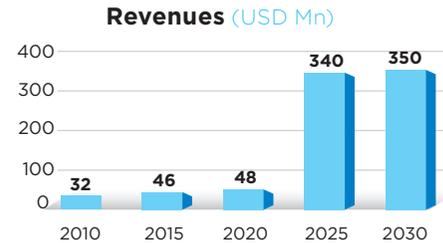
<sup>14</sup> <https://www.maximizemarketresearch.com/market-report/india-bottled-water-market/20197/>

<sup>15</sup> <https://www.financialexpress.com/economy/modis-nal-se-jal-water-mission-a-pipe-dream-or-262-billion-opportunity-for-investors/1719410/>

INVESTMENT IDEA **2****Desalination Plants**

Increasing water scarcity, rapid depletion of ground water, absence of freshwater resources and annual decrease in rainfall globally has augmented demand of desalination plants globally. One of the most effective approaches to obtaining clean water is removing mineral components from sea water or brackish water, known as desalination. The global desalination market was valued at USD 17.7 billion in 2020 and is expected to grow at a compounded annual growth rate (CAGR) of 9.51 percent to reach USD 32.1 billion by 2027.<sup>16</sup> Desalination is a primary source of fresh water for Middle East countries such as Saudi Arabia, Israel, UAE and Kuwait and other Asian countries such as Singapore and the Maldives. The Middle East uses more than 55 percent of global desalination capacity. Saudi Arabia is the single largest producer of desalinated water, with an estimated production capacity of 4 million cubic meters of desalinated water per day with plans to increase it to 8.5 million cubic meters per day by 2025.<sup>17</sup>

India is the world's largest consumer of groundwater and one of the 17 countries with extremely high water stress. Groundwater usage in the country is more than that of China and the US put together. More than 39 percent of all water usage in the country is procured through groundwater and approximately 60 percent of irrigation in the country is done through groundwater.<sup>18</sup> At the current rate of groundwater depletion, crop production in the country could decline by up to 20 percent by 2025.<sup>19</sup> Rising demand for water not only for irrigation but also from industries has made it a necessary to explore desalination as an alternative to groundwater.



India's desalination market was valued at USD 940 million in 2018 and is expected

to grow at a CAGR of 8.9 percent to reach USD 1.4 billion by 2024.<sup>20</sup> The country is one of the top-10 desalination markets in the world, owing to its vast coastline of over 7,515 kilometres. There are more than 18,000 desalination plants in the world, located across 177 countries producing an estimated 95 million cubic meters of freshwater per day. India accounts for more than 1,000 membrane-based desalination plants with varying capacities ranging from 20 million cubic meters to 10,000 million cubic meters per day.<sup>21</sup>

Currently, there are two technologies with the most desalination capacity in the world: multi-stage flash distillation (thermal) and reverse osmosis (membrane). An estimated 85 percent of all plants around the world use membrane-based technology, which is 23 percent cheaper than thermal technology. Technological advancements have made desalination much cheaper over the years. According to the Desalination Association of India, desalinated seawater costs about 10 paise per litre. Considering the amount of desalinated water produced by large plants, economies of scale can further reduce the cost per litre. Some well-known desalination plant operators in the country include Suez Water Technologies & Solutions, Hitachi Plant Technologies India Pvt. Ltd., VA Tech Wabag Ltd., Ion Exchange India Ltd. and Ionex Engineers.

Desalination does create some legal and environmental issues. First, globally, desalination plants generate an estimated 142 million cubic meters of salty brine per day, which contains 5 percent salt compared to seawater which contains 3.5 percent salt. This brine contains chemicals used in pre-treating seawater such as chlorine and copper. These are sent back to the oceans causing serious ecological harm to marine life. Second, desalination is a very energy-intensive process that requires consistent supply

of electricity for its operation. Electricity accounts for more than 55 percent of the operational cost of a desalination plant. Plants powered by fossil fuels also raise concerns of high carbon emissions in high pollution zones. Third, contracts with water purchasers of desalinated water need to include clearly defined roles and responsibilities so that the plant owner does not have to bear offload expenses. Local government entities, which are major water purchasers, often do not pay such costs, leading to an additional cost burden on plant owners. Fourth, use of the right technology is an important consideration for the sustainability of the plant. While membrane technology is the most widely used technology, it may not always be the most economical option for every region.

Considering the large scale of investments required in building a desalination plant, investors need to be wary of the possibility of corruption. Government estimates indicate the average cost of building a 100 million litres a day plant to be around USD 52 million. However the same plant built under public-private partnership by a third-party private player could cost twice the estimated amount. However, quality of output is much better in case of private party industrial set-up and operations.

<sup>16</sup> <https://www.prnewswire.com/news-releases/global-desalination-market-report-2021-market-was-valued-at-17-7-billion-in-2020-and-is-expected-to-grow-with-a-staggering-cagr-of-9-51-from-2020-to-2027--301264141.html>

<sup>17</sup> <https://www.researchandmarkets.com/reports/2867343/desalination-technologies-global-market>

<sup>18</sup> <https://graphics.reuters.com/INDIA-ENVIRONMENT-WATER/0100B2C41FD/index.html>

<sup>19</sup> <https://www.scidev.net/global/news/groundwater-depletion-in-india-threatens-food-security/>

<sup>20</sup> <https://www.techsciresearch.com/report/india-desalination-plant-market/2302.html>

<sup>21</sup> [http://indiaindia.org.in/intro\\_desalination-1.html](http://indiaindia.org.in/intro_desalination-1.html)

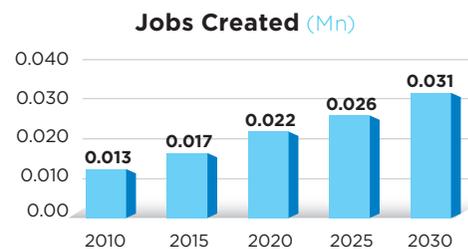
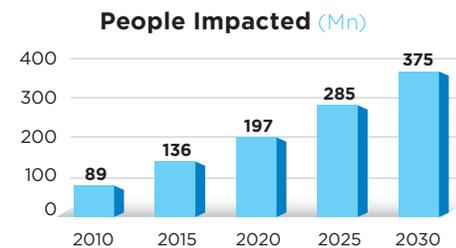
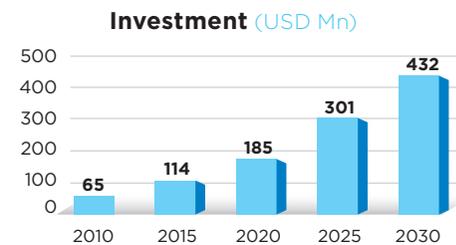
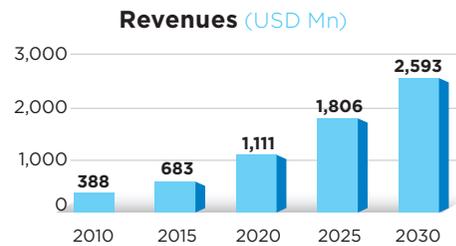
INVESTMENT IDEA **3**

## Liquid Waste Management Blackwater Treatment

**B**lackwater contains all sewage including toilets, urinal waste and flush water along with anal cleaning water that contains pathogens of faeces and the nutrients of urine that are diluted in flush water. It also includes liquid waste generated from agricultural, industrial and commercial activities. Once treated blackwater can be put to outdoor use including for subsurface irrigation. Treatment of blackwater requires physical, chemical and biological methods and disinfection to remove harmful pathogens, bacteria, viruses and protozoans. However, it is important to remove solids, break down organic compounds, remove harmful chemical substances such as nitrogen and phosphorus and eliminate microorganisms that cause disease.

The global water and wastewater treatment market was valued at USD 283.98 billion in 2019 and is expected to grow at a CAGR of 7 percent to reach USD 472.53 billion by 2027.<sup>22</sup> At the same time, the global sewage treatment facilities market was valued at USD 120.4 billion in 2020 and is estimated to grow at a CAGR of 6 percent to reach USD 169.9 billion by 2026.<sup>23</sup> More than half of the world's population does not have access to safe sanitation, and an estimated 4.2 billion people contribute to 14 billion litres of faecally contaminated wastewater every day, equivalent to 5,600 Olympic-sized swimming pools. This liquid waste is directly responsible for increase in diarrhoeal diseases such as cholera, typhoid, rotavirus, etc. leading to the death of around 800 children per day.<sup>24</sup>

India is among the lowest ranked countries in terms of water quality index. The fact that only 2 percent of India's urban regions have both sewerage systems and sewage treatment plants is responsible



for the country's rank of 120 among 122 nations globally.<sup>25</sup> However the market for wastewater treatment in India is growing

at the rate of 15-20 percent annually. An increased government push towards public private partnership models such as projects with the Danish government for sewage treatment in Rajkot, New Delhi and Jamshedpur are encouraging signs for private investors to boost the triple bottom-line of economic prosperity, environmental quality and social benefit.

Some of the most commonly used blackwater treatment methods are:<sup>26</sup>

- **Septic tanks:** including physical treatment through percolation, filtration and biological processes through anaerobic and aerobic digestion
- **Cess pits:** the most common and cheap alternative which includes sealed tanks that hold sewage for collection and transportation
- **Biodigesters:** use of aerobic and anaerobic digestion by naturally occurring bacteria
- **Recycling systems:** including recycling of treated water into the blackwater system loop rather than discharging it.

There are 920 sewage treatment plants in India, of which only 615 are operational. With limited capacity for treating blackwater, almost 62 percent of sewage is left untreated. In total, only 60 percent of industrial and 26 percent of domestic wastewater is treated in India.<sup>27</sup> Some Indian companies in the sewage treatment plant segment include NeoTech Water Solutions, Constrarch Enviro, Capital Controls India, Shiva Global Environmental and TBS Environmental Solutions & Technology.

Designing and building a blackwater treatment plant is an expensive proposition that often lacks financial viability. Construction of large blackwater treatment plants entails a huge upfront cost, which makes the private sector averse to investing in these plants. Water treatment and distribution is primarily done by municipal corporations, which are not free to increase

user charges for their services irrespective of innovations and advancements in their operations. In such cases, the private sector is more attracted in a Build-Operate-Transfer model where they are assured of returns on investment. Governments in most countries generally attract private players by providing up-front capital expenditure for infrastructure. The private player then takes care of the material assets, technology, management expertise, and resource efficient set-up for running the plant.

While there are obvious human and environmental health issues in operating a blackwater treatment plant, it is important to recognise some risk mitigating measures. Analysis of the cost recovery plan requires reliable calculations, and a thorough analysis of any viability funding gap is essential. Political and regulatory stability is another important consideration while investing in long-term large investment projects. Reinsurance guarantees should accompany the contracts to ensure stability and sustainability. Using high-end technology may sometimes require additional investments than budgeted. Contracts should have provisions to allow flexibility in budgets up to a certain percentage on a requirement basis. Finally, since a usage-based fee is not a prevalent payment model in India, private operators have only agricultural and industrial users to charge for water usage. Efforts should be made to look for additional revenue source in agreement with the municipal corporations.

<sup>22</sup> <https://www.emergenresearch.com/industry-report/water-and-wastewater-treatment-market>

<sup>23</sup> <https://www.prnewswire.com/news-releases/global-sewage-treatment-facilities-market-to-reach-169-9-billion-by-2026--301353048.html>

<sup>24</sup> <https://www.downtoearth.org.in/blog/environment/untreated-wastewater-in-developing-countries-14-billion-a-day-and-we-don-t-know-where-it-ends-up-75009>

<sup>25</sup> <https://economictimes.indiatimes.com/blogs/et-editorials/the-clean-water-and-fuel-opportunity/>

<sup>26</sup> <https://www.thecropsite.com/focus/5m/49/growing-more-food-with-less-water-black-water>

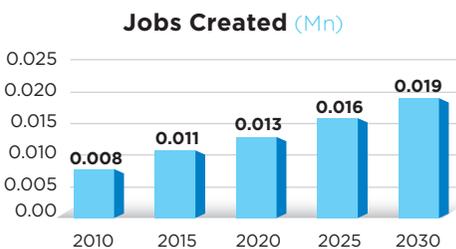
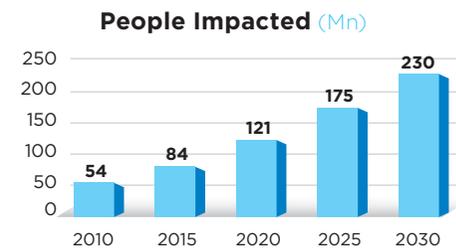
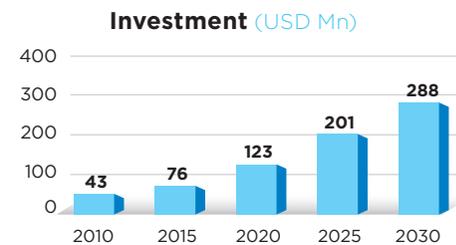
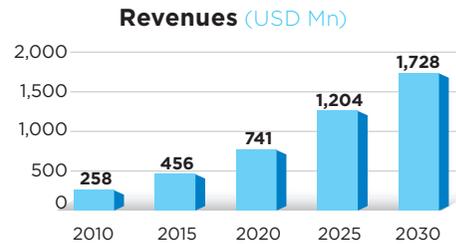
<sup>27</sup> <https://global-recycling.info/archives/3814>

INVESTMENT IDEA **4**

## Liquid Waste Management Greywater Treatment

Greywater treatment is the process of cleaning wastewater discharged from sinks, showers, dishwashers, clothes washing, baths and washing machines, but not toilet water. Once treated, it can meet up to 35 percent of domestic water demand and can be used for purposes such as toilet flushing, floor washing and car cleaning. The global liquid waste management market was valued at USD 65.93 billion in 2018 and is expected to register a CAGR of 3.3 percent to reach USD 85.02 billion by 2026. The US is the largest market for wastewater treatment, where 95 percent of wastewater is treated and then reused.<sup>28</sup> Developed countries such as Japan reuse more than 53 million litres of water every day by adopting a multi-pronged strategy involving small treatment plants and closed-loop water supply at the building level.

In a developing country such as India, the average individual generates nearly 30-70 cubic meters of wastewater per year. If treated, most of this water can easily be used for irrigation. At the current average, wastewater generation from a million individual will be sufficient to irrigate approximately 1,500-3,500 hectares of land. The overall composition of greywater is about 10 percent of kitchen water, 25-35 percent of water from clothes washing and 50-60 percent of water from bathing and other ablutions, which is the least polluted form of greywater and generally is contaminated by only shampoo, soaps, detergent and toothpaste. Hence 60 percent of all household greywater can be recycled and reused. In high-income countries about 70 percent of wastewater is treated. In contrast, in developing countries more than 80 percent of all



wastewater is left untreated and discharged back into environment, polluting rivers, lakes and oceans.<sup>29</sup>

Using treated greywater not only reduces dependency on groundwater but can also potentially reduce water bills by up to 50 percent. Further, treating on-site reduces the need to move water from one place to another and minimises the chances of dumping untreated water back into the environment. Urban residents such as those in Pune receive 700 million litres of water every day from civic bodies. Investment in liquid waste management can convert almost 90 percent of the used water into usable water, meeting 75 percent of the city's water demand.<sup>30</sup>

According to the Central Pollution Control Board, India's water demand is expected to rise to 1.5 trillion cubic meters by 2030, making it one of the most water-stressed countries in the world.<sup>31</sup> Increasing demand for treated municipal water, rapid urbanisation, a growing population and depleting groundwater levels have increased the demand of wastewater treatment as never before.

India's wastewater treatment plants market stood at around USD 2.4 billion in 2019 and is expected to reach USD 4.3 billion by 2025.<sup>32</sup> Regulatory restrictions such as zero liquid discharge, for the treatment of sewage before discharging into water bodies are expected to augment demand for wastewater treatment plants through 2025. Various government schemes such as Swachh Bharat Mission, Jal Shakti Abhiyan, Namami Ganga, Atal Mission for Rejuvenation and Urban Transformation and Smart Cities Mission have multiple provisions for wastewater treatment. Such a push from government is sure to attract public and private investments into wastewater treatment in India and provides a massive opportunity for private investors to fill the gap in terms of technology selection, fund rotation and implementation.

Wastewater treatment in India has turned into a multibillion-dollar industry. Since India has not mandated the installation of greywater treatment systems in residential buildings, there are very few household users of greywater in the country. Most greywater usage in the country is for industrial purposes and many companies have been operating in the segment such as Waterneer Technologies, Harvel Agua India, BioKube and AZUD Watertech.

Greywater has a much underestimated economic value. Agricultural use of treated greywater which contains useful nutrients can replace the use of artificial fertilisers. However, greywater treatment is a difficult market for companies. It requires deep pockets, skilled personnel, coordination between different government departments and organisations, and public awareness of the issues. It is an energy-intensive process that requires a large amount of electricity for operations and extensive maintenance services. A lack of skilled technical personnel is a major challenge. Moreover, a lack of documented success stories from low-income developing countries along with lack of hands-on guidance plays a major role in low private sector interest in the sector.

<sup>28</sup> <https://www.fortunebusinessinsights.com/liquid-waste-management-market-102643>

<sup>29</sup> <https://geographyandyou.com/grey-water-management-in-india/>

<sup>30</sup> <https://timesofindia.indiatimes.com/city/pune/grey-water-treatment-can-help-reuse-60-used-water/articleshow/19905913.cms>

<sup>31</sup> <https://www.downtoearth.org.in/blog/water/decentralised-wastewater-solutions-the-need-of-the-hour-for-india-67218>

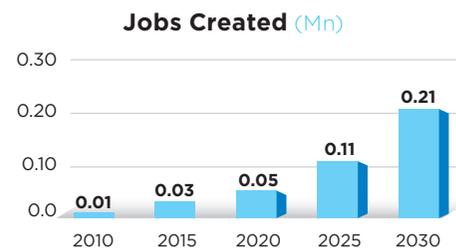
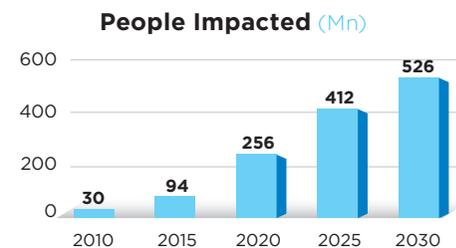
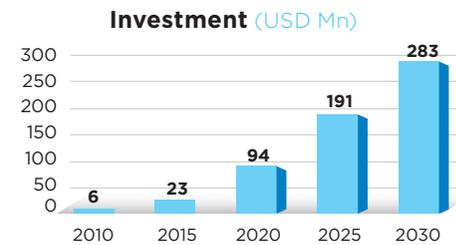
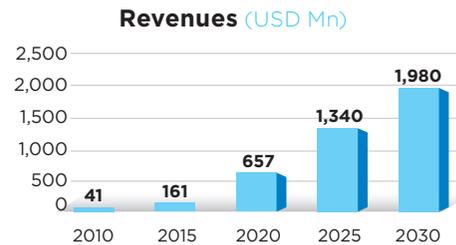
<sup>32</sup> <https://www.businesswire.com/news/home/20200313005294/en/India-Wastewater-Treatment-Plants-Market-Stood-at-Around-2.4-Billion-in-2019-is-Projected-to-Reach-4.3-Billion-by-2025>

INVESTMENT IDEA **5****Faecal Sludge Collection & Transportation**

While Sustainable Development Goals 6 focuses on access to safe and improved sanitation for all, it also emphasises reducing the amount of untreated water. This can only be achieved if all elements of sanitation including access, collection, treatment and re-use are handled effectively. The combination of such functions put together is known as faecal sludge management. Faecal sludge is the raw or partially digested slurry that contains both solid and liquid waste that accumulates in onsite sanitation systems (OSS) such as septic tanks and pit latrines.

While India declared itself open defecation free in October 2019 by building 110 million toilets across the country, two-third of the country's households with toilets are not connected by a sewer network. The urban Indian population produces 0.12 million tonnes of faecal sludge on a daily basis, 60 percent of which is dumped in open water and land bodies.<sup>33</sup> The key to sustainable health outcomes lies in preventing faecal contamination in the environment by planning for city- and ward-level faecal sludge management. While much focus has been given by the government and several implementing agencies to the treatment, reuse and disposal of faecal sludge, the logistics at the front end has been largely ignored. The process is currently done largely by the unorganised sector.

More than 50 percent of the global population depends on OSS systems. In contrast, it is 70 percent for Indian population. It is a matter of grave concern that most of the sludge from these pits finds its way back into the environment. There are more than 100 faecal sludge treatment plants in India and 400 under various stages of planning, procurement and construction.<sup>34</sup> Most cities in India



have private operators providing sludge collection and transportation facilities through cesspool vehicles, vacuum trucks or honey suckers. Most of these private

operators illegally dump this faecal sludge in water bodies, storm drains, sewer lines, wastelands, etc. Faecal sludge has very high pollution load because of severe pathogen levels and very high moisture levels. Nevertheless, the provision of this service has helped eradicate manual scavenging in the country.

India is among the first countries to announce a national policy on Faecal Sludge & Septage Management (FSSM) in 2017.<sup>35</sup> According to the national policy, all urban local bodies have been directed to provide nationwide implementation of FSSM services and provide safe, sustainable sanitation in each and every household in India. Collection or emptying of faecal sludge from OSS should ideally be done every two to three years. However, it is common practice to empty only when the tanks are full. Maintaining a schedule of emptying the tanks is important so that they are cleaned in a timely manner to increase the efficiency and enhance the discharge quality of the septic tanks. Collection is done both manually and mechanically. As per The Prohibition of Employment of Manual Scavengers and their Rehabilitation Act 2013, employment or engagement of manual scavengers is prohibited in India. However many inaccessible areas of the country continue to employ manual scavengers for collection and emptying of faecal sludge.

Faecal sludge collection and transportation needs private funding to completely overhaul the systems and procedures of traditionally under-funded small and medium sized urban local bodies with inadequate sanitation infrastructure. Currently, low-income communities and underserved populations of the country have an inequitable burden of faecal sludge collection and transportation. Unregulated private operators charge fees according

to the ability of the community to pay and the load of work required to manage the sludge. Often such communities delay emptying sludge, which results in overflow, posing serious environmental and health hazards in and around the vicinity. Operation and management of faecal sludge collection and transportation incurs many associated costs in the form of protective wearables, washing products, cleaning tools, advanced container vehicles, trained manpower, deworming medicines, etc. Urban local bodies generally operate in a very cost-conservative manner often compromising on the safety of workers. Impact investments through social enterprises can aid in addressing many such issues including promotion of sanitation worker protection schemes, community-based livelihood schemes, pushing individual household toilets and women-led sanitation enterprises.

The fact that collection and transportation of faecal sludge is primarily controlled by private operators provides an opportunity for largescale investment to transform the way the industry operates. Suggested actions such as fixed fee range for collection and transportation, licensing of private operators, sensitisation of private operators, record keeping and scheduled desludging can go a long way in organising a fragmented market and will encourage investors to take note of the segment.

<sup>33</sup> <https://www.weforum.org/agenda/2019/09/how-to-improve-sanitation-in-india/>

<sup>34</sup> <https://www.iwmi.cgiar.org/2020/09/business-models-for-faecal-sludge-management-in-india/>

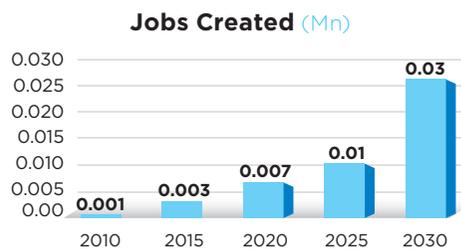
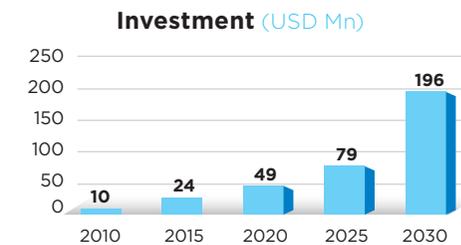
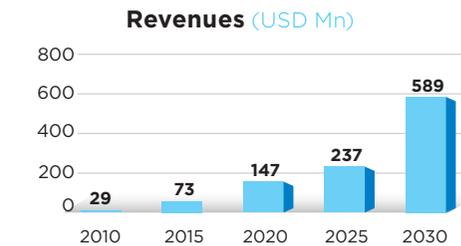
<sup>35</sup> Faecal Sludge And Septage Management in Urban Areas, NITI Aayog January 2021

INVESTMENT IDEA **6****Waste to Energy**

Rapid urbanisation and industrialisation along with rising income levels across the globe have led to increasing quantities of waste that have become unmanageable in most countries, posing a significant threat to the environment. The world produces over 2 billion tonnes of waste per year, approximately 70 percent of which is not managed in an environmentally safe manner. Developed countries with high income levels, comprising just 16 percent of the global population, contribute 34 percent of global waste. At the current rate, global waste quantities are expected to be almost 3.5 tonnes annually by 2050. Solid waste treatment and disposal accounted for an estimated 1.6 billion tonnes of carbon dioxide equivalent greenhouse gas emissions in 2016. At the current rate of waste generation and disposal, solid waste-related emissions are expected to reach 2.38 billion tonnes of carbon dioxide equivalent annually by 2050.<sup>36</sup>

In recent years technologies have been developed to utilise waste as a means of energy and at the same time reduce the quantity of waste through safe disposal. The global waste-to-energy market was valued at USD 35.8 billion in 2019 and is expected to grow at the compounded annual growth rate (CAGR) of 5.7 percent to reach 54.16 billion by 2027.<sup>37</sup> Europe leads the waste-to-energy market with a share of above 45 percent. The presence of global companies such as Seuz, Veolia and Ramboll Group has given the European region its dominance. However, the Asia Pacific region, with the fastest population growth, is expected to lead the growth of waste-to-energy during this period.

India is the third largest energy consuming country in the world, generating more than 80 percent of electricity by coal, oil



and biomass. As per the Indian Renewable Energy Development Agency, the country has realised only 2 percent of its waste-to-energy potential and the industry is expected to grow at a CAGR of 9.7

percent by 2013.<sup>38</sup> In 2017, India's urban and industrial organic waste had the potential to produce 5,690 megawatts of electricity. India is expected to generate 543 million tonnes of waste by 2050, which has the potential to produce 3 gigawatts of electricity. The Indian waste management and waste-to-energy industry offers a USD 14 billion business opportunity by 2025.<sup>39</sup> With more than 50 percent of municipal waste remaining untreated and municipal solid waste comprising more than 75 percent of total waste generated in the country, there is an excellent investment opportunity for private investors with deep pockets.

Thermal technology is the most prevalent segment in the waste-to-energy industry, accounting for more than 52 percent of all energy generated through waste worldwide. Organic waste, classified as non-biodegradable and biodegradable, contains essentially carbon-based compounds that are used to generate energy in the form of electricity and biogas/syngas. Some popular technologies to recover energy from waste include:

- **Biomethanation:** Anaerobic digestion through bacterial fermentation of organic materials which is converted into biogas producing manure as an end product. Companies include Ex- Asia Bio-energy, Cicon Environment Technologies, Bermaco/WM Power, Sound Craft Industries and Hydroair Tectonics.
- **Incineration:** Combustion of municipal solid waste to produce steam that produces power through steam turbines. Some players are Ex- A2Z Group of Companies, Hanjer Biotech Energies, SELCO International and East Delhi Waste Processing Company.
- **Gasification:** Use of high temperatures, usually in the range of 500-1800 degrees Celsius in the presence of oxygen to produce synthetic gas. Ex- Zanders

Engineering and UPL Environmental Engineers are two such companies.

- **Pyrolysis:** Production of combustible gases by heating combustible materials in the absence of oxygen. Companies include Ex- Amber Industries, Krishna Eco Energies, Ecogreen Pyrolysis and Pyrocrat Systems.

There are many advantages of investing in waste-to-energy such as reduction in landfills, a source of clean energy and an opportunity for resource recovery. Some limitations and risks are associated with it as well. First and foremost, waste-to-energy incinerators are a major source of carbon dioxide emissions including fossil CO<sub>2</sub> from burning plastics and biogenic CO<sub>2</sub> from burning wood, paper, food, etc. Leading waste to energy market, Europe has doubled CO<sub>2</sub> emissions in the last 10 years through incinerators. Second, a big hindrance is that it is a very capital-intensive business and faces challenges including funding, distribution, manpower availability, and maintenance support. Third, privately owned waste-to-energy firms often compete with government-owned centralised grids. Consumers usually prefer buying power from government-owned enterprises, which are generally cheap in comparison to private operators. Fourth, there is always the possibility of government interventions because of political reasons. Though governments in developing countries support waste-to-energy business models and encourage private participation through incentives such as low-interest rate loans for such projects, interruptions in the supply chain and the unorganised nature of the business remain a concern.

<sup>36</sup> [https://datatopics.worldbank.org/what-a-waste/trends\\_in\\_solid\\_waste\\_management.html](https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html)

<sup>37</sup> <https://www.emergenresearch.com/industry-report/waste-to-energy-market>

<sup>38</sup> <https://www.eai.in/ref/ae/wte/wte.html>

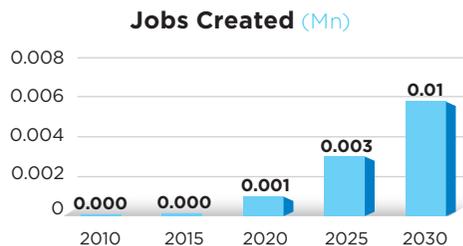
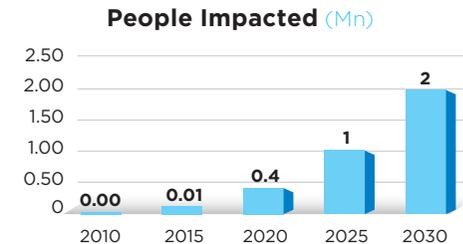
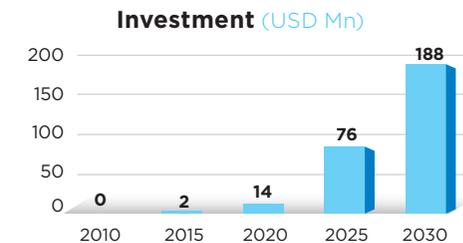
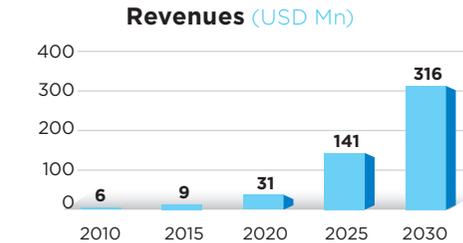
<sup>39</sup> <https://www.psa.gov.in/mission/waste-wealth/38>

INVESTMENT IDEA **7****Solid Waste Management Recycling**

Authors Assa Doron and Robin Jeffrey wrote in their book, *The Waste of a Nation*, “Never in history have so many people had so much to throw away and so little space to throw it as the people of India in the second decade of the twenty-first century.” Growth in urbanisation across the world and rapid industrialisation, along with rising middle-class incomes have led to an exponential increase in waste generation worldwide. A 2018 World Bank report found that India is the world’s highest waste generating nation with an estimated 277.1 million tonnes of solid waste generated annually. According to a 2016 estimate, India’s annual waste generated is likely to touch 387.8 million tonnes by 2030 and 543.3 million tonnes by 2050.<sup>40</sup>

According to the government’s estimates, at present, about 68% of municipal solid waste is processed and 97% of the waste is collected door-to-door in urban India. Of this, 78% of the waste is segregated at source.<sup>41</sup> However, there is no organised and scientifically planned segregation of this waste. Segregation and sorting take place under unsafe and hazardous conditions and the effectiveness of segregation is fairly low. On a number of occasions, due to improper handling, the segregated constituents are mixed up again during transportation and disposal.

The Government of India has been pushing the agenda of waste management since the launch of Swachh Bharat Mission (SBM) Urban, which called for 100% scientific management of municipal solid waste, renewed with the launch of SBM Urban 2.0, which mandates complete solid waste management for all cities. Moreover, with an augmented thrust on recycling and India’s urgent demand for a quality waste



management system, segregation and recycling of solid waste management appears to be a sound case for public private partnerships as Urban Local Bodies

alone are unable to accomplish the task as per Municipal Solid Waste Rules. In 2006, it was estimated that Indian cities would require USD 5 billion to provide adequate solid waste management services.<sup>42</sup> This amount of investment is not possible without alternative funding models such as PPP. Recyclable materials are mainly processed and segregated by private units. Increased interventions are required to incentivise and encourage PPP to address municipal solid waste management challenges.

With SBM 2.0 the government plans to infuse USD 5.3 billion into solid waste management. In addition, the government is looking for private sector participation in capacity building of contractors, ensuring timely supply of material, and promoting joint ventures where a technical agency can join hands with financial firms to participate in procurement for recyclable solid waste and develop contractors for carrying out integrated engineering, procurement and construction projects. Other identified business models include:

- Management of material recovery facilities
- Waste to compost, biomethanation, plastic waste processing, refuse-derived fuel, and waste to electricity
- Construction and demolition of waste processing units
- Mechanised sweeping equipment
- Bioremediation of dumpsites, etc.

Recycling of solid waste presents a massive opportunity as currently only 30 percent of 75 percent recyclable waste is recycled in India and the remaining ends up in landfills.<sup>43</sup> The garbage treatment industry in India is expected to offer a USD 14 billion business opportunity by 2025. To add to that the country has the potential to generate 3 gigawatts of electricity from

waste by 2050.<sup>44</sup> In India, the PPP model is still in a nascent stage and there are very few success stories under municipal waste management. Currently there are many startups operating in the country focusing on recycling solid waste such as plastics, e-waste, batteries, floral waste, etc. Some notable names include Exigo Recycling, Attero Recycling, Cashify, Banyan Nation, Lohum CleanTech, TrashCon Labs and Namu E-waste. The most promising part is that most startups have been able to raise external funding from private equity investors.

Recycling is essential for solid waste management because it will ensure better service delivery and segregation by tackling the problem at its source. Digitisation in recycling can also help with better database management tracking and monitoring of collection and transportation, minimising human intervention in waste segregation and therefore eliminating the health hazards.

Challenges in terms of regulations that cover almost every aspect of operations including environmental regulations, health and safety rules, transportation laws, zoning and land-use matters need to be overcome. The expectation of new regulations around solid waste management recycling should also be noted since they may have a negative impact on private companies’ bottom-line.

<sup>40</sup> <https://theprint.in/india/pm-calls-for-week-long-garbage-free-country-but-india-is-the-worlds-highest-waste-generator/478889/>

<sup>41</sup> <https://timesofindia.indiatimes.com/city/chandigarh/hp-go-a-top-country-in-municipal-solid-waste-processing/articleshow/85084238.cms>

<sup>42</sup> <https://www.tandfonline.com/doi/full/10.1080/23311843.2016.1139434>

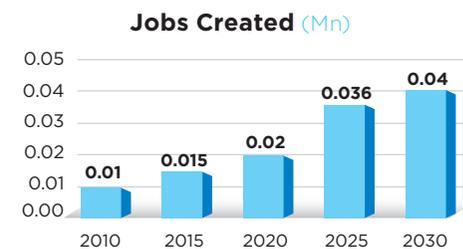
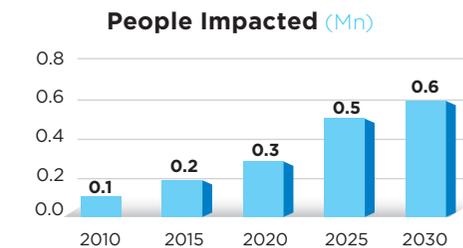
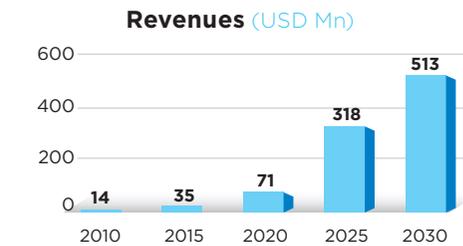
<sup>43</sup> <https://www.mordorintelligence.com/industry-reports/india-waste-management-market>

<sup>44</sup> <https://global-recycling.info/archives/2898>

INVESTMENT IDEA **8****Solid Waste Management Collection and Transportation**

The primary objective of the Swachh Bharat Mission (Urban) is the collection and transportation of municipal solid waste in a scientific and segregated manner clean. The solid waste management rules of 2016 made it mandatory for all Urban Local Bodies (ULBs) to undertake door-to-door collection of segregated waste, and to store and transport it efficiently. Collection and transportation of solid waste is the largest expenditure head in the municipal waste management system. India's urban population of 400 million residents generate 65 million tonnes of solid waste, which is poised to grow to 165 million tonnes by 2030 and 436 million tonnes by 2050. More than 10,000 hectares of valuable urban land is being utilised as landfills. Moreover, the country is losing 1,250 hectares of land every year due to extension and creation of landfills.<sup>45</sup> At the current rate India would require roughly 1,400 square kilometres of landfill area by 2047 for dumping its municipal solid waste which is equivalent to three of the most populated cities of the country—Hyderabad, Chennai and Mumbai. It is important to make collection and transportation of solid waste resilient, efficient, streamlined and citizen-centric to make it manageable in the coming years.

Most cities in India are unable to provide adequate waste collection services to their residents and ULBs generally rely on private contractors and residents to dispose of their solid waste. Only a few ULBs have been able to achieve 100 percent collection and transportation of solid waste through effective procedures. Biodegradable waste (organic waste of food, plants, etc.) constitutes the largest



proportion of municipal solid waste, accounting for 52 percent, followed by non-biodegradable waste (construction

and demolition waste) at 32 percent and recyclable waste (plastic, paper bottles, glass, etc.) at 17 percent. India generates nearly 9.4 million tonnes of plastic waste every year. The increasing quantity of plastic waste has been a major contributor of environmental pollution. Estimates suggest that more than 43 percent of all plastic manufactured in the country is utilised for single-use disposals and packaging material.<sup>46</sup> While some of the plastic waste is recycled, most of the non-recyclable plastic waste is used in road construction and furnace oil.

The solid waste management industry needs digitisation of waste collection and disposal that goes beyond information technology. Smart waste management will improve data quality and create better insights into waste streams during operations. Disposal should be considered in the initial design and carried out accordingly. There is a need for a smart integrated waste management system that ensures real-time monitoring of collection and transportation. Advanced technologies such as radio frequency identification, geo-tagging of waste transportation vehicles, the Internet of things and machine-to-machine communication can be used to improve operational efficiency and streamline collection along with tracking the transportation.

Many startups are coming up with innovative ideas to manage waste, as well as convert it into valuable resources. However, India requires a fair amount of knowledge to tackle the challenges plaguing this industry. Some notable Indian companies in this area include Eco-wise, Antony Waste Handling Cell, Greenobin, Citizengage, Extracarbon, Kabadiwala and Plastics for Change. Investors are increasingly finding the waste management industry worth investing in and all the

companies mentioned have been able to raise funding from private equity/debt investors.

As the government plans to develop smart cities across the country, ULBs have to be geared up to rework their solid waste management strategies. With technological advancement in collection and transportation, it is important to spread awareness of waste segregation at source. Estimates suggest that almost 80 per cent of the waste at Delhi landfill sites could be recycled provided the ULB ensures that the waste is segregated at source. The smart city plan also provides for doing away with landfills in 20 major cities. Such ambitious targets can only be achieved through greater awareness and increased participation of private players and corresponding investments through the private route.

As with all investments, any associated risks must be considered. For solid waste they are mainly related to health. Manual handling predominates hence there are incidents of muscular-skeletal disorders. Workers at municipal solid waste incinerators are exposed to a variety of hazardous substances such as heavy metals, respirable quartz dust, dioxins, furans and mutagens. They should be protected by using safety measures on and around garbage trucks and with personal protective equipment.

<sup>45</sup> <https://www.niua.org/csc/assets/pdf/key-documents/phase-2/Waste/SBM-Guidance-on-Efficient-Collection-and-Transportation-of-MSW.pdf>

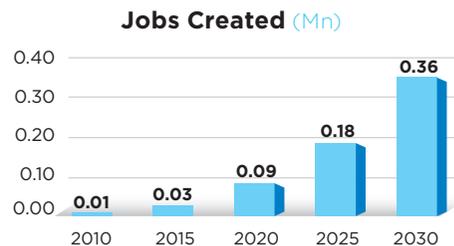
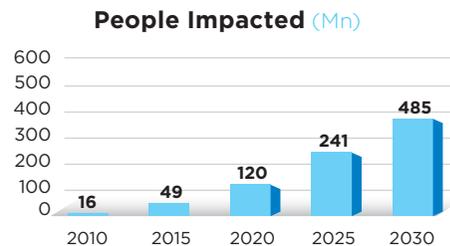
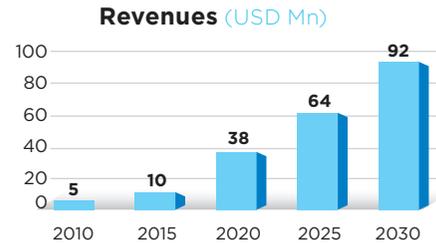
<sup>46</sup> <https://www.orfonline.org/research/solid-waste-management-in-urban-india-imperatives-for-improvement-77129/>

INVESTMENT IDEA **9****Communal Facilities**

As stated before, Sustainable Development Goal 6 (SDG 6) advocates for access to adequate and equitable sanitation and hygiene for all and an end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations. Despite some progress by all member nations, the rate of development is not enough to meet the targets set under the SDG 6 by 2030. The world needs to quadruple its efforts in order to meet the targets set under the SDG 6. In 2017, more than half the world's population, an estimated 4.2 billion people, suffered from sanitation services that left human waste untreated. Nearly 673 million people around the world did not have access to toilets, and 367 million children attend schools without toilets.<sup>47</sup> The importance of communal facilities became starkly apparent in March 2020 with the advent of the Covid-19 pandemic.

The world needs an estimated USD 105 billion to achieve universal sanitation by 2030, which includes USD 36 billion in operation and maintenance of basic sanitation facilities and USD 69 billion in safely managed sanitation. By 2030, the approximate cost of providing safely managed sanitation is estimated at USD 24 per beneficiary. While most countries have national plans and policies for sanitation, less than 10 countries across the globe have formally approved policy and approved plans with sufficient financial and human resources.

With the launch of Swachh Bharat Mission (SBM) in October 2014, the Government of India embarked upon making India open-defecation free (ODF) in the next 5 years by building toilets across the country. At that time, it was estimated that nearly half of Indian households defecate in the open.



The data showed that open defecation is the root cause of major health issues such as child malnutrition, diarrhoea, tuberculosis and childhood stunting. The

government did declare the country ODF in October 2019, having built over 110 million toilets thereby giving access to toilets to 600 million people. However, recent reports by WHO and UNICEF suggest that at least 15 percent of the Indian population still defecates in the open, with 22 percent of the rural population and 1 percent of the urban population doing so.<sup>48</sup>

The SBM 2 launched in 2020 focused on sustainably eradicating defecation and solid & liquid waste management. One of the most important facets of SBM 2 was the construction and maintenance of community sanitary complexes (CSC) in all villages with more than 100 households, primarily to cater to the needs of floating populations. In 2019, as part of the Garib Kalyan Rozgar Abhiyaan, the government announced the construction of 75,000 CSCs.

There is a need for increased private investment in communal facilities. SBM 2 has provisions for financial assistance for building and maintaining CSCs. However, operations costs can be met through self-revenue generating models that can encourage private participation. Gram panchayats are generally responsible for the operation and maintenance of CSCs and as such they should endeavour to introduce self-sustainable revenue models such as 'Pay per use' for private operators. Another encouraging fact for private operators under SBM 2 was an increase in the construction cost of CSC from USD 0.2 million to USD 0.3 million. This is significant as the private sector would have some flexibility in choosing quality products & services and can support rapidly deployable, effective, and resilient community toilet complexes, which might be quickly constructed and easily maintained. There is enough scope for combining modern technology in the maintenance and operation of CSCs. Such

opportunities can not only boost private participation in communal facilities but also play an important role in India's mission to completely end open defecation.

Many private companies and startups are engaged in the construction and maintenance of communal facilities in India. Some prominent ones include 3S (Sanitation Solutions Simplified), Basic Shit, Svadha, Ekam Eco Solutions, Samagra and Bankabio. Private players are getting funding support from private equity investors.

Risks to consider are mainly operational in nature. Though shared toilets are a big facilitator of curbing open defecation among the floating population, poorly maintained and dirty communal facilities are a big source of health risks. Lack of cleanliness in communal facilities can lead to poor health outcomes such as diarrhoea, helminth infections, enteric fevers, faecal-oral diseases and adverse maternal or birth outcomes. Lack of sanitation is also linked to infections and eye diseases such as trachoma. Public health education campaigns are needed to improve sanitation standards in informal settlements. Community facilities work well where people are able to communicate and devise a workable cleaning schedule and are informed about the public health consequences of unclean toilets.

<sup>47</sup> <https://apps.who.int/iris/bitstream/handle/10665/336687/9789240015470-eng.pdf>

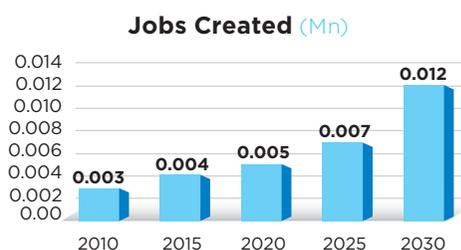
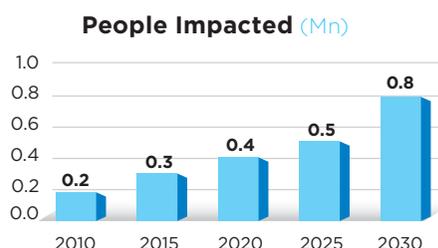
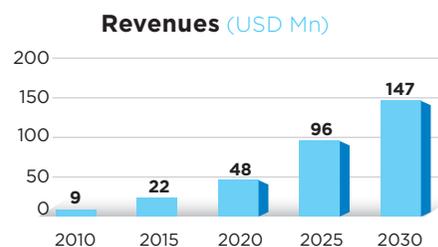
<sup>48</sup> <https://www.downtoearth.org.in/news/rural-water-and-sanitation/is-india-really-open-defecation-free-here-s-what-numbers-say-77918>

## INVESTMENT IDEA 10

## Sanitation Workers Skilling and Safety Equipment

One of the most important contributors to public health are sanitation workers who risk their own health and life in cleaning public toilets, emptying pits and septic tanks, cleaning sewers and manholes, and transporting faecal sludge. They are exposed to various occupational hazards such as infections caused due to contact with excreta-related pathogenic organisms, injuries on the job, including falling from the collection truck, suffering cuts and lacerations from metal waste, suffering back and spinal cord injuries from lifting heavy loads, fractures, amputations, etc. Their vulnerability is exacerbated by financial challenges, stigma due to the nature of the work and caste-based discrimination. They are some of the world's most marginalised, poor and discriminated against communities, often at the bottom of the social and economic ladder.

Millions of sanitation workers have died in developing countries while being exposed to health hazards and working without protective equipment. In India, over a million sanitation workers have died in the last 50 years, including 9,730 deaths in the last five years.<sup>49</sup> According to official data, between 2017 and late 2018, 1 sanitation worker died every fifth day in the country while other estimate suggests that the numbers were thrice the official data, with 3 deaths every 5 days.<sup>50</sup> India has over 5 million sanitation workers with more than 50 percent of the urban workforce comprising of women. The female workforce is more prone to facing discrimination in wages, has negligible participation in decision making and is often excluded from the benefits of government welfare programmes.<sup>51</sup>



Sanitation workers are broadly divided into nine different categories based on their type of work with varying level of health hazards

such as sewer cleaning, faecal sludge handling, railway cleaning, latrine cleaning, treatment plant work, community toilet keeping, school toilet cleaning, drain cleaning and domestic work. Around 40 percent of all sanitation workers are based in urban regions and are involved in the riskiest jobs such as sewer cleaning and septic tank cleaning. Almost all sanitation workers belong to the lowest sub-caste communities in India.

According to the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013, manual scavenging is banned in India. Efforts have been made by central and state governments to dignify sanitation workers through various schemes and provisions. Under the Swachh Bharat Mission-Urban, more than 84,000 informal waste pickers have been integrated into the formal workforce by several urban local bodies such as New Delhi Municipal Corporation and Mysuru Municipal Corporation. Under the Scheme for Rehabilitation of Manual Scavengers (SRMS) thousands of sanitation workers have been provided with training in multiple trades along with a capital subsidy for self-employment projects.

Efforts have also been made by government and private operators to automate drainage cleaning in the country. In November 2020, the central government announced the Safaimitra Suraksha Challenge to prevent hazardous cleaning of sewers and septic tanks and promote their mechanised cleaning in 243 cities of India. The scheme includes training of sanitation workers on cleaning of sewers and septic tanks along with equipment and workforce norms for managing waterborne sanitation. Private companies such as Genrobotics have developed the world's first robotic scavenger called Bandicoot that is engineered for cleaning any type of sewer manholes. Similar examples include SEPoy Septic Tank Robot developed by a group of students from IIT Madras.

The government is providing frameworks and policies to help eradicate manual scavenging and encouraging private companies to adopt technological equipment. To improve the working conditions of sanitation workers much participation is required from the private sector to advise further on the use of advanced machines in sanitation. Providing social protection and labour rights to sanitation workers has become a vital need to for an inclusive and sustainable ecosystem. The majority of manual scavengers are part of the informal workforce and are forced to work as daily wagers and contractors without any financial security. There is a need to not only eradicate manual scavenging but also provide skill development to the sanitation workforce. Skilling sanitation workers will help them use advanced sanitation equipment, access loans and cash assistance, engage in professions other than sanitation, explore self-employment and be able to take advantage of various government schemes launched to assist sanitation workers.

All such initiatives require private investment and focused monitoring along with management expertise for streamlined operations. Ultimately, there is a need for mind-set change among those who still consider sanitation workers as untouchable and second-class citizens. Government and the private sector should work towards organising a traditionally fragmented and unregulated workforce to give dignity to sanitation workers and acknowledge their contribution towards the cleanliness of the country.

<sup>49</sup> <https://indianexpress.com/article/opinion/columns/why-are-so-many-sanitation-worker-deaths-unaccounted-7451152/>

<sup>50</sup> [https://www.susana.org/\\_resources/documents/default/3-3730-7-1574428900.pdf](https://www.susana.org/_resources/documents/default/3-3730-7-1574428900.pdf)

<sup>51</sup> <https://home.kpmg/in/en/home/insights/2020/07/protecting-our-sanitation-workers.html>

# 100 Startups & Investors

| Investment Idea  | Startups- Investment Stage/ Last Funding Type   |   |          |          |           |  |
|--|---|---|----------|----------|-----------|--|
|  | Angel/Seed  | Series A  | Series B | Series C | Series D+ |  |
| <b>INVESTMENT IDEA 1</b><br><b>Drinking Water</b>      | <b>Startup:</b> HYDROP (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> AtServe (2020)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Uravu Labs (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> VayuJal (2016)<br><b>Investors:</b> Engineers India, IITM Incubation Cell<br><hr/> <b>Startup:</b> OCEO (2016)<br><b>Investors:</b> Mass Challenge, Climate Launchpad, ShelterTech Accelerator<br><hr/> <b>Startup:</b> Maithri Aquatech (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> WaterMaker (2004)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Lamaara Technologies (2018)<br><b>Investors:</b> Times of India, Kerala Startup Mission | <b>Startup:</b> Janajal (2015)<br><b>Investors:</b> tricolorcleantech.com<br><hr/> <b>Startup:</b> Swajal (2011)<br><b>Investors:</b> Agra Chains, Rajasthan Venture Capital Fund, SIDBI, Tlabs, Millennium Alliance, Saurya Eneritech<br><hr/> <b>Startup:</b> Waterlife (2008)<br><b>Investors:</b> Matrix Partners India, Aavishkaar, Michael & Susan Dell Foundation, Millennium Alliance |          |          |           |  |
| <b>INVESTMENT IDEA 2</b><br><b>Desalination Plants</b> | <b>Startup:</b> Solnce Green Energy (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Arun Electrochemical Systems (2005)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Theway Membranes (1999)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Ionex Engineers (2007)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Green Water Science (2005)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Thermosift Engineering (2017)<br><b>Investors:</b> Unfunded   |   |          |          |           |  |

| Investment Idea  | Startups- Investment Stage/ Last Funding Type  |  |          |          |  |
|--|--|--|----------|----------|--|
|  | Angel/Seed   | Series A   | Series B | Series C | Series D+  |
| <b>INVESTMENT IDEA 3</b><br><b>Liquid Waste Management: Blackwater Treatment</b> | <b>Startup:</b> ECOSTP (2017)<br><b>Investors:</b> Habitat For Humanity, Shelter Tech Accelerator, Brigade REAP<br><hr/> <b>Startup:</b> Proklean Technologies (2009)<br><b>Investors:</b> Infuse Ventures, CIIE, Siana, Ava, Angel Investors<br><hr/> <b>Startup:</b> Ossus Bio (2018)<br><b>Investors:</b> IKP Eden, Shell E4<br><hr/> <b>Startup:</b> SFC Environmental Technologies (2008)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Absolue Water (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> SmartTerra (2016)<br><b>Investors:</b> T-Hub<br><hr/> <b>Startup:</b> VeleSolv (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Green Aqua Enviro Projects (2014)<br><b>Investors:</b> Unfunded   |  |          |          | <b>Startup:</b> Banka Biolo (2009)<br><b>Investors:</b> Public listed<br><hr/> <b>Startup:</b> Shriram EPC (2000)<br><b>Investors:</b> Public listed |
| <b>INVESTMENT IDEA 4</b><br><b>Liquid Waste Management: Greywater Treatment</b>  | <b>Startup:</b> Grey Water Solutions (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Indrawater (2017)<br><b>Investors:</b> SINE, CleanTech, Riidl, Palava Accelerator<br><hr/> <b>Startup:</b> Rainstock (2014)<br><b>Investors:</b> RTBI<br><hr/> <b>Startup:</b> Vision Earthcare (2004)<br><b>Investors:</b> SINE<br><hr/> <b>Startup:</b> Cerulean Enviro Tech (2015)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> 7-11ERM (2017)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> REVY Environmental Solution (2015)<br><b>Investors:</b> emPower, AIM Smart City Acceleartor<br><hr/> <b>Startup:</b> Jalsevak Solution (2016)<br><b>Investors:</b> Startup Incubation and Innovation Centre<br><hr/> <b>Startup:</b> 3RManagement (2015)<br><b>Investors:</b> Unfunded | <b>Startup:</b> Greywater (2010)<br><b>Investors:</b> Nexus Venture Partners |          |          |  |

| Investment Idea  | Startups- Investment Stage/ Last Funding Type  |   |          |  |           |
|--|--|---|----------|--|-----------|
|  | Angel/Seed   | Series A  | Series B | Series C   | Series D+ |
| <b>INVESTMENT IDEA 5</b><br><b>Faecal Sludge Collection &amp; Transportation</b> | <b>Startup:</b> Jalodbust (2019)<br><b>Investors:</b> FreeFlow<br><hr/> <b>Startup:</b> Arasan Air Septic Tank Cleaning (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Universal Sludge India (2007)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Honey Sucker (2019)<br><b>Investors:</b> Bill & Melinda Gate Foundation   |   |          |  |           |
| <b>INVESTMENT IDEA 6</b><br><b>Waste to Energy</b>                               | <b>Startup:</b> Paterson Energy (2016)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Micro Renew Solutions (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> JSAMEY Biotech (2018)<br><b>Investors:</b> a-IDEA<br><hr/> <b>Startup:</b> My Eco Energy (2011)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> E3 Waste Solutions (2018)<br><b>Investors:</b> Startup Nexus<br><hr/> <b>Startup:</b> Techniron (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> EnergyBin (2015)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Pelican Biotech (2008)<br><b>Investors:</b> BIRAC<br><hr/> <b>Startup:</b> Rays Enserv (2014)<br><b>Investors:</b> Startup Nexus<br><hr/> <b>Startup:</b> Growdiesel (2001)<br><b>Investors:</b> Unfunded |   |          |  |           |
| <b>INVESTMENT IDEA 7</b><br><b>Solid Waste Management - Recycling</b>            | <b>Startup:</b> Banyan Nation (2013)<br><b>Investors:</b> CIIE, Artha, Village Capital, Millennium Alliance<br><hr/> <b>Startup:</b> Recykal (2016)<br><b>Investors:</b> Circulate Capital, Bank of Singapore, Idea Entity, Triton, Avia International<br><hr/> <b>Startup:</b> WeConvert (2015)<br><b>Investors:</b> Right Side Capital Management, MARL 5G Accelerator, Alchemist Accelerator<br><hr/> <b>Startup:</b> Mend Earth (2021)<br><b>Investors:</b> Startup Incubation and Innovation Centre   | <b>Startup:</b> Karma Recycling (2012)<br><b>Investors:</b> Infuse Ventures, Low Carbon Enterprise Fund |          | <b>Startup:</b> Attero Recycling (2008)<br><b>Investors:</b> Kallari Capital, International Finance Corporation, Oriental Bank of Commerce, DFJ, Forum Synergies |           |

Continued...

| Investment Idea   | Startups- Investment Stage/ Last Funding Type   |          |          |          |           |
|---|---|----------|----------|----------|-----------|
|   | Angel/Seed  | Series A | Series B | Series C | Series D+ |
| <b>INVESTMENT IDEA 7</b><br><b>Solid Waste Management - Recycling</b>                       | <b>Startup:</b> R2 PROMISE (2017)<br><b>Investors:</b> Karnataka Startup Cell, Brigade REAP<br><hr/> <b>Startup:</b> LUCRO (2012)<br><b>Investors:</b> Circulate Capital<br><hr/> <b>Startup:</b> Ziptrax (2016)<br><b>Investors:</b> Shell E4<br><hr/> <b>Startup:</b> Exigo Recycling (2012)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Pyrocrat (2007)<br><b>Investors:</b> Shell E4, Plug and Play APAC   |          |          |          |           |
| <b>INVESTMENT IDEA 8</b><br><b>Solid Waste Management - Collection &amp; Transportation</b> | <b>Startup:</b> Waste Ventures (2013)<br><b>Investors:</b> Village Capital, T-Hub, Yunus Social Business, Beyond Capital Fund, Toniic<br><hr/> <b>Startup:</b> The Kabadiwala (2013)<br><b>Investors:</b> ABCOM Invest, Lemon ideas, Beehive<br><hr/> <b>Startup:</b> Extra Carbon (2011)<br><b>Investors:</b> Jaarvis Accelerator, Brand Capital, Valpro, Trinity Engineers<br><hr/> <b>Startup:</b> Junkart (2015)<br><b>Investors:</b> KIIT Technology Business Incubator, Startup Tunnel<br><hr/> <b>Startup:</b> Citizengage (2015)<br><b>Investors:</b> Al Hamra Group, Tracxn Labs, PitchRight ventures, Prevage Ventures, Setu Net<br><hr/> <b>Startup:</b> Raddi Connect (2015)<br><b>Investors:</b> AIM Smart City Accelerator<br><hr/> <b>Startup:</b> Kabadiwalla Connect (2015)<br><b>Investors:</b> Upaya Social Ventures<br><hr/> <b>Startup:</b> Amster Tec (2017)<br><b>Investors:</b> CoE IoT<br><hr/> <b>Startup:</b> Swapeco (2019)<br><b>Investors:</b> IIITD Innovation & Incubation Center<br><hr/> <b>Startup:</b> Shoonya Environmental Solutions (2019)<br><b>Investors:</b> Unfunded<br><hr/> <b>Startup:</b> Saahas Zero Waste (2001)<br><b>Investors:</b> C4D Partners, Asha Impact, Artha Impact, Indian Angel Network, Yukti<br><hr/> <b>Startup:</b> Zeleno (2016)<br><b>Investors:</b> Risers Accelerator<br><hr/> <b>Startup:</b> Karo Sambhav (2017)<br><b>Investors:</b> Unfunded |          |          |          |           |

| Investment Idea   | Startups- Investment Stage/ Last Funding Type   |  |          |          |           |
|---|---|--|----------|----------|-----------|
|   | Angel/Seed  | Series A   | Series B | Series C | Series D+ |
| <b>INVESTMENT IDEA 9</b><br><b>Communal Facilities</b>          | <b>Startup:</b> Basic Shit (2014)<br><b>Investors:</b> AIM Smart City Accelerator   | <b>Startup:</b> Saraplast (1999)<br><b>Investors:</b> Aavishkaar, ResponsAbility |          |          |           |
|   | <b>Startup:</b> Ekam Eco (2013)<br><b>Investors:</b> Unfunded   |  |          |          |           |
|   | <b>Startup:</b> Samagra Sanitation (2011)<br><b>Investors:</b> Bill & Melinda Gates Foundation, The Nudge Foundation, Upaya Social Ventures, Millennium Alliance, N/Core            |  |          |          |           |
|   | <b>Startup:</b> Altersoft Innovations India Pvt Ltd (2012)<br><b>Investors:</b> Unfunded  |  |          |          |           |
|   | <b>Startup:</b> GARV Toilets (2016)<br><b>Investors:</b> Indian Institute of Technology, Village Capital, Villgro, Startup Incubation and Innovation Centre, SDG Impact Accelerator |  |          |          |           |
|   | <b>Startup:</b> Eram Scientific Solutions (2008)<br><b>Investors:</b> Bill & Melinda Gates Foundation   |  |          |          |           |
|   | <b>Startup:</b> Loocafe (2017)<br><b>Investors:</b> Unfunded  |  |          |          |           |
|   | <b>Startup:</b> Wowlet (2016)<br><b>Investors:</b> empoWer, AIM Smart City Accelerator  |  |          |          |           |
| <b>Startup:</b> Kleen Loos (2013)<br><b>Investors:</b> Unfunded |   |  |          |          |           |

| Investment Idea   | Startups- Investment Stage/ Last Funding Type   |          |          |          |           |
|---|---|----------|----------|----------|-----------|
|   | Angel/Seed  | Series A | Series B | Series C | Series D+ |
| <b>INVESTMENT IDEA 10</b><br><b>Sanitation Workers Health Infrastructure &amp; Skilling</b> | <b>Startup:</b> Spruce Up (2015)<br><b>Investors:</b> Unfunded  |          |          |          |           |
|   | <b>Startup:</b> TrashCon (2017)<br><b>Investors:</b> Karnataka Startup Cell, Indian Institute of Management Bangalore, iB Hubs, Shell E4                  |          |          |          |           |
|   | <b>Startup:</b> IRS (2018)<br><b>Investors:</b> IPV, FirstPort, Plug and Play APAC, AVI Global Plast, Nepra, Kamal Jyoti Investments                      |          |          |          |           |
|   | <b>Startup:</b> Quaadbotics (2020)<br><b>Investors:</b> Unfunded  |          |          |          |           |
|   | <b>Startup:</b> Vinglabs (2019)<br><b>Investors:</b> Unfunded   |          |          |          |           |
|   | <b>Startup:</b> Genrobotic Innovations (2015)<br><b>Investors:</b> Unicorn India Ventures, 10000 Startups, The Seed Fund, Bharat Petroleum, Seafund       |          |          |          |           |
|   | <b>Startup:</b> Antariksh Waste Ventures (2017)<br><b>Investors:</b> IITM Incubation Cell   |          |          |          |           |
|   | <b>Startup:</b> NasoFilters (2019)<br><b>Investors:</b> LetsVenture, PitchRight Ventures, Seven Hills Partners, Veeraa Ventures, Full Circle Technologies |          |          |          |           |
|   | <b>Startup:</b> Ajantha Techno Solutions (2020)<br><b>Investors:</b> Unfunded   |          |          |          |           |

## Author Bios



**Amit Bhatia**, Founder & CEO, Aspire Impact & Aspire Circle

Amit Bhatia (www.amitb.in), is the Founder of Aspire Impact & Aspire Circle, was formerly Inaugural CEO of G7's Global Steering Group for Impact Investment (2017-20); Founding CEO of India's Impact Investors Council (2014-2017); Founding CEO of WNS Knowledge Services; and Founder of McKinsey Knowledge Centre.



**Abhinav Akhilesh**, Director, KPMG

Abhinav Akhilesh is a Partner with KPMG in India, leading their WASH and Social & Rural Development practices. He is a published author on social programming, social enterprises, and sanitation ecosystem. Abhinav is an alumnus of Harvard Kennedy School of Government and IIM Lucknow.



**Ambar Mitra**, Regional Leader, Microsoft India

Ambar Mitra has 21+ years of experience in executive roles globally in Financial Planning & Analysis, Process Excellence, Operations and Business Analytics, Divestiture, and Integration Management. He was on Board of Directors at CoreNet Global. Currently, he is working as Regional Head, Real Estate and Facilities in Microsoft India.



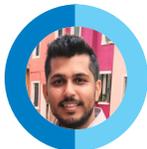
**A L N Rao**, CEO, Exigo Recycling

A.L.N. Rao is the CEO- of Exigo Recycling. He is an internationally acclaimed speaker, panelist, mentor, & advisor in Recycling/Refurbishing/Retail industry. He is associated as core committee/ council member with NITI Aayog, CII, R2-TAC, R2, MRAI, MAIT. Mr. Rao held leadership positions in Attero Recycling, Aditya Birla Retail & Videocon group.



**Bhitush Luthra**, Principal Consultant, Athena Infonomics

Bhitush Luthra is passionate about working towards water and sanitation for all. At Athena he leads projects on Monitoring Evaluation and Learning in WASH and Sanitation Financing. He has experience of working in South Asia and Africa, in citywide sanitation planning, non-sewered sanitation etc. He has authored the Practitioner's Guide on Septage Management in India.



**Manik Dhingra**, Co-Founder, Shoonya

Manik Dhingra is the co-founder of Shoonya and Eywa Environmental Service Foundation. Shoonya implements market-based solutions to enable; diversion of waste from landfills and reclamation of landfills. While Eywa focuses on empathetic leadership development for the waste management sector.



**Manoj Gulati**, MD, Water.org

Manoj Gulati has 27 years of experience in IT, supply chain & development sector globally. He was Senior Director- SE Asia & Country Director-India at SightLife. He was associated with Gartner Inc. and is the Member of Steering Committee, India Sanitation Coalition-FICCI and Chair-Credit Financing Taskforce.



**Naina Lal Kidwai**, Chair, ISC FICCI

Naina Lal Kidwai is Chairman Advent India Advisory board and past president of FICCI and CEO & Chairman of HSBC India. She chairs the India Sanitation Coalition and FICCI Water Mission and has authored 3 books including the bestseller "Survive Or Sink: An Action Agenda for Sanitation, Water, Pollution, and Green Finance"



**Natasha Patel**, CEO, ISC-FICCI

Natasha Patel has 30+ years of experience in financial services globally. Since 2018, she is focussing in development sector, building strategic philanthropy dialogue for Dasra & subsequently steered ISC, creating & implementing social sector initiatives between investors, grantees, intermediaries including the Government around enhancement of private sector funding in WASH.



**Nikhil Sawhney**, VC & MD, Triveni Turbine

Nikhil Sawhney is the VC & MD at Triveni Turbines & Director at Triveni Engineering. He is the VP-All India Management Association & on the Board of Governor-IIM Calcutta. He helped found CII-Triveni Water Institute and is Trustee-Tirath Ram Shah Charitable Hospital, the Emmanuel College India Trust and the Ananta Aspen Center, Member-Trilateral Commission and various Government of India led bilateral CEO forums. He is Fellow & Co-Chair-Ananta Aspen-led India-Israel Forum.



**Nimish Shah**, MD, IAPMO

Nimish Shah is an accomplished environmental sustainability and health-focused business leader. He heads the International Association of Plumbing & Mechanical Officials, India dedicated to protecting public health through rigorous testing, improved standards, and certification of WASH systems & solutions. He has authored a book "Swachh Bharat for Swastha Bharat"



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Pawan Sachdeva has -27 years of work experience spanning across the public market investing, water-related public policy, and gas pipeline laying. Currently, he is Director of Avendus Capital Pte Ltd, Singapore, and Non-Executive Director of Water Management International Pte Ltd Singapore.



**Pranshu Singhal**, Founder, Karo Sambhav

Pranshu Singhal founded 'Karo Sambhav' which designs & implements circular solutions for multiple waste streams. He won 'Social Entrepreneur of the Year 2021 India' award by Schwab Foundation, sister organization WEF. He was Director-Digital Learning, Microsoft & Head-Sustainability, Nokia. He is an Aspen, Ashoka, Chevening & Aspire Circle Fellow.



**Rajeev Kher**, Founder & MD, Saraplast

Rajeev Kher concentrates his efforts in providing migrant clientele high-quality toilets & cleaning services since 1999, now recognized as an industry standard and profitable business model. Rajeev served on the Board of Directors at Portable Sanitation Association International (PSAI) - first Indian & first Asian on this coveted forum.



**Venugopal Gupta**, Director- Accelerator Program, Toilet Board Coalition

Venugopal Gupta is the Director of Accelerator and Investments at TBC. He has over twenty years of experience as an entrepreneur and senior executive in the corporate sector. Venu holds an MBA from INSEAD.



**Vineet Rai**, Founder, Aavishkaar

is the Founder and Chairman of Aavishkaar Group, an Impact Investment Platform impacting millions using an entrepreneurship-based development approach. The Group includes Aavishkaar Capital, Arohan, Ashv Finance, Intellectap & Sankalp, has 7K+ employees & manages assets in excess of US \$ 1.2 Billion. Vineet has received numerous Global awards and serves several International reputed advisory boards



**Wilma Rodrigues**, Founder & CEO, Saahas Zero Waste

Wilma Rodrigues is the founder and CEO of Saahas Zero Waste (SZW), a social enterprise that implements holistic, zero waste solutions across India. She believes that in the 21st-century businesses must not just talk but deliver on environmental and social impact.

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# ASPIRE™

Aspire, founded by Amit Bhatia, focuses on impact leadership and ecosystem development through three initiatives: Aspire Impact ([www.aspireimpact.in](http://www.aspireimpact.in)) for ecosystems, Aspire Circle ([www.aspirecircle.org](http://www.aspirecircle.org)) for social leadership and Aspire Education ([www.aspireeducation.in](http://www.aspireeducation.in)) for education. Aspire, established in 2007, based in Gurgaon (India) is committed to making Impact a way of life.

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