



THE SANITATION ECONOMY at SECTOR SCALE

TRANSFORMATIVE SOLUTIONS FOR
NEW BUSINESS VALUE
NOVEMBER 2019



FOREWORD

A CALL TO ACTION FOR SECTOR LEADERS

The Sanitation Economy has the potential to unlock 3.8 trillion litres of new resources every year regenerated from toilets and sanitation systems via the Circular Sanitation Economy.

Sanitation is becoming a material issue for businesses across sectors and no longer a development issue alone.

Businesses are responsible for providing access to safely managed sanitation for their employees, across supply chains and in communities where they operate.

Poorly managed sanitation has become a business risk that can no longer be ignored affecting the health of workers, their families and communities, well-being and productivity, environmental contamination of soil and water. There is also the missed opportunity to mitigate and adapt to climate change.

An estimated 2.3 billion people around the world still lack access to basic sanitation and 4.5 billion people - more than half the world's population - still lack access to safely managed sanitation along the entire service chain. Increasing urbanisation is aggravating sanitation issues, environmental degradation and public health.

Ensuring safely managed sanitation for workers wherever they are is the mounting human rights issue that is coming for all businesses everywhere.

As business leaders we have the opportunity now to raise the bar, setting new standards for our sectors with safely managed sanitation in our operations, supply chains and communities using sanitation business approaches that unlock new resources currently constrained, to ensure sustainable business growth and to end the global sanitation crisis.

15.6 million global tea workers and their families produce 33 billion litres of Toilet Resources every year.

With today's technologies and new business models, these Toilet Resources can be converted into one of the following:

7.6 billion MJ of bio fuel
12 billion MJ of Biogas (heat)
1.4 billion kWh (electricity)
2 million tonnes of co-compost at a 3:1 ratio, regenerating
16,000 tonnes of Phosphorus
17,000 tonnes of Potassium
23,000 tonnes of Nitrogen

Sanitation can create new economic value and becomes a solution provider for urgent business and societal issues that address many of the Sustainable Development Goals – from water security, to climate change, food security and human rights.

With Sanitation Economy approaches, sanitation access can also become a solution for water security, energy security, food security and health. Universal access to safely managed sanitation, using circular sanitation approaches, can unlock these new resources for manufacturing and agricultural sectors facing energy, nutrient and water constraints.

Toilet Resources (our term for human waste) are valuable renewable resources that grow with population growth and that transform the economics of sanitation from unaffordable costs into multi-billion dollar business opportunities, reducing the cost of sanitation for society.

The Tea Sector is leading the way in re-thinking and re-building better resource flows and creating a model for scaling up sustainable sanitation across the broader agriculture industry. This approach to the Sanitation Economy, implemented across a business sector, isn't limited to agriculture. These systems work when there is a population of employees, biological resource flows (e.g. food or animal waste) and a need for energy, nutrients or water. With these requirements, the Circular Sanitation Economy is a solution for various industries beyond agriculture, including manufacturing and mining.

Any business operations with energy, nutrient, and water flows – from breweries to supermarkets – may find that integrating these flows, together with sanitation, yields a strong business case.

Circular Sanitation Economy approaches have the potential to transform biological waste cycles and unlock new resources for business and society.

Hajar Alififi
Global Brand Vice President, House Hold Cleaners
Unilever
Toilet Board Coalition Steering Committee Member



Anurag Priyadarshi
Global Sustainability Manager
Tata Global Beverages



Sandy Rodger
Chief Operations Officer
Toilet Board Coalition



THE BUSINESS CASE

SANITATION ECONOMY OPPORTUNITIES FOR SECTORS

The business case for sanitation provision just got stronger.

The Sanitation Economy presents a new model for best practice for sectors to adopt and proliferate. The provision of sanitation, important in itself, now can also provide economic, environmental, and social benefits for many types of business operations.

From cost to value

In this model sanitation is more than toilets and waste treatment: the toilets create value, unlocked within three domains – the Toilet Economy, Circular Sanitation Economy, and Smart Sanitation Economy. Each offers business models with new revenues.

New business models

Entrepreneurs are already combining these models to suit local conditions, and pathways to scale and profitability are emerging, creating opportunities for large and small business. Work is required to build up ecosystems of businesses plus investment, regulation, standards, education, and other enablers, but the potential is already clear.

The Sanitation Economy is a systemic approach creating the right underlying resource flows (energy, nutrients, water, data, and finance) for sustainable systems.

Sanitation Economy approaches equip businesses with ways to optimise flows of renewable energy, biological nutrients, water, related to facilities such as plantations, food processing plants, breweries, and mining communities.

TRIPLE BOTTOM LINE BENEFITS

ECONOMIC

Systems that capture Toilet Resources can produce feedstock to create organic fertilisers and energy, leading to cost savings for operations, cost recovery for initial infrastructure investments, and even potentially new sources of revenue.

ENVIRONMENTAL

Circular sanitation systems have multiple environmental benefits – reduced carbon emissions and water pollution, and potentially improved soil health and reduced fertiliser.

SOCIAL

Clean, safe, sanitation improves the livelihoods, and health of a community, specifically enhancing women's safety, dignity and equality.

For the complete list of economic, environmental and social benefits refer to *The Sanitation Economy in Agriculture* (Toilet Board Coalition, 2018).



THE TOILET ECONOMY

Designing for circularity enables new choices for sanitation infrastructure – the type of toilet technology chosen matters. Pit latrines and sewers are no longer the only options. There is a growing new industry of diverse toilet technologies to fit different contexts. In the Sanitation Economy the toilet becomes a delivery system of resources and data.

New workplace standards adopted by companies and sectors can scale up the Toilet Economy approaches.



THE CIRCULAR SANITATION ECONOMY

Sanitation systems are abundant in value adding flows of reusable and renewable resources including energy, nutrients and water – resources currently scarce across many sectors and geographies. New technologies are available today to convert Toilet Resources (our term for human waste) into reusable resources. In the Circular Sanitation Economy recovering resources from toilets enables cost recovery of sanitation infrastructure, operations and maintenance while closing the loops of biological materials (previously discharged into water bodies if treated at all) with far reaching business applications that we are only beginning to understand.

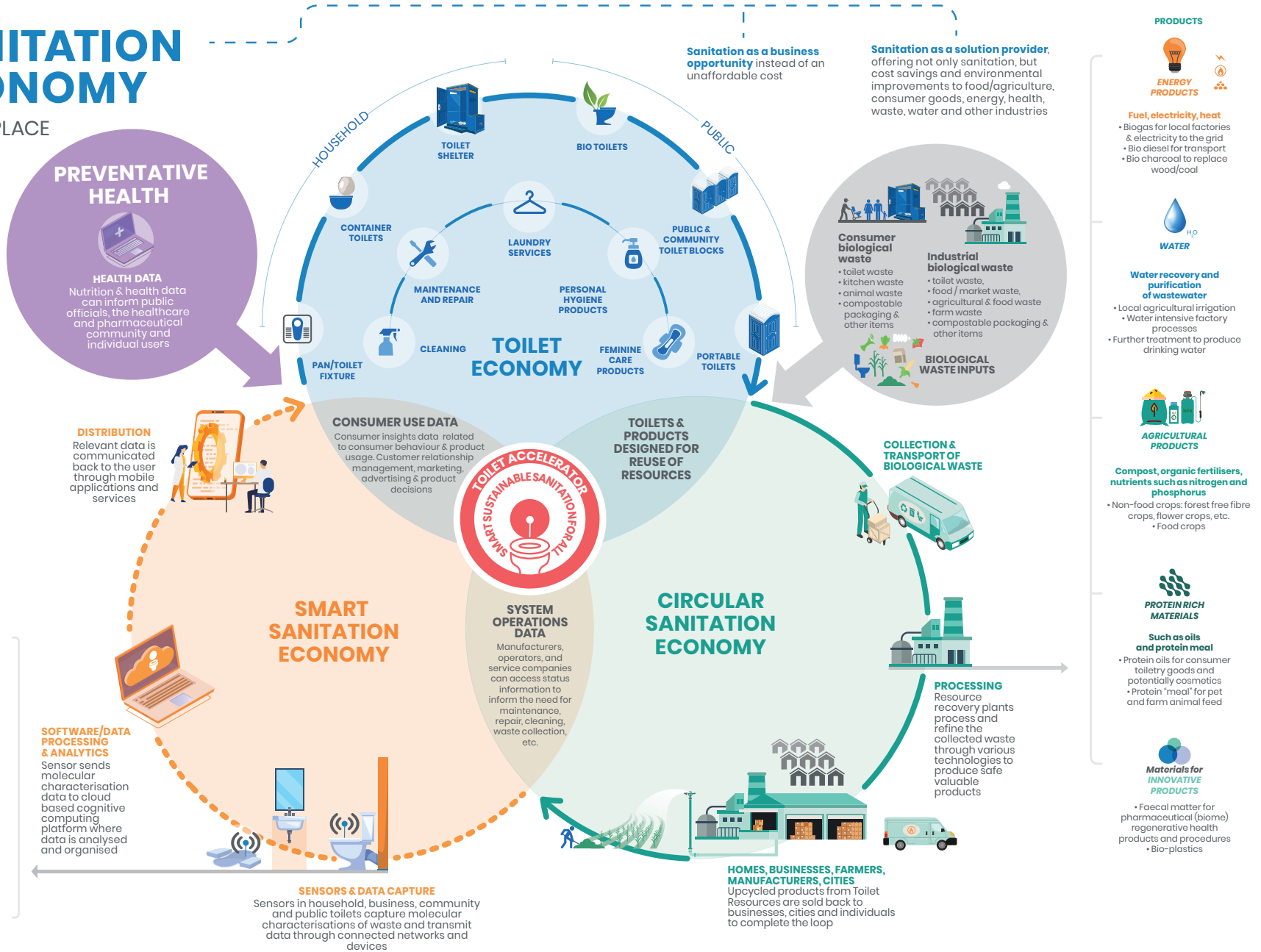


THE SMART SANITATION ECONOMY

Digitising sanitation systems produces new data streams and insights to optimise sanitation service delivery and understand Toilet Resource quality for reuse. Sensors to track wastewater and sewage quality can provide information about nutrient loads in order to assess the most appropriate re-usage output (ie. energy, organic fertiliser or water) as well as information about health and behaviour.

THE SANITATION ECONOMY

MARKETPLACE



SANITATION ECONOMY OPPORTUNITIES FOR SECTORS

3 SECTOR OPPORTUNITIES FOR SCALE

The private sector has a unique ability through their supply chains and use of resources to accelerate the scaling of the Sanitation Economy. Business leaders and public sector actors have been working together to align, coordinate, and expand efforts towards the provision of sustainable sanitation across the world. The tea industry is a leading example of the Sanitation Economy working at a sector level.



Our manufacturing facilities have set ambitious carbon positive goals. Taking a circular approach to sanitation can help us to meet those goals while delivering safe and hygienic sanitation.

- Hajar Aliffi, Global Brand Vice President, House Hold Cleaners, Unilever

AGRICULTURE

Agricultural industries are in the spotlight in terms of human rights and safe working conditions for workers. Sanitation Economy approaches for sanitation could provide solutions that create healthier communities, while producing renewable resources in the form of fuel, fertiliser or nutrients

As climate change continues to disrupt agriculture systems, circular sanitation can increase the resilience of sustainable agriculture.

MANUFACTURING

Implementing the Sanitation Economy within factories, that have existing biowaste flows, could help sectors meet low carbon targets, increase the amount of water recycled and produce a sustainable energy source.

TEA

Tea is an industry with strict margins and obstacles to overcome in a sector with a heavy spotlight to cut costs while providing adequate environments for its workers. The tea sector demonstrates the first steps to a sector level approach by opening up the market for unique business partnerships, driving sustainable sanitation, and providing a solution for vital resources.

For forward-thinking industry leaders interested in the benefits of the Sanitation Economy, "Sanitation at a Sector Scale" is not tea specific. All industries with biological waste flows, nutrient or fuel requirements and a population of workers can benefit from implementing circular sanitation systems. Beyond tea, agricultural and manufacturing are two key industries with the resource requirements and waste flows needed by circular sanitation systems.

These sectors can begin to build the Sanitation Economy into a working system at scale by:

- Assessing resource flows and calculating the amount of fuel, fertiliser, feed, or water which could be generated on a plantation or within a factory by using the Toilet Board Coalition's Toilet Resource Calculator
- Comparing the economic, environment and social benefits of different technologies that convert Toilet Resource into an end product (i.e. fuel or fertiliser). The Toilet Board Coalition has developed a framework to support this decision process, which is available upon request.
- Collaborating with entrepreneurs, investors, and governments to implement a trial of a circular sanitation system.



It's key to boost new circular agriculture models by recycling nutrients such as Nitrogen & Phosphorus - from urban, agricultural and industrial waste - into high quality fertilizers. Our partnership announced in January 2019 with Yara, a group specializing in crop nutrition, is a great example of necessity to join forces to unlock new shared value opportunities.

- Eric Lesueur, CEO 2eI, Veolia | 

Specifically, the Indian fertiliser sector has 'tremendous' growth potential in the coming years. Fertiliser production in India is growing at a compound annual growth rate of 4% from FY13 onwards and with production estimated to reach 465,000 tonnes by 2020.

Ecofys & Toilet Board Coalition, 2019

According to Statistics MRC, the Global Organic Fertilizers Market is:

\$6.7 billion in 2017

and is expected to reach \$19.7 billion by 2026¹.

¹ <http://www.researchformarkets.com/reports/organic-fertilizers-global-market-44744>



“Investing in appropriate and innovative technology to provide high standards of hygiene and sanitation for our employees is essential. Circular sanitation systems are important to further enhance our long-term sustainability.”

– Noel Lindsay-Smith, Operations Director of Eastern Produce Kenya LTD

THE RESOURCE STORY

There are over 15.6 million people living and working on tea plantations throughout the world. By implementing circular sanitation, a plantation has the opportunity to produce their own energy, nutrients or water – offsetting the need to purchase these resources. The numbers below are an estimate of what could be possible, based on academic studies of the characteristics of Toilet Resources. It's a rough calibration of the opportunity, which should be a starting point for more detailed feasibility assessment in each location.

GLOBAL TEA PRODUCTION

The global tea sector employs an estimated **15.6 million tea plantation workers** that produce at least **8.3 billion litres** (220,000 tonnes of solid faeces) of Toilet Resources per year. Assuming each worker represents one household with an average of 4 members per household*, then **62.4 million people** reside on tea plantations producing **33 billion litres** (870,000 tonnes of solid faeces) of Toilet Resources per year. If all the Toilet Resources of those living on tea plantations were captured, treated and converted into one of the usable products below, this could produce:



Fuel

1.3 million tonnes of Briquettes mixed with ash at ratio of 45:55 resulting in **7.6 billion MJ**

510 million m3 of Methane Gas resulting in **12 billion MJ** of Biogas (heat) or **1.4 billion kWh** (electricity)



Fertiliser

2 million tonnes of 3:1 co-compost using additional bio-waste from the surrounding communities
16,000 tonnes of Phosphorus,
17,000 tonnes of Potassium
23,000 tonnes of Nitrogen



Feed

840,000 tonnes of Black Soldier Larvae



Water

Low Flush System (additional 65 billion L of water) with 75 % recovery
73 billion litres of water

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Good sanitation is a win-win for everyone: workers, businesses and the environment. It is critical for the health and well-being of plantation workers and their families, so involving tea communities from the outset is crucial to ensure their needs are met. Collaborations between tea communities, government, tea producers and packers can drive transformational change. This can have positive benefits for tea workers and also makes commercial sense for businesses.

– Ethical Tea Partnership



*Household averages calculated based on the United Nation's Household Size and Composition Around the World 2017 Report

TEA PLANTATION IN ASSAM INDIA

In Assam, 2.6 million tea plantation workers produce at least 1 billion litres (36,000 tonnes of solid faeces) of Toilet Resources per year. Assuming each worker represents one household with an average of 4.8

members per household*, then **12.5 million people** reside on tea plantations in Assam

producing **6.6 billion litres** (170,000 tonnes of solid faeces) of Toilet Resources per year. If all the Toilet Resources in Assam were captured, treated and converted into one of the usable products below, this could produce:



Fuel

250,000 tonnes of Briquettes mixed with Ash at 45:55 ratio resulting in **1.5 billion MJ**

100 million m³ of Methane Gas resulting in **2.4 billion MJ** of Biogas (heat) or **280 million kWh** (electricity)



Feed

170,000 tonnes of Black Soldier Larvae



Fertiliser

420,000 tonnes of 3:1 co-compost
3,100 tonnes of Phosphorous
3,300 tonnes of Potassium
4,600 tonnes of Nitrogen



Water

Low Flush System (additional 12 billion L of water) with %75 recovery
14 billion litres of water

THE SANITATION ECONOMY HAS THE POTENTIAL TO UNLOCK 3.8 TRILLION LITRES OF NEW RESOURCES EVERY YEAR REGENERATED FROM TOILETS AND SANITATION SYSTEMS VIA THE CIRCULAR SANITATION ECONOMY.

The numbers above were calculated using the Toilet Resource Calculator developed by the Toilet Board Coalition to help business, governments and organizations to understand the potential of Toilet Resources. A community's Toilet Resources in these calculations can only be used for one product i.e for feed or fertilisers. There are innovations that use Toilet Resources to create more than one product, however they are not represented in these numbers. This is an illustrative example of the tea sector, other industries can use the Toilet Resource Calculator to estimate the opportunity in their sector.

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Hygiene, being the most important ingredient for health, acts as a catalyst for education and the overall development of maternal and infant mortality key performance indicators. Thus the development of an efficient sanitation system is the most basic and crucial need and we at APPL are committed to enhancing the abilities of our workers communities to meet their most basic needs – water, energy, sanitation.

– Jagjeet Kandal, Managing Director of Amalgamated Plantations



DRIVERS FOR ACTION

A Sanitation Economy approach offers solutions to a range of global development issues while accelerating the provision of sanitation, and creating value for multiple business sectors. The Sanitation Economy places sanitation at the centre of a 'new grid' which fundamentally realigns and harnesses flows of nutrients, water, energy, data, and capital. In India alone these markets have been estimated at \$62 billion in 2021 (*Toilet Board Coalition, 2017*). Uniquely, these resources are available in proportion to the population, rather than being depleted as population grows.

SANITATION CAN CREATE NEW ECONOMIC VALUE AND BECOMES SOLUTION PROVIDER FOR URGENT BUSINESS AND SOCIETAL ISSUES THAT ADDRESS MANY OF THE SUSTAINABLE DEVELOPMENT GOALS - FROM WATER SECURITY, TO CLIMATE CHANGE, FOOD SECURITY AND HUMAN RIGHTS.



Contributions to slow climate change by producing renewable energy and reducing carbon and methane emissions, helping businesses meet low carbon targets, while also helping agricultural systems adapt to changing rainfall patterns.



Providing water security through new sources of clean water for agricultural and industrial use, reduced contamination of existing water sources, lower water use in sanitation, and reduced need for irrigation.

Enabling innovation, sales, marketing and consumer research opportunities with consumers in developing markets.



Providing food security by improving soil health, agricultural productivity, climate change resilience, and reducing plantation operating costs through organic fertilisers and soil conditioners.

Enabling female empowerment and health benefits.



Improving the health of workers, both with sanitation's traditional function of preventing disease transmission, and also by providing real-time data for preventative and reactive healthcare for employees.

Creating a waste pathway for all forms of compostable (biological) waste, preserving nutrients and energy in the process, and enabling the replacement of plastic items with compostable alternatives.



TEA SECTOR PROJECT

TOILET BOARD COALITION & ETHICAL TEA PARTNERSHIP

The Toilet Board Coalition and the Ethical Tea Partnership came together in January 2018, to develop innovative sanitation solutions that would improve the lives of tea communities, be implemented at scale, and maintained effectively in the long-term. This project is building the evidence that demonstrates the benefits of circular sanitation and the resources it provides – fuel, nutrients, feed and water for industry, in order to reach a tipping point, where circular sanitation is accepted as best practice across the tea sector.

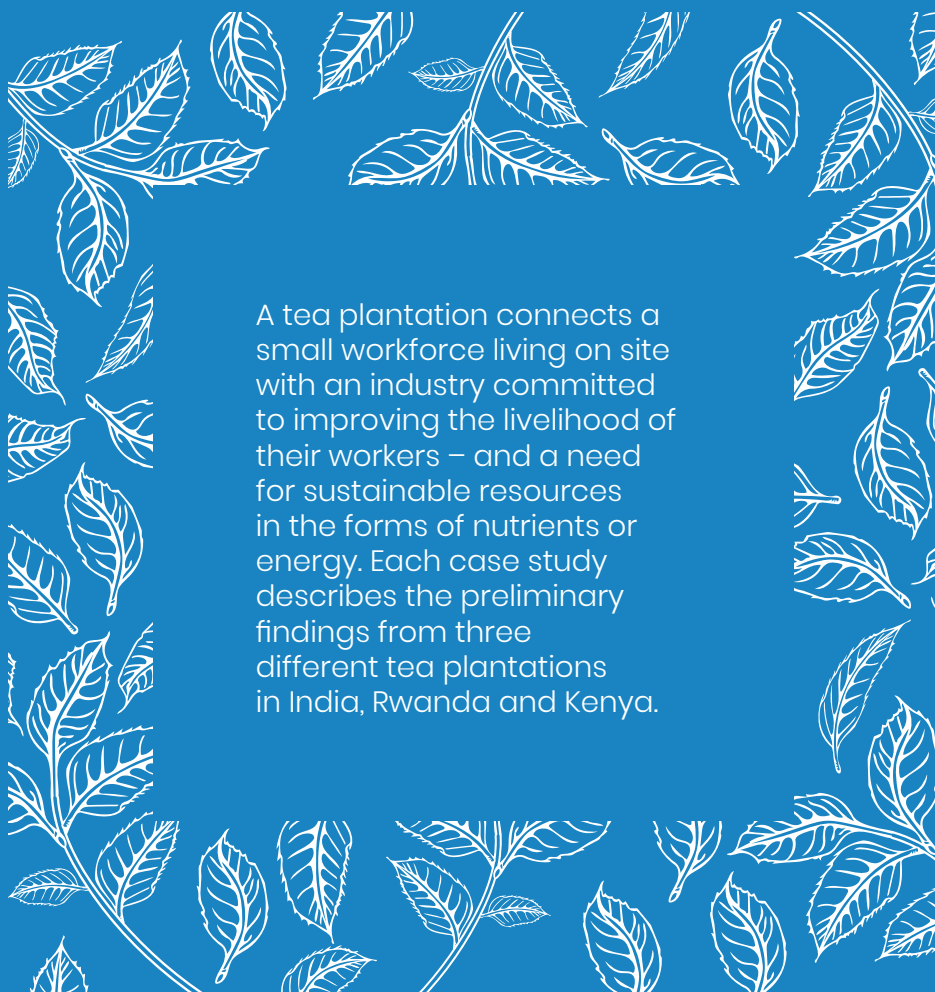
With support from business partners, the Toilet Board Coalition conducted an initial feasibility study on a tea plantation in Assam, India to understand which circular sanitation technology provided the optimal benefits for the tea plantation. Since the initial feasibility study, the project has completed new studies on two additional tea plantations in Africa and is supported by a collation of companies in the tea sector with the joint goal to improve sanitation for their workers.

The Ethical Tea Partnership focuses on root causes of a range of social issues to improve the lives of tea communities, including water and sanitation.





CASE STUDIES IN THE TEA SECTOR



A tea plantation connects a small workforce living on site with an industry committed to improving the livelihood of their workers – and a need for sustainable resources in the forms of nutrients or energy. Each case study describes the preliminary findings from three different tea plantations in India, Rwanda and Kenya.

1 Case study India

Location	Assam, India
Population	4,400
Estimated Toilet Resources Generated Per Year	2.3 million Litres (61 tonnes of solid faeces)
Preferred Toilet Resource Product	Biogas
Current Sanitation	Dual Honeycomb Pit Latrines

Opportunity for Improvement

Each household has their own dual honeycomb pit latrines, 555 in total, but due to population increases most pit latrines fill at a faster pace than intended. The plantation is committed to implementing a circular sanitation system to protect the health and environment of their employees, and prevent the manual emptying of pit latrines. They are currently meeting with various entrepreneurs to implement trials of their technology on the plantation.

KEY INSIGHTS

Pit latrines should not be considered the default solution for rural sanitation. Pit latrines are not ideal for circular sanitation as it is difficult to remove the waste, usually involving manual removal and additional water. Other toilet technologies exist which facilitate this process.

Plantation owners and other stakeholders want proven solutions to implement, but the capability may not exist in the required locations. **Support is needed from the private sector to develop businesses capable of building and operating circular sanitation systems.**

Though initial feasibility studies have demonstrated a positive economic return for agricultural systems that implement circular sanitation, some agricultural plantations will need the support of innovative finance mechanisms and investment to build the initial infrastructure.

2 Case study Kenya

Location	Nandi Hills, Kenya
Population	40,000
Estimated Toilet Resources Generated Per Year	21 Million Litres (550 tonnes of solid faeces)
Preferred Toilet Resource Product	Briquettes or Compost
Current Sanitation	Pit Latrines & small trials of circular sanitation

Opportunity for Improvement

Each year the plantation closes 100 to 200 full pit latrines, having to build new ones to replace them with a lack of available land. With a commitment to building the plantation of the future and a desire for implementing a high level of sanitation, plantation management has implemented trials of three innovative sanitation solutions; a waterborne sanitation system with anaerobic digester that treats a school's Toilet Resources providing reusable flush waters for toilets; solar toilets that dry the waste into a powder to decrease the volume of waste, and composting toilets.

KEY INSIGHTS

Circular sanitation systems are an integral part of future-proofing plantations against uncertainties such as climate change, world markets and the increasing expectations of worker conditions by creating sanitation systems that provide a renewable source of fuel, fertilisers or water.

Building a circular sanitation system piece by piece with small trials requires less funding than transforming an entire system. However, to reduce costs by combining waste streams, foresight, and planning is needed to transform individual components into a circular sanitation system.

3 Case study Rwanda

Location	Rwanda
Population	3,500
Estimated Toilet Resources Generated Per Year	1.8 Million Litres (49 tonnes of solid faeces)
Preferred Toilet Resource Product	Biogas
Current Sanitation	Greenfield

Opportunity for Improvement

The two previous case studies have looked at the feasibility of implementing circular sanitation on plantations that already have sanitation solutions in place, usually in the form of pit latrines. The plantation in Rwanda is a new plantation, where the toilet blocks for tea pickers are planned but not yet built. This creates the opportunity to implement circular sanitation solutions free of existing physical constraints, potentially reallocating the existing finances for a circular system.

KEY INSIGHTS

The "Sanitation at a Sector Level" is about encouraging sector leaders, that have the power to change systems across industries, to implement circular sanitation. This creates the opportunity for entrepreneurs in decentralised waste treatment to reach a larger scale, while in parallel encouraging sector leaders that have the power to change systems to implement circular sanitation. With circular sanitation as industry best practice, **new tea plantations could build sanitation systems to be circular reducing the CAPEX needed to 'redo' already implemented systems.**

Trials within greenfield sites can demonstrate that incorporating circular sanitation systems in the initial design reduces costs by not having to retrofit solutions or use suboptimal technologies (e.g. pit latrines).



TOOLBOX FOR BUSINESS

The Toilet Board Coalition (TBC) has developed a set of tools to allow cities, governments, plantation and factories to assess the economic, environmental and social benefits of implementing circular sanitation. The first tool is hosted on the TBC's website that allows users to calculate the amount of Toilet Resource product (i.e. fuel, fertiliser, feed, water) could be generated. The calculator also connects the user to entrepreneurs who are innovating in each technology.

Additional tools in the TBC toolbox include frameworks for businesses, governments and cities to understand the feasibility and benefit of implementing circular sanitation systems, by comparing the economic, environmental, and social benefits of each technology.

These frameworks are available upon request.

One of Camellia's principles is to be a responsible custodian of the environment. Consistent with that principle, Group operations are committed to developing and implementing sustainable policies and practices for their own businesses in the countries where they operate. Camellia Group operations have found that the best way to implement sanitation innovations is to work directly with sanitation entrepreneurs and with partner companies on the ground. These interactions have led to the implementation of pilot trials of circular sanitation which best suit the environments in which they are operating.

– Anna Chilton,
Sustainability Manager,
Camellia



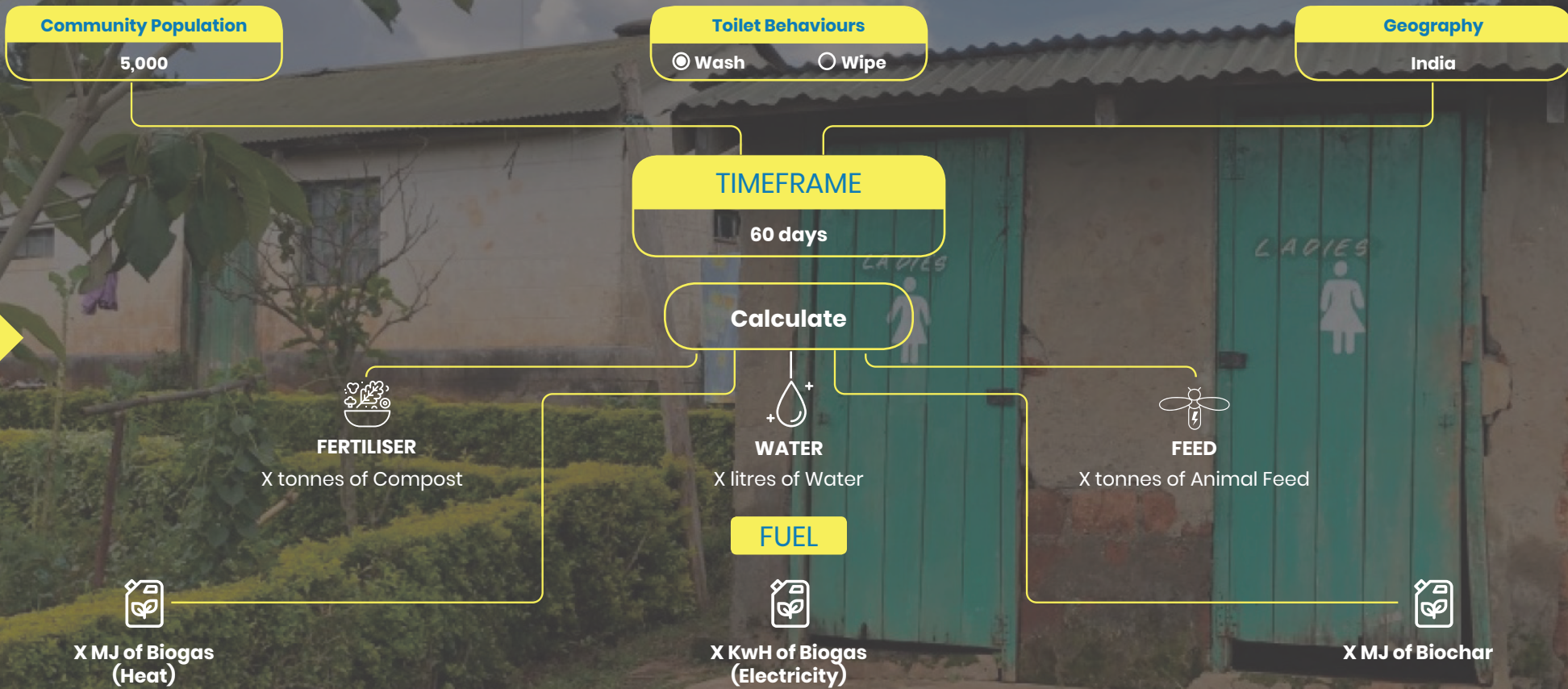
Other Tools:

As part of the Stockholm Environment Institute's (SEI) Urban Circle Project, SEI has developed a tool for cities **to boost their resource efficiency, and capitalise on waste by calculating a city's circular resource flows.**

The Container Based Sanitation Alliance (CBSA) has developed a tool **to calculate the GHG emissions mitigated by implementing circular sanitation systems.**

TOILET RESOURCE CALCULATOR

CALCULATING THE POTENTIAL OF HUMAN WASTE



CALL TO ACTION



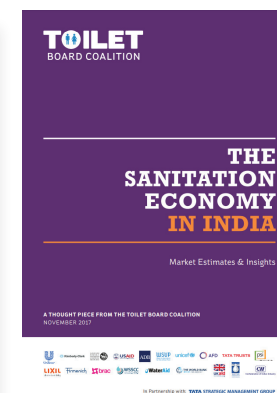
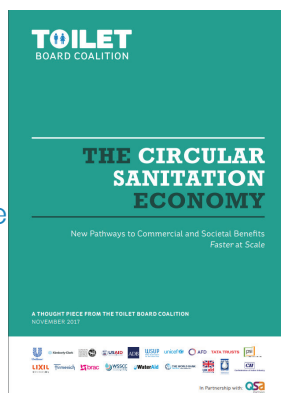
About the TOILET BOARD COALITION

Established in 2015, the Toilet Board Coalition (TBC) is a business-led partnership platform with the goal to accelerate the transition to the Sanitation Economy. Our ambition is to transform sanitation systems from unaffordable public costs into robust marketplaces of sustainable business value.

The TBC is facilitating private sector engagement; large company - small company partnerships; and public-private collaboration to contribute to the achievement of Sustainable Development Goal 6 - universal access to water and sanitation.

We run the Toilet Accelerator, the world's first accelerator programme dedicated to Sanitation Economy business solutions that are smart, circular, and resilient to address the unmet sanitation needs of the world's most vulnerable.

The members of the Toilet Board Coalition believe that accelerating the Sanitation Economy will deliver significant benefits to business and society.



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BOARD COALITION



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