INCLUSIVE INNOVATIONS

Business Models for Converting Waste into Value

Waste-to-value innovations generate high value products, minimize landfill pressures, and provide employment opportunities for waste workers

HIGHLIGHTS

- Waste-to-value enterprises help divert tons of waste material that has recoverable value from landfills, thereby creating huge environmental impact.
- Such enterprises collect and treat waste that otherwise results in severe health impacts in communities, especially the poorer sections of society.
- Most enterprises ensure a dignified work-place and higher than minimum wages to the waste workers.

Summary

Burgeoning population, scarce financial resources, and limited capacity to manage environmental issues are some of the common problems faced by most developing countries. With growing populations and changing lifestyles, the quantum of waste generated is growing apace. Inadequate awareness and willingness to responsibly dispose waste results in steep increase in the amount and costs of garbage that countries will be required to deal with by 2025.[1]

The enormous amount of waste generated in developing countries and the significant potential for resource recovery are the primary triggers for waste-to-value based business models. In addition to generating high value products and minimizing pressure on landfills, these models provide an opportunity for informal waste workers to enhance their quality of life and earn higher incomes. Enterprises in this business model have devised innovative mechanisms to recycle and reuse waste while creating jobs and dignity for waste collectors. Some of these enterprises create high value items from dry waste such as fashion goods and affordable housing material while addressing waste workers' issues. Others collaborate with households, industries and governments to provide composting related services to minimize the pressure on landfills.

Development Challenge

Globally, millions of tons of waste is generated annually. It is estimated that on an average, a developing country generates nearly 100,000 metric tons of solid waste per day[2], of which around 40%[3] is recyclable. In a number of metropolitan cities in developing countries the amount of plastic waste has grown to 20% of the total amount of the household waste.[4] Globally, organic waste constitutes nearly 46% of the total solid waste composition. In low incomes countries, the percentage is even higher - organic waste comprises 64% of the

[1]'What a Waste' Report Shows Alarming Rise in Amount, Costs of Garbage, Feature Story, The World Bank, June 2012 http://www.worldbank.org/en/news/feature/2012/06/06/report-shows-alarming-rise-in-amount-costs-of-garbage
[2] East Asia Forum article http://www.eastasiaforum.org/2016/04/30/indias-waste-management-problems-are-piling-up/
[3] Green Schools Program http://www.greenschoolsprogramme.org/knowledge-bank/waste/
[4]Creating inclusive value chains in plastic waste management is paramount for a green economy, SEED, February 2015 https://www.seed.uno/blog/articles/1587-creating-inclusive-value-chains-in-plastic-waste-management-is-paramount-for-a-green-economy.html

total waste.[5] Plastic waste is increasingly becoming difficult to manage by the waste management authorities, because of the increased complexity of plastics. According to the European Commission as much as 10 million tons of litter, mostly plastic, ends up in the world's seas and oceans, broken into micro-plastic or 'plastic soup'.[6] Developing countries do not have efficient waste collection and management processes. As a result, waste lies in local dumps awaiting collection, and eventually is moved to open dumpsites. Untreated organic waste leads to generation of harmful greenhouse gases. Likewise, inorganic waste including untreated leachate causes pollution in surrounding soil and water bodies[7], eventually resulting in environmental degradation and severe health impacts.

Ironically, much of this waste has value and can be recycled and reused if segregated and collected in sufficient quantities. Most households are unaware about the need to segregate waste at source and habitually dump all waste together, resulting in generation of mixed waste, where the dry waste gets contaminated and cannot be recycled thereafter. Most countries find it easier to dump mixed waste since sorting costs are very high and they face resource and capacity constraints. Hence, while there is value in waste, the cost of extracting it is very high, primarily because of waste disposal practices at source.

The waste collection and management sector in most developing countries is primarily unorganized. Waste workers are typically informal and earn low incomes from middlemen who operate small, local collection and segregation activities to earn incomes. There are a number of women and children engaged in hazardous waste management activities. The Centre for Disease Control and Prevention (CDC) has provided some guidance to reduce risks to workers handling various types of waste. Some of these include washing hands immediately after handling waste, and use of personal protective equipment (PPE) such as waterproof gloves and rubber boots to prevent cuts and direct contact with waste. CDC also recommends provision of training on disease prevention, and required vaccination for the waste workers.[8] Informal waste workers work without any protection, and face the risk of poor health, Societal neglect and disrespect for the waste workers exacerbates their conditions.

Business Model

Components of the Model

Waste-to-value enterprises minimize the amount of waste lying on streets and in open dumps. They collectivize waste workers, and offer them formal employment and better working conditions. They aim to build a sustainable business around recycling and reuse of waste that are either difficult to treat or harmful if left untreated. These enterprises create useful and innovative recycled products from waste including artistic items such as woven baskets and photo frames, utility items such bags, pen stands, and file holders, and affordable construction material. As a result, they address larger challenges of environmental degradation, waste workers' dignity, and general awareness about waste disposal and treatment.

Figure 1. Recycling and composting waste to create value

[5] Urban Development Series, Knowledge Papers, Waste Composition World Bank , June 2012 http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1334852610766/Chap5.pdf

[6] Our Oceans, Seas and Coasts, Descriptor 10: Marine Litter http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/index_en.htm

[7] Prevention of environmental degradation by means of solid waste management, Journal of Industrial Pollution Control, January 2016 http://www.icontrolpollution.com/articles/prevention-of-environmental-degradation-by-means-of-solid-waste-management-.php?aid=45751

[8] Guidance for Reducing Health Risks to Workers Handling Human Waste or Sewage, Global Water, Sanitation and Hygiene, Centre for Disease Control and Prevention http://www.cdc.gov/healthywater/global/sanitation/workers_handlingwaste.html

Why? **Development Challenges**	• Limited understanding of resource recovery leads to excessive waste reaching landfills • Improper disposal of waste results in environmental degradation and health hazards • Unorganized waste management sector involving excessive dependence on middlemen	• Inadequate public awareness on appropriate disposal practices • Lack of integration with rural agricultural communities on benefits of composting and techniques • Inability of government to establish and maintain composting plants
What?	**Recycling dry waste to create value**	**Composting wet waste to create value**
Components		
How? **Key Activities**	• Enterprises recycle waste thereby diverting it from reaching landfills and oceans • Most enterprises include informal waste workers in their recycling operations • Enterprises provide waste workers better livelihood options and safe working conditions	• Enterprises manufacture composting facilities using design thinking approaches • Some enterprises focus on rural farmers and provide them access to decentralized composting facilities • A few enterprises educate governments on composting and partner with them to set up and operate composting plants

Waste-to-value enterprises are broadly classified into two categories:

Dry waste recycling

Some waste-to-value enterprises recycle dry waste such as paper, fabric, glass, rubber, plastic, and e-waste. They procure these items mostly from waste collection enterprises or informal waste collectors. Some enterprises employ workers on contract to collect waste from households, schools, and commercial establishments. The waste is then recycled into fashion goods, construction materials, and pieces of art. Kenya based Ocean Sole and Tosheka Textiles, India based Green Wave, and Haiti based Thread International are some examples of enterprises that aim to decrease the amount of dry waste that enter landfills and oceans, through their operations.

Some enterprises also address the need to uplift waste worker conditions, as a part of their business model. For instance, Ghana based RECNOWA upcycles waste to high fashion goods while creating employment opportunities, restoring dignity and financial independence for youth. Similarly, India based Trash2Cash provides employment as well as a safe and dignified working environment to slum dwellers. Mexican enterprise Eco Domum pays higher than market wages to their trash collectors for a constant supply of raw materials for its recycling plant.

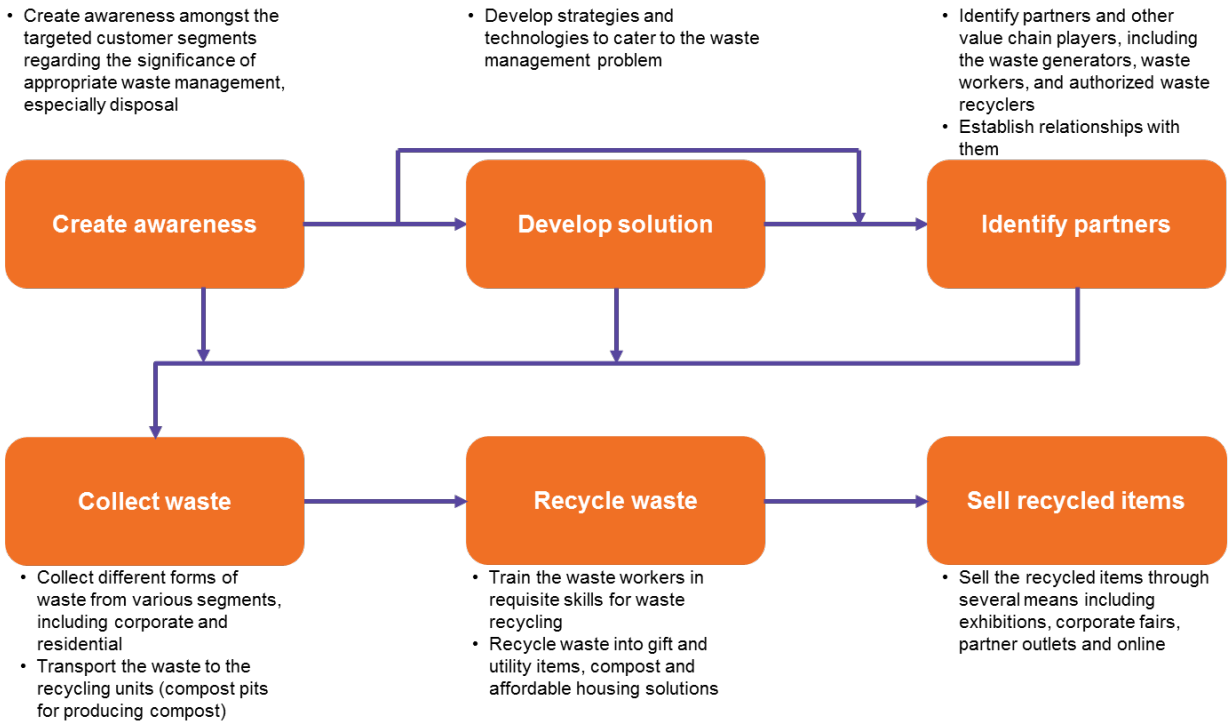
A few enterprises focus on generating value from plastic waste and have even developed proprietary technology. Kenya based COREC, for instance, manufactures products for roofing and fencing solutions from plastic waste. Similarly, Indian enterprise, Protoprint, has an innovative technology to make 3D printer filament from waste plastic; the enterprise employs informal waste workers to use the recycling technology in the labs that are set up at local dump sites.

Wet waste composting

Wet waste needs to be treated quickly as it tends to break down rapidly; composting is the most common solution to treat wet waste sustainably. Social enterprises provide residential and community composting facilities, as well as a wide range of products to enable composting at source. Some of them also provide training on effective composting methods. For instance, India based Daily Dump designs and distributes terracotta composting pots and creates awareness amongst communities on segregation at-source and trains them in on-site composting. Ghana based DeCo! and India based Vivam Agrotech specifically focus on rural farmers and provide them decentralized composting facilities that they can use to compost agricultural waste

in their farms. A few enterprises collect wet waste, process it at their own establishments, and sell the compost in the market. In Bangladesh, Waste Concern supports the government by providing them capacity building on composting services.

Figure 2. Features of waste-to-value services



Cost Factors

Waste-to-value enterprises report that they incur most of their costs in salaries of employees[9] engaged in collection and recycling of waste. Another major cost component is investment in training the employees on specific recycling skills, and handling and transportation of waste from the collection point to the recycling center. Recycling activities constitute a small percentage of the total cost as they are mostly carried out manually or involve minimum use of machinery. Enterprises also incur costs in renting or leasing warehouses and recycling centers. Of the total expenditure incurred in solid waste management, typically 70% to 80%[10] is directed towards the collection and transporting[11] of wastes.

A number of enterprises including Ocean Sole, Daily Dump, and RECNOWA share that staff salaries are their main cost component. Enterprises incur additional costs on providing supplementary benefits to employees for instance, daily meals, health insurance, and salaries that are higher than the mandated minimum wage. Daily Dump ensures that its waste workers are paid higher than minimum

ReMaterials, the enterprise that sells modular roofing solutions under the brand name 'ModRoof' classifies its cost components as follows:

- **Capital expenditure** (machines): **20%** of total cost
- **Production expenditure** (raw materials): 20% of total cost
- **Operational expenditure** (rent, electricity, consumables. salaries): **60%** of the total cost

[9] Both permanent and those working on contract
[10] Collection of Municipal Solid Waste in Developing Countries, UN-HABITAT, 2010
[11] As per this reference, the definition of collection and transportation does not involve at-source segregation, sorting, handling, transporting to sorting facilities, cleaning, size reduction, baling, processing (including composting) and manufacturing.

wages. Ocean Sole pays an average of USD 150-USD 200 per month to its employees. The enterprise also incurs expenditure on employee training and material recycling. It spends KES 6-KES 10 (USD 0.06-USD 0.1) to recycle 1 kilogram (kg) of plastic bottles, and KES 25 (USD 0.25) to recycle 1 kg of flip-flops. The number of employees in waste-to-value enterprises varies depending upon the type of operations and the level of mechanization deployed.

Table 1. Number of employees as indicated by some of the waste-to-value enterprises

Company	Number of employees
Daily Dump	15
Ocean Sole	36-40
RECNOWA	136

In rare cases, enterprises also incur costs in obtaining licenses for transportation of waste. For instance, Kenyan authority National Environmental Management Authority (NEMA) mandates licenses to transport waste.

Revenue Streams

Waste-to-value enterprises generate revenues from the sale of recovered and recyclable materials, including compost fertilizer. The market for compost is more local, but is usually underdeveloped and dependent on local potential and market requirements. Revenues from the sale of compost are usually insufficient to cover more than 40% of the costs of collection and processing of organic waste. [12]

Besides, sale of products, consultancy fees is another important source of revenue for waste-to-value enterprises.

Waste-to-value enterprises sell recycled materials at competitive prices. Most of the products and services are affordable to the customer, and financially viable for the enterprises. In some cases, the products are sold at premium prices because of their artistic value; enterprises make huge margins for such products. For instance, Ocean Sole sells artistic hand-made products created from recycled flip-flops. The product prices range from USD 3[13] to USD 8000[14]. USA based ReMaterials that is operational in India charges its customers for the sale and installation of ModRoof, which is priced around INR 220-230 (USD 3.3-USD 3.45) per square feet (sq.ft.). The price is competitive compared to concrete roofs that are priced around INR 350-INR 500 (USD 5.25-USD 7.5) per sq.ft. ModRoof is also better than metal and cement roofs that are less expensive at around INR 80 (USD 1.2) per sq.ft.[15] The enterprise shared several factors that ModRoof scores over these alternatives[16].

Waste-to-value enterprises also earn consultancy fees for sharing technical knowhow and designing waste treatment solutions. Donors support many of these enterprises, particularly those that have a stated mission to improve the quality of life of waste worker families and address environmental degradation. Enterprises also report grant funds as revenues. For instance, RECNOWA earns revenues by providing consulting services

[12] Global Waste Management Outlook 2015, UNEP
http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/GWMO%20report/GWMO%20full%20report.pdf
[13] Wholesale small items such as key-rings
[14] Big collectibles
[15] Self-reported
[16] Corrugated cement and metal sheets are the most widely used roofing materials in these communities all over the world, but these options are uncomfortable and even dangerous because of the following reasons:

- Unbearably hot in the summer
- Loud and leaky during monsoon season
- Break frequently, causing injury
- Require costly, time-intensive repairs
- Contain toxic chemicals like asbestos

to its customers, in addition to the revenue earned by sale of products. The enterprise also counts grant money as one of its revenue streams. Daily Dump charges nearly INR 2000-INR 4500 (USD 30-USD 67.5) for visits to clients' premises. In these visits, the enterprise provides auditing and consulting services regarding appropriate waste management techniques.[17]

Financial Viability

Most waste-to-value enterprises operate on a financially sustainable basis, primarily because they usually procure the raw materials (waste) for their products free of cost. They convert this waste (food, paper, and plastic) into useful products such as artistic merchandise, home and utility products, and affordable roofing, which is sold to a wider customer base at market prices. While some enterprises brand their products, others are vendors to global brands. Since the enterprises incur cost mostly in operational expenses (labor and transportation), their profitability depends on keeping these costs reasonably low and achieving premium prices[18], scale and reach for the recycled products.

There are several ways in which waste-to-value enterprises ensure financial viability. For instance, RECNOWA sources the raw materials for free from households. Therefore, the cost of products made after recycling is always lower than that of competing conventional goods.[19] Waste collection and segregation is manpower intensive. Enterprises introduce efficiency in these tasks to not only keep costs low but also to minimize waste handling by staff. Triciclos[20] has recycling bins for different types of waste. People deposit their waste in the respective bins and Triciclos then recycles individual waste streams to different products. Segregation at source eliminates the need for Triciclos to sort the waste, thereby improving process efficiency. In 2012, the enterprise reported USD 1.4 million in revenue, generating a profit of 8% of sales and a 30% return on capital.[21]

The financial viability of waste-to-value enterprises that recycle plastic is heavily dependent on global economics of oil production - when oil prices dip, the price of plastic resin follows. Currently, oil prices are very low; hence it is cheaper for manufacturers to buy virgin plastic than to buy recycled plastic.[22] In early 2015, new polyethylene terephthalate (PET), a type of plastic which is used to make soft-drink and water bottles, cost 83 cents a pound[23]. That was 15% higher than the cost of recycled PET. In around late March 2015, the cost of new PET dropped to 67 cents a pound, or 7% less than the recycled form, which costs 72 cents a pound.[24] While waste-to-value enterprises do not have control over the global economics of commodity prices, they can ensure their financial viability by decreasing the level of contamination of waste entering the recycling process. With less contamination, more value can be extracted from the waste stream, helping to improve the economics of recycling.

Partnerships

Waste-to-value enterprises engage with different stakeholders to maximize individual and common financial benefits. They establish partnerships for business development, awareness building, and consumer financing initiatives to support purchase of recycled products[25].

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[17] Self-reported
[18] Except for compost
[19] Self-reported
[20] An enterprise that works to reduce the recyclable waste in Chile. Chile generated 17 million tons of solid waste in 2009, a 42% increase from 2000. A small amount of this waste is recycled by municipalities, non-profits, and corporations, as well as individuals who collect materials that can be sold for a profit. Nevertheless, while 90% of waste in 2010 was recyclable, only 10% was recycled.
[21] Triciclos Innovative Business Model to Increase Recycling https://sharedvalue.org/groups/triciclos-innovative-business-model-increase-recycling#_edn1
[22] according to data compiled by industry publication Plastics News
[23] according to data compiled by industry publication Plastics News
[24] Recycling Becomes a Tougher Sell as Oil Prices Drop, Wall Street Journal, April 2015 http://www.wsj.com/articles/recycling-becomes-a-tougher-sell-as-plastic-prices-drop-1428279575
[25] When the consumer want to buy recycled products. This is more specific to the consumer financing provided to access affordable housing solutions provided by several waste-to-value enterprises that recycle plastic waste into housing solutions. Based on interview with ReMaterials.

A number of enterprises partner with other organizations engaged in spreading awareness about waste management in schools, households, and corporates. Ocean Sole, for instance, partners with several international organizations and stakeholders including United Nations Environmental Program (UNEP), Blue Ventures, Waste Busters, and the Kamba community. UNEP supports the enterprise by supporting its outreach initiatives. Another enterprise, Tosheka Textiles partners with local stores to run awareness campaigns to urge customers to deposit their clean plastic bags in collection bins.

Vivam Agrotech partners with local governments to conduct research to improve technology for composting, and reducing carbon emissions.

Enterprises partner with local waste picker organizations to procure waste, and engage closely with them to ensure efficiency. Often, they prefer to engage closely with these organizations to design processes to collect, segregate and sort specific waste such as plastic, e-waste, and glass. Protoprint partners with waste picker co-operatives in India to set up 'Filament Production Labs' at local dump sites. At these labs, Protoprint sets up its machines and trains waste pickers to process the plastic waste into 3D printer filament.[26] By selling their plastics to scrap dealers, waste pickers are able to earn approximately USD 0.25 per kg. Once processed, Protoprint's filament retails for between USD 20-USD 25 per kg, empowering waste pickers by passing on significantly higher earnings.[27]

Daily Dump has over has over 73 partners including volunteers, NGOs and small businesses that help the enterprise sell products, undertake installation, and provide after-sales support.

Enterprises partner with national and local regulatory bodies for financial and outreach support. For instance, India based Trash2Cash partners with National Bank for Agriculture and Rural Development (NABARD) that facilitates sale of recycled Trash2Cash products in fairs and exhibitions[28]. Trash2Cash has also partnered with Bidhannagar Municipal Corporation, PricewaterhouseCoopers (PwC), Ericsson, Lexmark International, and DLF to receive financial support as a part of their corporate social responsibility (CSR) plans and strategies. ReMaterials partners with micro finance institutions (MFIs) such as SEVA (Mahila Housing Seva Trust), Saath Microfinance, and Fullerton to provide consumer finance. Through these partnerships, the enterprise provides microfinance access to help low-income customers purchase the enterprise's recycled construction material.

Implementation: Delivering Value to the Poor

Awareness

Waste-to-value enterprises need to invest in building awareness in both, the pre-production (treat at source, collect waste in bins, segregate waste) and post-production phases (marketing to sell recycled products, brand positioning). Besides this, waste-to-value enterprises raise awareness regarding the significance of effective waste management, which creates the larger environmental and social impacts. The awareness campaigns of Daily Dump are designed for different audiences including children, housekeeping staff, homemakers and corporate teams. In a study it conducted, the enterprise found that 72% of the respondents were interested in sustainable practices for waste management, however, only 17% subscribe for waste management services such as waste composting. Ocean Sole is constantly engaged in several awareness activities and campaigns. On the occasion of International Coastal Clean-Up Day on 17 September 2016, Ocean Sole launched a competition to gather ideas to reduce and recycle plastic waste. The competition will run until 17 September 2017, and the winner will be awarded USD 10,000.[29]

[26] Protoprint's "FlakerBot" shreds and grinds cleaned plastic bottles so they can be fed into the "RefilBot" which uses a rotating heating mechanism to melt the plastic and extrude to filament.
[27] Protoprint: Converting waste plastic into 3D printer filament, D-Lab, MIT https://d-lab.mit.edu/scale-ups/protoprint
[28] To advertise and sell their products
[29] Government urged to ban use of plastic to protect marine life, Daily Nation, 19 September 2016 http://www.nation.co.ke/counties/ban-use-of-plastic/1107872-3386622-beetj1z/

Acceptance

Most of the enterprises engaged in this business model find it challenging to gain customer acceptance at three stages. One is at the source, where the primary challenge is to convince the consumer categories segregate waste at-source, which could be a big boost to this business model.[30] Therefore, most enterprises incorporate awareness generation as one of its prime activities, and engage with partners and communities to improve general waste management awareness, before advertising about their product or service.

Secondly, the enterprises face difficulty to gain customer acceptance in case of in-house recycling. Despite explaining the simplicity of some waste-to-value solutions such as in-house composting, very few customers readily accept the same. A number of waste-to-value enterprises customize waste management solutions to suit specific requirements of various customer categories, including corporate houses and residential complexes. For instance, Daily Dump provides customized composting mechanisms for different users. They incorporate design thinking approaches in building their products.[31] The enterprise offers low maintenance composting pots such as terracotta pots, and leaf composters to household users. The enterprise also provides auditing and consulting services to the customers, tailored to suit their waste management requirements.

Lastly, as shared by a few enterprises[32], waste-to-value enterprises encounter challenges at the point of sale because of inadequate demand for recycled products. Customers attach more value with a product which is made from virgin raw materials, than from recycled items. This is specifically relevant when the price of recycled items is at par or higher than normal items. Enterprises try to ensure that the prices of the solutions on offer are affordable, at least to the low income communities.

Accessibility

Enterprises increase accessibility of their solutions to the prospective customer segments by deploying various strategies. Many of them engage with local distributors and waste workers to ensure accessibility to their products and services. For instance, Daily Dump hires waste workers from local communities to install the enterprise products and provide its services. Likewise, Ocean Sole and RECNOWA engage local community citizens in its distribution process. Besides, some enterprises also adopt online medium to increase accessibility of waste-to-value products and services to targeted customers. Daily Dump has its own online portal through which it sells its products and services.

Affordability

Generally most gift, home décor and utility products made by recycling waste are sold at premium prices (compared to available alternatives) to customers that can afford them. For instance, the artistic products made by Ocean Sole and Trash2Cash are sold at prices that are 2-3 times higher[33] than those charged by non-waste-to-value enterprises for similar products. Enterprises leverage their brands and promote the larger good their products seek to achieve to these buyers.

Enterprises that recycle plastic waste to provide affordable housing solutions to low income communities need to make their products affordable. Eco Domum converts plastic waste into affordable housing solutions to people living below poverty line in Mexico[34]. A family could purchase a house constructed using Eco Domum's recycled material for 5,000 pesos (USD 273) which is significantly lower than the house made from conventional construction items such as brick and mortar. Tanzania based, Mbezi Plastic Recycling is another such enterprise that converts plastic waste into affordable and durable building material for urban use.

[30] This is because the waste-to-value enterprises can collect segregated waste from customer premises, and directly deploy respective recycling operations. The enterprises can also choose from the segregated waste, the type of waste they wish to collect as per their recycling solutions.
[31] Based on primary interviews with Daily Dump
[32] Such as Trash2Cash
[33] Self-reported
[34] Mexico ranks as the 12th largest plastics consumer in the world, consuming over 5 million tons of plastic each year. In Mexico nearly 10% of total population (11.5 million) lives in extreme poverty – subsisting on an average daily consumption of USD 1.25 or less. In effect, these people cannot afford proper housing.

Enterprises also tie up with financial institutions to make the products affordable to customers. ReMaterials, that offers ModRoof as an affordable roofing solution, charges monthly installments from its customers. The enterprise also leverages its partnership with organizations such as SEVA (Mahila Housing Seva Trust), Saath Microfinance, and Fullerton to facilitate consumer finance, and make the solution further affordable to the customers.

Results and Cost-Effectiveness

Scale and Reach

Considering the diversity and quantum of waste produced in most developing countries, and the simplicity of operations, waste-to-value enterprises have a huge potential to expand their scale and reach. Some of the 'reach' indicators include number of customers served; they can be individual customers, households, and corporates. Reach indicators also include the number of jobs created for people from low income communities. Scale of the waste-to-value business model can be measured in terms of levels of segregation achieved at-source, amount of waste diverted from landfills, amount of greenhouse gases and carbon emissions prevented from disturbing the environmental balance. Most enterprises that were contacted for this research shared that they took a minimum of 5 years to create commendable impact.

Table 2. Scale and reach for select ompanies

Company	Country of operation	Years of operation	Scale & Reach
Daily Dump	India	10	• Served 32,326 households • Saves 27,435 kg of organic waste daily from landfills
ReMaterials	India	-	• Served 250 customers
RECNOWA	Ghana	5	• Served 1000+ customers • Created 30 direct jobs and 100 indirect jobs
Trash2Cash	India	6	• Trained nearly 400 community rag-pickers, covering three major slums in Kolkata • Engages with ~23 corporate offices in Kolkata • Achieved 90% of waste segregation at source • Recycles nearly 2000 kg of paper, plastics and 2500 kg of wet waste every week reducing 5500 MT of carbon equivalent emission annually
Triciclos	Brazil	7	• 40000+ waste depositors per month

A number of enterprises report that they plan to expand geographically. For instance, Eco Domum aspires to expand its service portfolio outside Mexico in the next three to five years. RECNOWA seeks to replicate the project in all ten regions of Ghana.[35] Green Wave India plans to open 4 new units in Mumbai. Daily Dump plans to expand to South America; the company has identified a partner in Chile to market its products.[36] Ocean Sole also plans to replicate its model in India by end of 2017.

Enterprises also plan to expand their product portfolio and offer different services. Green Wave India plans to venture into collection and recycling of cooking waste. The enterprise also aims to start producing a range of products made with flower waste, including color dyes, powdered colors for Holi[37], fragrances, paper, and

[35] Self-reported
[36] Self-reported
[37] Holi is a spring festival celebrated in India and Nepal. It is also called as festival of colors.

mosquito repellent.[38] ReMaterials aspires to expand its manufacturing facilities, human resources, and foray into solar roofing, and walls, and tie up with more microfinance companies for consumer financing.[39]

Some enterprises plan to improve scale and reach by making their processes more efficient. For instance, Triciclos plans to measure changes in consumer behavior as a result of its education efforts.[40] Likewise, Ocean Sole plans to streamline production, improve marketing, distribution channels, and global distribution. The enterprise plans to invest in technology to increase its production capacity of recycled products. It also wants to partner with a flip-flop manufacturing company that could help recycle further waste generated from the recycling operations of the enterprise.

Improving Outcomes

Waste-to-value enterprises engage with low income communities in two ways. Most of the enterprises engage with them as employers, providing improved aspects of income generation and better dignity at workplace. Some of the enterprises also engage with low income communities as sellers of affordable solutions, mostly housing material.

As a part of its operations, EcoPost has withdrawn over 1 million kilograms of plastic from landfills and saved an estimated 250 acres of forest.

Waste-to-value enterprises have several direct and indirect environmental and social impacts. They redirect waste before it reaches landfills, thereby reducing carbon emissions significantly. Recycling is one of the cheapest and fastest ways[41] to reduce greenhouse gas emissions; it reduces emissions 25 times more than that achieved through incineration. Waste-to-value enterprises also help reduce the use of virgin materials needed for production, thereby conserving natural resources and energy while reducing air and water pollution.[42] Metal extraction from ores is an extremely energy-intensive process; recycling to recover these metals involves lower overall energy consumption. For instance, aluminum recycling can reduce energy consumption by as much as 95%. Likewise, plastic recycling can decrease energy consumption by 70%, steel recycling by 60%, paper recycling by 40% and glass recycling by 30%.[43] Triciclos recycles over 2 million kilograms of waste, equivalent to over 5 million kilowatts of electricity, over 20,000 trees, nearly 750,000 liters of petroleum, over 3.5 million liters of water, and nearly 9 tons of carbon dioxide.[44] The enterprise aims to reduce waste generation and increase recycling rates by changing the behavior of several stakeholders in the waste cycle, including consumers, companies, and independent recyclers. Waste Concern saved nearly 0.1 million meter^3 of landfill space by recycling 102,183 metric tons (MT) of waste.[45] Thread International develops innovative clothing that helps in reduction of water use in washing by 50% as compared to cotton clothing.[46]

Enterprises converting plastic waste into affordable housing solutions for low income communities in developing countries have not only helped divert significant amount of plastic waste from the landfills, but also provided a technically superior product to low income communities. For instance, EcoPost has withdrawn over 1 million kilograms of plastic from landfills and saved an estimated 250 acres of forest.[47] ModRoof results in

[38] Self-reported
[39] Self-reported
[40] Triciclos Innovative Business Model to Increase Recycling https://sharedvalue.org/groups/triciclos-innovative-business-model-increase-recycling#_edn1
[41] Assessment of Materials Management Options for the Massachusetts Solid Waste Master Plan Review, Final Report, Tellus Institute, December 2008 http://www.mass.gov/eea/docs/dep/recycle/priorities/tellusmmr.pdf
[42] Waste pickers, Women in Informal Employment: Globalizing and Organizing http://wiego.org/informal-economy/occupational-groups/waste-pickers
[43] The truth about recycling, The Economist, 2007 http://www.economist.com/node/9249262
[44] Triciclos Innovative Business Model to Increase Recycling https://sharedvalue.org/groups/triciclos-innovative-business-model-increase-recycling#_edn1
[45] Self-reported
[46] Equivalent to a 35 minute shower. Self-reported. http://www.threadinternational.com/our-impact/
[47] Based on calculations by the Canadian Forestry Association

waste reduction of 600 kg of plastic per 250 sq.ft. roof panel.[48] It also helps in reducing the temperature in comparison to other roofing substitutes.[49]

Enterprises that engage in recycling organic waste have also created significant environmental impacts. For instance, Daily Dump offers customized composting solutions to household and industrial customers, and recycles nearly 28,600 kg of organic waste daily.[50]

Millions of people worldwide earn their living from recycling waste. However, there is a lack of reliable statistical data to support this, which makes it difficult to estimate the total population engaged as informal waste workers. Secondly, waste pickers are mobile and their population fluctuates with season. They also avoid researchers; fearing information will be passed on to public officials. Brazil is the only nation that systematically captures and reports official statistical data on waste pickers. According to Brazil's official statistical system, over 229,000 people were engaged in informal waste collection and recycling in 2008.[51] Another study, 'Women and Men in the Informal Economy: A Statistical Picture', suggests that waste pickers represent less than 1% of the urban workforce. Of this, 0.1 - 0.4% are present in seven West African cities, and 0.1% are present in India.[52]

Biobolsa treated over 150,000 tons of organic waste, produced nearly 4500 tons of biogas in nearly 2200 bio-digesters.

Given the labor intensive nature of the business model, waste-to-value enterprises improve livelihoods by providing training to women and youth from low-income communities, helping them gain skills for life and improving their household incomes. Waste-to-value enterprises also provide dignified workplace to waste workers. Nearly 97% of waste pickers in Bogota and Durban admit social exclusion as a major issue at the workplace; the figure is 76% in Nakuru. Globally, over 80% of the waste pickers reported harassment by government officials, police, middlemen and others as a significant problem.[53] For instance, Trash2Cash trains women in paper mache art to produce artistic products from waste. The women currently participate in symposiums, exhibitions, cultural fairs and receive accolades from buyers, and corporate clients. The enterprise has trained nearly 400 community rag-pickers, covering 3 major slums in Kolkata.[54]

Trash2Cash has helped women workers create an identity and financial independence for themselves. It has helped the women workers to own and operate their bank accounts. Thread International has provided direct jobs to over 300 people and indirect income generating opportunities to nearly 3,575 people in Haiti.[55] Ocean Sole employs and empowers over 100 people (mainly women), who did not have any source of income prior to joining the enterprise. RECNOWA creates both significant environmental and social impacts. It has cut carbon emissions by more than 5 million kilogram, and helped the waste workers earn a higher wage than most other Ghanaians in similar industries. This initiative has also resulted in a reduction in incidences of waterborne disease such as typhoid, cholera, malaria and dysentery.

Trash2Cash has trained nearly 400 community rag-pickers, covering 3 major slums in Kolkata.

Cost-Effectiveness

In most developing countries, there are very limited efforts to extract value from waste, except the initiatives by the waste-to-value enterprises and not-for-profit livelihoods programs. As it is, the number of these

[48] Self-reported
[49] Self-reported
[50] Self-reported
[51] Waste pickers, Women in Informal Employment: Globalizing and Organizing http://wiego.org/informal-economy/occupational-groups/waste-pickers
[52] Waste pickers, Women in Informal Employment: Globalizing and Organizing http://wiego.org/informal-economy/occupational-groups/waste-pickers
[53] Waste pickers, Women in Informal Employment: Globalizing and Organizing http://wiego.org/informal-economy/occupational-groups/waste-pickers
[54] Self-reported
[55] Self-reported

enterprises and the scale they have achieved is able to address only a small fraction of the problem. Hence, in their absence, waste pickers would continue collecting and selling various types of waste informally through middlemen. It would also mean increasing pressure on landfills, open dumps and drains. This may result in several negative impacts including disease outbreaks, economic losses on account of lost man-hours, and business opportunities.[56]

The waste-to-value business model requires limited investment, and can achieve strong developmental impacts in terms of mainstreaming the marginalized and livelihoods. Given the pressure these enterprises face to remain sustainable, they tend to focus on keeping costs low. Most enterprises procure waste free of cost. A large number of recyclers also purchase sorted recyclable fractions from 'waste collection' enterprises, thereby making the operations more cost-effective. The recycling process involves minimum cost, as most of the operations are performed manually, involving local waste workers. As unskilled labor is inexpensive in most of the developing countries and because most waste-to-value enterprises also aim to improve the lives of waste workers, women and youth, they prefer deploying manual labor. This does impact financial cost and operational process efficiencies which come at the cost of social impact.

Enterprises in this business model follow different pricing strategies. A number of waste-to-value enterprises ensure affordable pricing to low-income customers. For instance, Eco Domum provides affordable housing solutions to the people living below poverty line in Mexico. A family could have one of Eco Domum's houses for 5,000 pesos (USD 273). Others who manufacture and retail products that compete with non-recycled products targeted at a general customer base that seeks utility (irrespective of whether the product creates jobs or is environmentally friendly) tend to price their products more competitively. Trash2Cash sells a pen stand made from recycled newspaper at the price of INR 60 (USD 0.9) and a photo frame made from recycled cardboard at INR 120-INR 200 (USD 1.8-USD 3). With growing awareness around waste recycling and reuse as well as the increasing use of design and art by waste-to-value enterprises, some of them are able to charge premium prices for a number of gift and utility items made from waste. Special artistic products are priced 2-3 times higher than similar products offered by various competitors. These are targeted at evolved customers who would pay this premium for overall good.

Scaling Up

Challenges

The two most critical challenges cited by enterprises in this research are business sustainability challenges and those arising from inadequate government regulations.

Business sustainability challenges arise because waste-to-value enterprises find it difficult to build strong revenue streams for the recycled products. A number of waste-to-value enterprises encounter challenges because of customer perception and inadequate demand for recycled products. Customers are either indifferent to the source of the products or find more value-for-money for a product which is made from virgin raw materials, than from recycled items. Enterprises that are vendors to larger brands face price competition from competing vendors. For self-branded products being sold on the "eco-friendly" or :green" tag, premium pricing tends to make them niche or local, impacting scale. Other business challenges are linked to inadequate finance to fund operational activities such as sorting and recycling, and stiff competition by illegal and informal workers and scrap dealers.

[56] In 1994, the city of Surat suffered an outbreak of plague like disease caused by major flooding as a consequence of uncollected waste blocking the drains. In the preceding years, the city had experienced a growth in population not matched by the infrastructure necessary to provide adequate solid waste management services. At the time municipal solid waste collection was limited to 40% of the city and the remaining waste was left uncollected and often came to be disposed of in drains and water bodies. The disease outbreak resulted in 693 cases reported and 56 deaths. Additionally, the country may have suffered as much as USD 2 billion in economic losses, including approximately USD 420 million in lost export earnings (for example, the United Arab Emirates suspended all cargo trans-shipments from India). The disease outbreak occurred just before the Diwali festival and over 45,000 people cancelled trips to India. Global Waste Management Outlook, UNEP, 2015 http://www.unep.org/ietc/Portals/136/Publications/Waste%20Management/GWMO%20report/GWMO%20full%20report.pdf

ReMaterials and RECNOWA cite access to finance and adequate human capital as the top two challenges faced by the enterprise to scale-up. Daily Dump mentions that lack of regulations and policies on composting make it difficult for Daily Dump to generate demand and willingness to pay for its composting products. A few other challenges encoutered by waste-to-value enterprises include finding enough material that is clean, uncontaminated and sorted, resulting in under-utilization of most of the enterprises.

The government and donors are typically aid oriented and not market-driven. Therefore, waste-to-value enterprises that have a for-profit orientation do not receive any tax breaks. This impacts the financial sustainability of the enterprise. Several enterprises finds it difficult to maintain business sustainability and plan for scale, while following all the requisite regulatory requirements. For instance, the National Environmental Management Authority (NEMA) in Kenya requires Ocean Sole to obtain a license to collect the flip flops from the beaches and waterways. The cost of transporting basic raw waste flipflops is expensive i.e.moving a truck full of 5000 kg of flipflops costs KES 55,000 (USD 544) to reach Nairobi from the sea coast. In addition, the enterprise needs to pay customs duties for flip-flops that are received from different parts of the world, while it cannot make Value Added Tax (VAT) claims on recycled flip-flops.

Role of Government and Policy

Governments have been fairly supportive of the waste-to-value industry in a few developing countries such as India, Brazil and Nigeria. They have launched programs and policies to raise general awareness regarding waste recycling, issued regulations to curtail waste generation and promote efficient waste management, and promoted waste-to-value enterprises by either partnering with them or providing them the required infrastructural support. In several countries, solid waste management regulations are enforced by multiple departments and ministries, which results in poor monitoring of implementation.

Regulations for effective waste management dominate in government interventions for the waste sector. While they do not directly support waste-to-value enterprises, they do encourage waste generators to seek ways to dispose of it. Waste-to-value enterprises benefit in terms of a willing seller group that can off-load waste at low costs to them. Regulations in India, for instance, include a component of generating value from waste and lessening the disposal burden. One way this is done is through a mandate to use plastic waste for road construction or for energy recovery, or conversion of waste to oil. In addition, the regulations comprise other components such as collect back system[57], phasing out of manufacture and use of non-recyclable multilayered plastic[58], and waste generators' responsibilities[59]. Similarly, regulations in Ghana emphasize recycling and reuse of waste. The Environmental Protection Agency (EPA) designs solid waste management guidelines for municipalities, and ensures that the district waste management plans promote recycling, reuse, composting, and waste minimization strategies.[60] This encourages waste generators to review their contribution to waste management. For instance, the National Association of Sachet Water Producers recognizes the impact and environmental concerns of indiscriminate disposal of waste from the consumption of their products.[61] In other countries like Kenya and Camaroon, while a number of ministries and departments

[57] The producers, importers and brand owners who introduce the plastic carry bags, multi-layered plastic sachet, or pouches, or packaging in the market within a period of six months from the date of publication of these rules, need to establish a system for collecting back the plastic waste generated due to their products. They shall work out modalities for waste collection system based on Extended Producers Responsibility and involving State Urban Development Departments, either individually or collectively, through their own distribution channel or through the local body concerned. This plan of collection has to be submitted to the State Pollution Control Boards while applying for consent to Establish or Operate or Renewal.

[58] Manufacture and use of non-recyclable multi-layered plastic should be phased out in two years' time.

[59] All institutional generators of plastic waste shall segregate and store the waste generated by them in accordance with the Solid Waste Management Rules, and handover segregated wastes to authorized waste processing or disposal facilities or deposition centers, either on its own or through the authorized waste collection agency. All waste generators shall pay such user fee, or charge, as may be specified in the bye-laws of the local bodies for plastic waste management.

[60] The options for the effective management of plastic waste in Ghana, Solomon Kusi Ampofo http://fonghana.org/wp-content/uploads/2013/02/REPORT-ON-MANAGEMENT-OF-PLASTIC-WASTE-IN-GHANA-21-328-STASWAPA.pdf

[61] Theoretical Framework for Plastic Waste Management in Ghana through Extended Producer Responsibility: Case of Sachet Water Waste, NCBI, August 2015 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4555319/

are responsible for solid waste management, none of the regulations specifically mandate recovery of value from waste.[62,63]

Regulations to control waste generation are more recent, and aim to particularly reduce plastic waste. In India, the government released regulations for plastic waste management[64], which mandate that the required thickness of plastic carry bags is increased from 40 to 50 microns.[65] The rules also mandate introduction of plastic waste management fee through pre-registration of the producers, importers of plastic carry bags and vendors selling the same. There are very few instances of governments engaging actively in awareness building programs to mobilize acceptance of waste management solutions. In Brazil, the government has launched several programs to promote awareness regarding waste recycling.[66]

In some countries, waste management is seen as a public responsibility; hence these governments establish and operate waste recycling plants. In Nigeria, where almost one-fifth of the total municipal solid waste constitutes plastic waste, the government has established plastic recycling plants in 26 cities in the country. The plants convert plastic waste into pellets that can be used for manufacturing. This initiative will complement the efforts of the local and state authorities in managing their municipal solid waste stream.[67] In Mexico too, the public sector and municipal governments are in charge of managing municipal solid waste (MSW). However, recycling is not practiced by the municipal communities at all times. There are some general policies to manage organic waste in Mexico but plastic waste management is not given any priority in the country.[68]

The most direct ways in which governments engaged with waste management enterprises is through public-private partnerships. They also promote waste-to-value enterprises by encouraging waste generators to direct waste towards these recycling plants. The Brazilian government is planning to partner with private enterprises that collect recyclable waste. Under this partnership, the government would reduce the ICMS[69], a value-added tax on sales and services.[70]The Nigerian government promotes private enterprises to engage in extracting and creating value from waste in order to cope with the rapid rate of generation and disposal of plastic materials.[71] In Ghana, RECNOWA benefits from government efforts to curb plastic waste pollution. The government mandates the citizens to send plastic waste to RECNOWA's collection points, instead of discarding it. Other policies such as arresting and prosecuting citizens who litter also help these enterprises. In India, Daily Dump received a government subsidy, when it undertook a pilot project to distribute 100 composters in low-income areas in Guwahati, Assam.[72]

[62] Policies and Regulations – Nairobi 2008 http://neerienvis.nic.in/pdf/rules_other;_country/policyandregulations_nairobi.pdf
[63] Waste management in Cameroon: A new policy perspective? Research Gate
https://www.researchgate.net/publication/223471093_Waste_management_in_Cameroon_A_new_policy_perspective
[64] Plastic Waste Management Rules 2016, Press Information Bureau, Government of India, Ministry of Environment and Forests
http://pib.nic.in/newsite/PrintRelease.aspx?relid=138144
[65] This increase in thickness will increase the cost of plastic bags by nearly 20%, which will bring down the tendency to give free plastic bags, and will improve collection of plastic bags by the waste-pickers.
[66] Recycling of Waste in Brazil, The Brazil Business, May 2015 http://thebrazilbusiness.com/article/recycling-of-waste-in-brazil
[67] FG pledges to phase-out the production and use of non- biodegradeble plastic in Nigeria, Federal Ministry of Environment, Nigeria, December 2013
http://environment.gov.ng/index.php/news-media/press-release/185-fg-pledges-to-phase-out-the-production-and-use-of-non-biodegradeble-plastic-in-nigeria
[68] Global Partnership on Waste Management, Mexico, UNEP
http://www.unep.org/gpwm/InformationPlatform/CountryNeedsAssessmentAnalysis/Mexico/tabid/106566/Default.aspx
[69] Imposto sobre Operações Relativas à Circulação de Mercadorias e Serviços de Transporte Interestadual e Intermunicipal e de Comunicações. The tax applies to the movement of goods, transportation and communication services and to supplying any goods
[70] http://thebrazilbusiness.com/article/the-16-most-common-brazilian-taxes
[71] FG pledges to phase-out the production and use of non- biodegradeble plastic in Nigeria, Federal Ministry of Environment, Nigeria, December 2013
http://environment.gov.ng/index.php/news-media/press-release/185-fg-pledges-to-phase-out-the-production-and-use-of-non-biodegradeble-plastic-in-nigeria
[72] Self-reported

Conclusion

Recycling not only mitigates environmental degradation due to untreated waste, but also reduces consumption of fresh raw materials, and energy for production of these materials. In the process, it also provides livelihoods to several people engaged in the waste management sector.

The model is highly replicable and can inspire copy-cat enterprises owing to the opportunity to recycle the immense volume of waste generated in developing countries. However, the scalability of individual enterprises is dependent on the quantum of discrete waste streams available to the enterprises for recycling on the one hand, and demand for recyclable products on the other. Customer perception towards purchasing recycled products dictates the potential to generate revenues; enterprises must therefore invest heavily in designing international quality products and marketing these products to customers. While the market for dry waste recycled products is global, the market for organic compost tends to be local. Government support in terms of setting up recycling facilities and providing tax incentives for recycling operations will facilitate the model's growth. Given the inadequate waste collection services in developing countries, the waste-to-value enterprises do not have enough waste material to convert into reusable products. If they are provided requisite value chain support from the 'waste collection' enterprises, the business model may exhibit better scale.

** INR to USD rate conversion: 1 INR = 0.015 USD*
** KES to USD rate conversion: 1 KES = 0.0099 USD*
** Peso to USD rate conversion: 1 Peso = 0.0546 USD*

Table 1. Social enterprises in waste-to-value

Company	Country	Solution description
360 Recycle	Jamaica	360 Recycle converts waste products such as plastic bottles, Styrofoam, cardboard, into construction materials (walls), playground and park equipment. 360 provides training and employment to community members. http://www.360cycleja.com/
Biobolsa	Mexico	Sistema Biobolsa converts manure into biogas and natural fertilizers. The enterprise provides installation services to carry out waste management. It also educates the farmers about the system to create maximum impact. http://sistemabiobolsa.com/?lang=en
Bioways India Services and Solutions	India	Bioways India Services and Solutions undertakes PET bottle recycling. It installs a PET crusher machine at the point of consumption / generation for PET bottle recycling. http://impactpreneurs.com/Bioways_India_Services_%26_Solutions_Private_Limited
Continental Renewable Energy Co.Ltd (COREC)	Kenya, Ethiopia, Namibia, Nigeria, Rwanda, Somalia, South Sudan, Tanzania, Zambia	COREC converts plastic waste into sustainable, durable, and affordable building material. The product range includes tiles, posts and covers ideal for fencing farms, homes, national parks, forest reserves and commercial places. http://www.coreclimited.com/about.html
Daily Dump (PBK Waste Solutions)	India	Daily Dump provides customized segregation and composting products to household and industrial users. The enterprise offers low maintenance composting pots such as terracotta pots, gamlas and leaf composters to households. It provides composting machines such as Aaga 550, suited to large-scale community recycling, to commercial users. http://dailydump.org/
DeCo! (Decentralized Composting for Sustainable Farming and Development)	Ghana	DeCo treats fruit and vegetable waste and converts it into organic and eco-friendly fertilizers used by smallholder farmers. The enterprise recycles and manages all sorts of waste generated by the farmers in this region including tree leaves, groundnuts and poultry manure. http://www.deco-farming.com/
Eco Domum	Mexico	Eco Domum converts plastic waste into affordable housing solutions. The enterprise collects plastic waste, sorts it, melts it, and finally compresses and crystallizes the plastic into the shape of the panels by means of a hydraulic press. It takes two tons of plastic to make one house. On an average, Eco Domum's plant produces panels to construct 1.5 houses a day. http://www.ecodomum.mx/
EcoPost	Kenya	EcoPost uses 100 % recycled plastics to make aesthetic, durable and environmentally friendly plastic lumber for use in applications ranging from fencing to landscaping. It makes money by selling the by-products made out of recycled plastic. http://www.ecopost.co.ke/
Green Cities	Liberia	Green Cities Inc. operates Liberia's first waste Segregation and Recycling center. The center hires youth to collect and sort the waste. Organic waste is converted to natural fertilizer. http://www.greencitiesinc.com/
Green Wave India	India	Green Wave India recycles flower waste into incense sticks. The flower waste is collected from temples at no cost. It has a manufacturing unit in Kanpur and employs local women workers to carry on the recycling process. http://www.unltdindia.org/investees/nikhil-gampa-%E2%80%93-green-wave

Mbezi Plastic Recycling	Tanzania	Mbezi plastic converts plastic waste into affordable and durable building material for urban use.
ModRoof (ReMaterials)	India	ModRoof is the flagship product of a waste management enterprise called ReMaterials. ModRoof is a modular roofing system for slum and village homes in the developing world. ReMaterials uses packaging and agricultural waste to manufacture the panels, which constitute the main component of the roofing system. ReMaterials has prototyped solar cells integrated into ModRoof panels. http://re-materials.com/
Ocean Sole	Kenya, Mozambique, Tanzania	Ocean Sole recycles flip-flops that are found littered on beaches and in waterways into colorful merchandise. These colourful masterpieces come with an important message about marine conservation, while providing a source of livelihood to many in need. Ocean Sole, which provides direct employment today to more than 100 people, aims to recycle 400,000 flip-flops every year. http://www.ocean-sole.com/
Protoprint	India	Protoprint partners with waste picker co-operatives in India to set up 'Filament Production Labs' at local dump sites. At these labs, Protoprint sets up its machines and trains the waste pickers to process the plastic waste into 3D printer filament. The co-operative then sells the filament to distribution partners, generating income for the waste-pickers. http://www.protoprint.in/
RECNOWA	Ghana	Recycle Not a Waste (RECNOWA) Initiative upcycles plastic trash and other waste materials from the waste stream, to high fashion goods whiles creating employment opportunities, restoring dignity and financial independence for the youth. http://recnowa.org/
Trash2Cash	India	Trash2Cash trains women to recycle plastic, wet waste and waste paper into micro-utility household products. The enterprise sources paper waste, food waste, and plastic waste from households and corporates. It recycles the items at its own recycling unit, and sells the products through exhibitions, fairs, corporate orders, and online requests. http://resolvetrash2cash.org/
Sustainable Technologies & Environmental Projects (STEPS)	India	STEPS provides management and disposal of unsegregated waste at source through the Polycrack technology. The Polycrack reactor treats unsegregated garbage and converts it into gas, oil and carbon. STEPS has a demo model of the Polycrack reactor at Mumbai, and its technology has been used at the MMRDA site, PCMC Nasik, Bhopal and at the Amarnath Yatra. http://stepsenergy.net/
Thread International	USA, Haiti	Thread LLC collects plastic waste from Haiti and Honduras, through local waste pickers, who are paid in cash. Its collection centers buy recyclables from the waste pickers, and sort the materials for transport to a centralized processing facility. Thread partners with recycling facilities in Haiti and Honduras where plastic bottles are washed and ground into valuable rPET flakes. The plastic flakes are transported from Haiti to the United States, where it eventually is extruded into filament and fiber, spun into yarn, and knitted or woven into fabrics. These fabrics are then sold to apparel and accessory manufacturers in the US. http://www.threadinternational.com/
Tosheka Textiles	Kenya	Tosheka Textiles provides a range of textile products that utilize waste management techniques to create fabric and material for textile design. Through partnerships with stores, Tosheka runs campaigns that urge customers to deposit their clean plastic bags in collection bins. These bags are then collected by the Tosheka group who distribute them to the

		women that work with Tosheka who further convert these plastic bags to recycled products for sale. http://www.toshekadesigns.com/
Triciclos	Brazil	Triciclos uses recycling stations and clean collection points (CCP) as systems to educate consumers about the consequences of untreated waste. These recycling stations have 20 different processors that segregate and treat solid waste Besides focusing on making street pickers reliable and trustworthy mentors, Tricolos also provides advisory and consultancy services. http://www.triciclos.net/en/
Waste Concern	India	Vivam Agrotech provides a range of waste management services such as composting, vermicomposting and biogas. The enterprise also conducts research to improve the technology for composting, and reducing carbon emissions, in partnerships with local governments. http://www.vivamgroup.co.in/
Wongpanit	Bangladesh	Waste Concern uses a decentralized composting model to convert organic waste to compost. The enterprise undertakes composting activities either by involving local communities in door-to-door waste collection and producing organic compost that is sold to rural farmers at lower prices via fertilizer companies. The enterprise also sources organic waste through direct collection from vegetable markets. It sells the compost to rural farmers and carbon credits in the international market. http://www.wasteconcern. org/

Additional Reading

East Asia Forum article http://www.eastasiaforum.org/2016/04/30/indias-waste-management-problems-are-piling-up/

Green Schools Program http://www.greenschoolsprogramme.org/knowledge-bank/waste/

Creating inclusive value chains in plastic waste management is paramount for a green economy, SEED, February 2015 https://www.seed.uno/blog/articles/1587-creating-inclusive-value-chains-in-plastic-waste-management-is-paramount-for-a-green-economy.html

Waste management in Cameroon: A new policy perspective? Research Gate https://www.researchgate.net/publication/223471093_Waste_management_in_Cameroon_A_new_policy_perspective

Global Partnership on Waste Management, Mexico, UNEP http://www.unep.org/gpwm/InformationPlatform/CountryNeedsAssessmentAnalysis/Mexico/tabid/106566/Default.aspx

Waste pickers, Women in Informal Employment: Globalizing and Organizing http://wiego.org/informal-economy/occupational-groups/waste-pickers

CASE STUDY: OCEAN SOLE

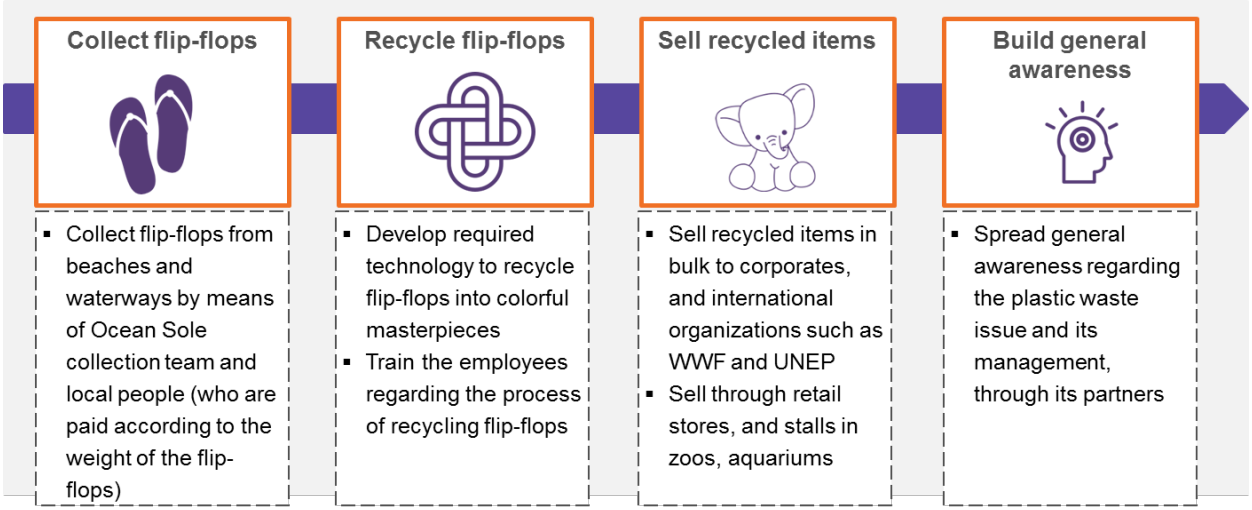
Ocean Sole®
The Flipflop Recycling Company

Founding year: 2013
HQ: Nairobi, Kenya
Countries of operation :
Recycling operations in Kenya.
Products are sold globally
Orientation: For-profit
Employees: 50
Turnover: USD 0.5 million

According to the United Nations (UN) estimates every square mile of ocean hosts nearly 50,000 pieces of plastic. In Kenya, where plastic flip-flops cost a dollar, beaches are littered not just with broken and battered domestic varieties but with flip-flops from all over the world. Branded flip-flops turn up on Kenya's east-facing shoreline from the Middle East, South Asia and Australasia.

Ocean Sole transforms the retrieved flip flops into colorful masterpieces. Safari animals, including lions, rhinos, elephants, giraffes, and warthogs deliver an important message about marine conservation. These recycled flip flops from the ocean shores also create global awareness about the careless human footprint. The enterprise works with local communities, train them in the required skillsets, and help them improve their livelihood. Most of the employees include women, who did not a source of income earlier.

The enterprise plans to recycle 400,000 flip-flops per year.



Operating Model

Ocean Sole is a Kenya based flip-flop recycling company. It was established as UniquEco Designs in 2005-06, and was rebranded as Ocean Sole in 2013. The enterprise collects discarded flip-flops from beaches and converts them into artistic items such as door stoppers, key rings, bracelets and installations of animals. All the products are hand-made, and use very little technology.

Ocean Sole employs a beach clean-up team that collects flip-flops for its recycling operations. The enterprise also purchases flip-flops from non-employees who collect flip-flops from the coast and sell it to Ocean Sole on a per kilogram rate. The enterprise conducts its recycling operations in Kenya and sells its products globally through distributors, retail stores, zoos and aquariums. The enterprise customizes the products on the basis of end customer requirements on the availability of flip-flops.

Ocean sole provides training to women located on the coasts of Kenya, Mozambique and Tanzania to make creative products from the reclaimed flip-flops. The enterprise works indirectly with over 100 individuals from in and around Nairobi and the coast, and provides formal employment to 50 people at its recycling workshops in Nairobi. The intervention helps in improvement of the livelihoods of the people, who, otherwise, did not have any source of income. Ocean Sole also provides other benefits to the employees such as free lunches, medical bill reimbursements, maternity and paternity leaves, and 21-26 days of annual leave.

The enterprise believes that there is negligible awareness regarding marine conservation. Therefore, it partners with several international organizations and stakeholders including United Nations Environmental Program (UNEP), Kuruwitu Conservation and Welfare Association, Watamu Marine Association, Msambweni turtle and marine group among a few. UNEP supports the enterprise initiatives in several ways. For instance, in November 2015, on His Holiness Pope Francis' visit to UNEP headquarters in Nairobi, the organization presented him an Ocean Sole elephant, as a symbol of the need to preserve wildlife and environment.[73] The enterprise has launched an education module with Kuruwitu Conservation and Welfare association, to spread awareness in a few primary schools in Kuruwitu, Kenya. Nearly 1000 children participate in the recycling workshops conducted by Ocean Sole as part of their school trips.

Ocean Sole is constantly engaged in several awareness activities and campaigns. The enterprise urges the Government of Kenya to ban plastics, as done by the governments of Rwanda and Tanzania to protect the marine ecosystem. On the occasion of International Coastal Clean-Up Day on 17 September 2016, Ocean Sole launched a competition to gather ideas to reduce and recycle plastic waste. The competition will run till 17 September 2017, and the winner will be awarded USD 10,000.[74]

The enterprise has received several awards including Kenya National Award at the Energy Globe Awards for its sustainable development in 2010. It was also featured on The British Broadcasting Corporation's (BBC) 'Indian Ocean' series in 2012. Ocean Sole was also appointed by the London Zoo to create a curtain for its butterfly park. Likewise, the enterprise has recreated the World Wide Fund for Nature's (WWF) iconic panda by recycling flip-flops. The Discovery Museum in Newcastle has Ocean Sole's elephant installation in its world culture collection.

Financial Sustainability

Ocean Sole pays USD 150-USD 200 in salaries to its employees.

The enterprise is currently profitable. Labor costs related to employee salaries and meals comprise one of the largest cost components for Ocean Sole. The average salaries paid to each worker ranges between USD150-USD200 per month. The enterprise also incurs expenses on employee training and material recycling. Ocean Sole spends KES 20-KES 30 (USD 0.2-USD 0.3) per kg of flip-flop purchased from the collectors. It also incurs costs in operating its recycling hub in Nairobi, where PET, glass bottles and tin are collected from informal traders to recycle. The major source of revenue is the sale of hand-made products created from recycled flip-flops. The price for its recycled items ranges between USD 3 for small items bought in bulk quantities to USD 8000 for collectibles. The enterprise maintains its financial sustainability by means of personal funding from shareholders and through the income generated by sale of recycled items.

Impact

As a part of its operations, the enterprise provides jobs to low income groups, and helps in environmental conservation by cleaning the beaches of marine litter and conserving marine life. The enterprise has created the Ocean Sole Foundation, initiating a global drive for supporting the clean-up of oceans with the innovative use of plastic marine debris and reducing the use of plastics. The Foundation campaigns actively for better management and protection of the ocean's resources, ecosystems and habitats.

Challenges and Lessons

The biggest challenge that the enterprise faces is to maintain the business sustainability and plan for scalability, while following all the requisite regulatory requirements. The National Environmental Management Authority (NEMA), Kenya mandates licenses to transport waste. Also, the cost of transporting basic raw waste

[73] UNEP Director Gives Pope Elephant Made From Waste Flip-flops https://tuko.co.ke/70494-exclusive-photo-see-environmentally-friendly-gift-unep-director-gave-pope-francis.html
[74] Government urged to ban use of plastic to protect marine life, Daily Nation, 19 September 2016 http://www.nation.co.ke/counties/ban-use-of-plastic/1107872-3386622-beetj1z/

flip-flops is expensive i.e. a truck full of 5000 kg of flipflops costs KES 55,000 (USD 544) to reach Nairobi from the sea-coast. The enterprise needs to pay custom duties for flip-flops that are received from different parts of the world, while it cannot make Value Added Tax (VAT) claims on recycled flip-flops. The government and donors are typically aid oriented and not market-driven. Therefore, the enterprise does not receive any tax breaks, because of its for-profit orientation. This impacts the financial sustainability of the enterprise. The enterprise also faces difficulty in generating demand for its products owing to customer's negative perception towards purchasing recycled products. To address the challenge, the enterprisepartners with local agents and distributors who create awareness to sell the products.

Road Ahead

Ocean Sole plans to streamline the production, and improve marketing and distribution channels by investing in appropriate technologies. It is targeting to recycle 400,000 flip-flops per year at USD 500,000 turnover. The enterprise also wants to partner with a flip-flop manufacturing company that could help recycle the residual waste generated after manufacturing of flip-flops. It hopes to expand its operations to other developing countries by end of 2017. The enterprise also targets to triple its revenues from USD 500,000 to USD 1.5 million by 2019.

CASE STUDY: Trash2Cash

Founding year: 2011
HQ: Kolkata, India
Countries of operation : India
Orientation: For-profit
Employees: 27
Turnover: USD 7500

Kolkata has one of the highest gross CO2 emission footprints in India of which city's municipal solid waste and landfill accounts for nearly 45% of the total emissions.

The Trash2Cash initiative evolved when climate action group South Asian Forum for Environment (SAFE) was exploring solutions to Kolkata's solid waste problem. The initiative developed into a waste management social enterprise.

Trash2Cash spreads awareness regarding segregation of waste at soruce, it collects both dry and wet waste, trains waste workers, especially women living in slum areas, to recycle the waste into gift and utility items such as pen stand, baskets, folders, photo frames, and compost.

The enterprise recycles nearly 5000 kg of waste per week.

Operating Model

"7% of total recyclable solid waste is paper" – Dipayan Dey, Chair, SAFE
(Trash2Cash Video, Youtube, February 2016)

Trash2Cash is an India based enterprise. It started as an urban climate initiative of South Asian Forum for Environment (SAFE) to solve issues related to municipal solid wastes, and to provide an alternative livelihood for Kolkata's rag-pickers and slum dwellers, especially women[75]. Currently, the enterprise engages in spreading door to door awareness[76] regarding significance of waste segregation at source.[77] Thereafter, it collects paper waste, food waste and plastic waste from households and corporates[78]. It eventually engages in recycling of waste collected from various sources at its recycling plant. It also practices vermicomposting to obtain quality compost from organic waste. The enterprise has recently forayed into textile recycling.

As a critical component of the business model, the enterprise trains the local rag-pickers and slum dwellers to collect waste paper, plastics and wet wastes from city dustbins and recycle the waste into gift and utility products such as pen stands, woven paper baskets, photo frames, folders, and piggy banks. The enterprise also sells customized items to its corporate and government customers.

[75] 65% of the employees are women
[76] at household level and corporate level
[77] 90-95%
[78] neither it charges any fee nor it pays

The enterprise partners with several stakeholders for financial and outreach support. National Bank for Agriculture and Rural Development (NABARD), besides being a regular customer of Trash2Cash products, also provides mainstream market linkage to the products through fairs and exhibitions. The enterprise has also partnered with the US consulate office and American Center in Kolkata that provide their paper waste for up-cycling. The US Consul General Craig L. Hall inaugurated the paper pulp unit of Trash2Cash in November 2015. Some of its other partners include Bidhannagar Municipal Corporation, PricewaterhouseCoopers (PwC), Ericsson, Lexmark International, and DLF.

Trash2Cash recycles 2000 kg of dry waste and 2500 kg of wet waste per week.

The major customers of the enterprise include urban middle class, corporates, government offices, municipal corporations, and interior decorators. The recycled items are sold through open sale in corporate houses and fairs, and through bulk orders obtained by means of marketing campaigns and online requests.

Financial Sustainability

Trash2Cash has leveraged its partnership with corporates and international organization to maintain its financial sustainability. For instance, Vodafone Essar Limited funded the concept of Trash2cash under Corporate Social Responsibility (CSR) partnership with South Asian Forum for Environment in 2010. Trash2Cash also received financial support from MATCH International Women's Fund (MIWF) in 2014. The enterprise has also taken a loan from NABARD to scale-up its operations. In 2012-13, the enterprise received financial support from Innovative Challenge Fund (ICF), under Ministry of Urban Affairs, Government of West Bengal.
Some of the major cost components include salaries of employees and other operational and maintenance costs including warehousing facilities and recycling machineries. The prime source of revenue is through the sale of recycled materials which also includes specially crafted artistic materials.

The enterprise offers a wide range of products and the prices vary for individual products. For instance, a pen stand costs INR 60 (USD 0.9) while a photo frame may cost somewhere between INR 120-INR 200 (USD 1.8-USD 3). The enterprise sells compost at the rate of INR 50 (USD 0.75) per kilogram (kg). Generally, the recycled products sold by the enterprise are relatively cheaper than competing products. However, special artistic products are priced 2-3 times higher than similar products offered by various competitors.

Impact

The enterprise follows an eco-friendly model that recycles waste and in turn minimizes landfill emissions while creating direct employment, safe and dignified working environment for school dropouts, slum dwellers and waste workers. The enterprise has trained nearly 400 community rag-pickers, covering three major slums in Kolkata.

The average price range of Trash2Cash products is between USD 0.75 and USD 3

The enterprise has helped the women workers create an identity and financial independence for themselves. It has helped the women workers be a part of financial inclusion in the country; they are now bank linked (their first social accreditation). They now manage the financial returns, raw material stock, production line, quality control of goods, sale proceeds and the overall merchandizing of the products.

The current engagement of the enterprise with nearly 23 corporate offices in Kolkata has achieved 90% of waste segregation at source. The enterprise recycles nearly 2000 kg of paper, plastics and 2500 kg of wet waste every week reducing 5500 MT of carbon equivalent emission annually.[79]

[79] Certified by the UNFCCC panel

The enterprise has received the International Match Foundation Award in 2013 for women empowerment, and received UNFCCC Momentum for Change, Lighthouse Activity Award in 2014. The enterprise' efforts have also been recognized as one of the best practices by UNEP in their 'Cleanup the World Campaign'.

ICF appreciated the enterprise's efforts to include informal waste workers in the organized waste management system by providing capacity building.

Challenges and Lessons

A primary challenge for the enterprise is that posed by waste *mafia* or illegal waste collectors and scrap dealers who steal the waste collected by the enterprise before it reaches the recycling facilities. Another critical challenge encountered by the enterprise is the lack of understanding amongst the stakeholders which mainly include various user categories such as corporates and households regarding the significance of waste management, specifically segregation-at-source. They are not convinced about the fact that waste can be upcycled. The enterprise conducts awareness campaigns to build up the required understanding and awareness regarding waste management.

Road Ahead

Trash2Cash plans to expand its product portfolio in the next 2-3 years.[80] The enterprise is in need of further financial and institutional support to expand its operations including organization of training and skill building programs for rag-pickers, investment in infrastructure such as work-space and waste recycling machines, and to provide added benefits such as health insurance facilities to the families of the employees.

[80] For instance, it plans to create doll houses out of waste paper.