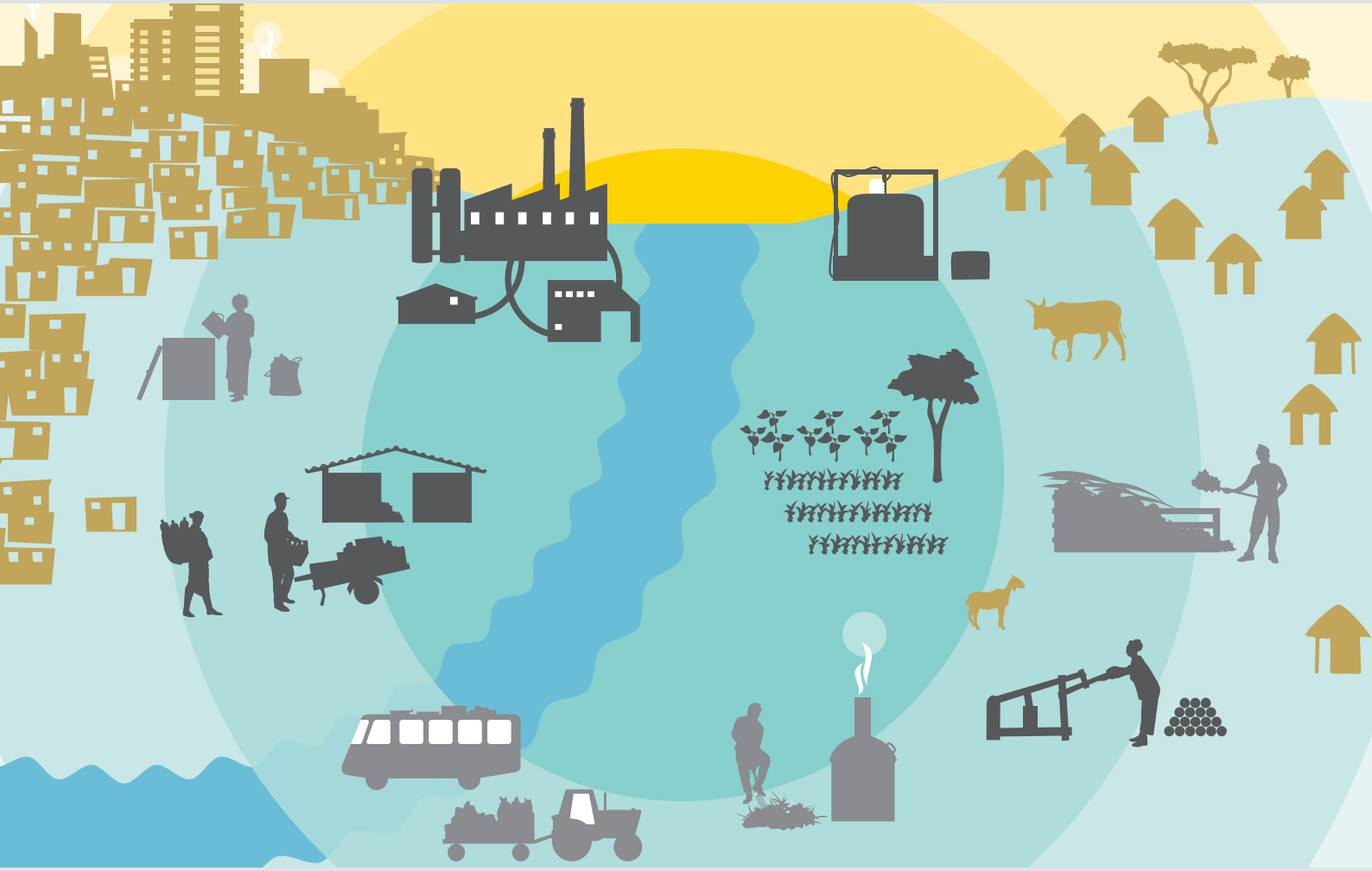
BENDING THE CURVE

Best practice interventions for the circular economy in developing countries



A SYNTHESIS OF FIVE LITERATURE REVIEWS

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Best practice interventions for the circular economy in developing countries

A SYNTHESIS OF FIVE LITERATURE REVIEWS

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Design: Wingfinger Graphics

Tearfund is a Christian relief and development agency building a global network of local churches to help eradicate poverty.

THE ARC OF THE MORAL UNIVERSE IS LONG, BUT IT BENDS TOWARD JUSTICE.

Martin Luther King

MAINSTREAM WASTE MANAGEMENT AND A CIRCULAR ECONOMY IN ALL SECTORS FOR A CLEAN AND HEALTHY ENVIRONMENT.

Alice Kaudia, Environment Secretary, Kenya

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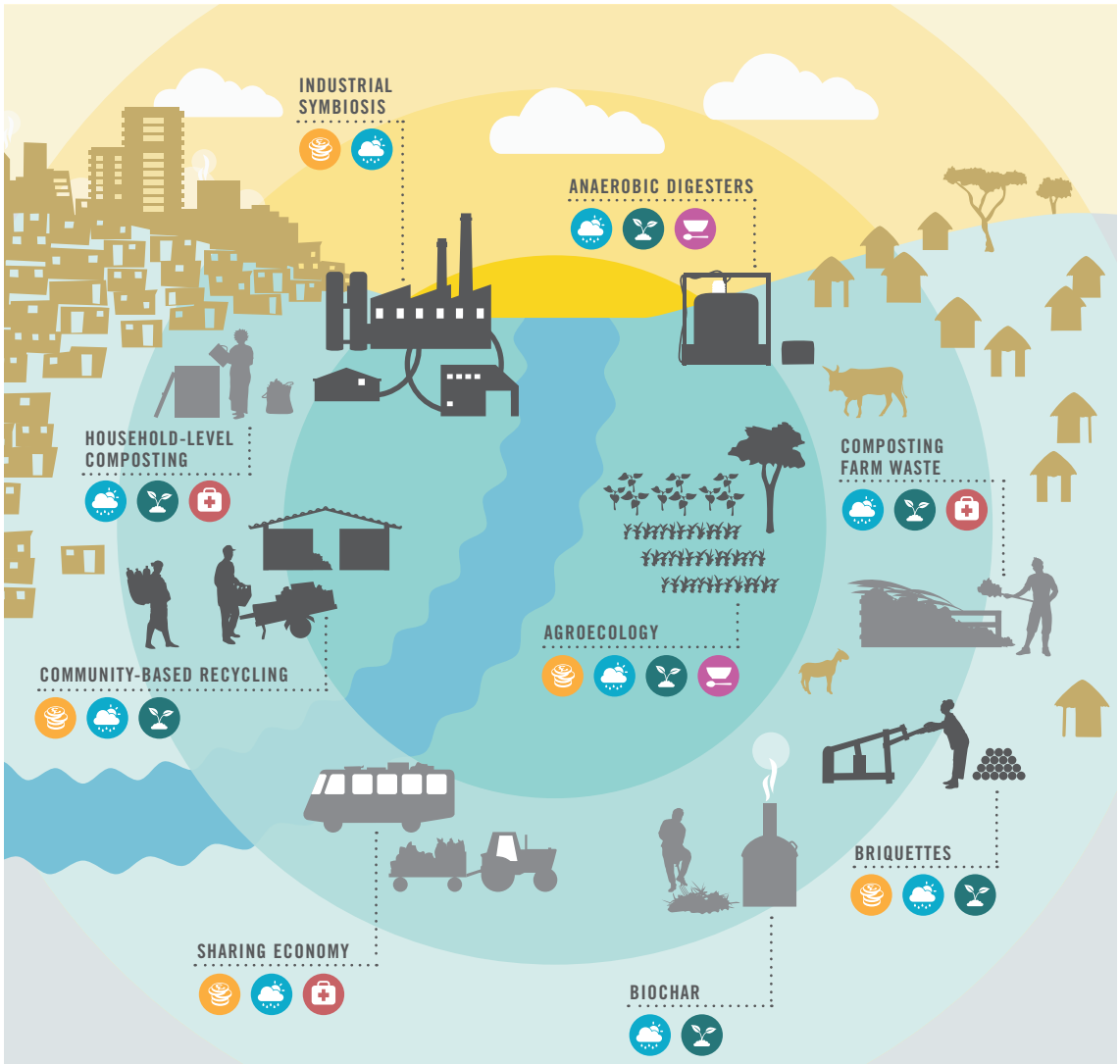
FIGURE **THE CIRCULAR ECONOMY IN DEVELOPING COUNTRIES: WHAT WORKS**



INTERVENTIONS:

PROVEN	**COMMUNITY-BASED RECYCLING** and waste collection **ANAEROBIC DIGESTERS** – biogas production using agricultural waste **INDUSTRIAL SYMBIOSIS** – waste from one industrial process becomes raw material for another **AGROECOLOGY** – a 'whole system' approach to food production that uses waste as an input **BRIQUETTES** – turning agricultural waste into solid fuel
EVOLVING	**SHARING ECONOMY** – ride sharing, tractor sharing etc **HOUSEHOLD-LEVEL COMPOSTING** **COMPOSTING FARM WASTE** **BIOCHAR** – fertiliser and fuel derived from agricultural waste

BENEFITS:

Health · Jobs · Reducing carbon emissions · Reducing pollution · Food

EXECUTIVE SUMMARY

There is growing interest in the circular economy as a strategy for helping to achieve the Sustainable Development Goals. In low- and middle-income countries, initial case studies[1] have shown that circular approaches hold great potential for increasing incomes, creating jobs, reducing the mortality and morbidity caused by pollution, and protecting ecosystems.

This paper takes the evidence base to the next stage, summarising the findings from five sector-specific literature reviews (urban waste, e-waste, industrial symbiosis, the sharing economy and agricultural waste). These studies assessed the barriers to the circular economy and examined the evidence base for good practice interventions that overcome these obstacles.[2] Here, we crystallise the key findings in order to focus discussion on which areas are most deserving of further consideration (through primary research, pilot projects or replication).

CIRCULAR APPROACHES HOLD GREAT POTENTIAL FOR INCREASING INCOMES, CREATING JOBS, REDUCING THE MORTALITY AND MORBIDITY CAUSED BY POLLUTION, AND PROTECTING ECOSYSTEMS

We have divided the circular economy practices we found into three broad categories: proven, evolving and speculative. Proven approaches are practices with a strong evidence base across different regional and country contexts. Evolving practices are those where the evidence base is patchier. The speculative category includes an area of major concern, with a few examples of best practice (e-waste) and two approaches to agricultural waste that have high potential benefits but rely on as-yet-unproven technology.

This paper provides compelling evidence for the economic, health and environmental benefits – and cost effectiveness – of several circular economy interventions. These approaches are suitable to be replicated at scale. They include community-based recycling, industrial symbiosis, anaerobic digestion, agroecology and briquette production. Each of these approaches has the potential to be implemented in a way that empowers marginalised and poor communities, and Tearfund partners are already using several of these methods in the field. Other interventions show promise but require further piloting and research, with the most pressing of these being e-waste.

Thus far, attention has focused on the gains that developed countries and multinational companies (MNCs) can make from the circular economy by creating value through producing more from less. It is equally if not more important for people living in poverty and developed countries to have the opportunity to create value from the circular economy, if the circular economy is not to exacerbate global economic inequalities and power imbalances.

1 As set out in Gower R and Schroder P (2016) *Virtuous circle: how the circular economy can create jobs and save lives in developing countries*, Tearfund and the Institute of Development Studies

2 Urban waste, agricultural waste and e-waste are all problems created by the linear economy. The literature reviews examined a range of interventions to address these particular problems, whereas the sharing economy and industrial symbiosis are examples of existing circular economy interventions. With both sets of interventions we examined their effectiveness, barriers to their scaling-up and whether there was evidence of actors overcoming these obstacles.

Table summarising proven and evolving interventions

INTERVENTION	Category	Main benefits	Barriers
Community-based recycling in informal settlements	PROVEN	• reduces air pollution and waterborne diseases • creates jobs • mitigates climate change • benefit-cost[3] ratios of approximately 10:1[4]	• education and social norms regarding separation at source • informality of recyclers • chemical fertiliser subsidies
Anaerobic digesters (biogas production using agricultural waste)	PROVEN	• reduces indoor air pollution • raises crop yields • mitigates climate change • benefit-cost ratios in the region of 6:1	• finance for capital costs • maintenance systems • publicity of success
Industrial symbiosis[5]	PROVEN	• creates jobs • reduces pollution • mitigates climate change • benefit-cost ratios exceeding 3:1	• waste data • commercial confidentiality/trust • environmental legislation
Agroecology	PROVEN	• increases resilience • optimises yields and productivity • reduces external inputs	• buy-in • upfront investments of time and labour • agency short-termism
Briquettes	PROVEN	• reduces indoor air pollution • creates jobs • reduces deforestation	• finance • market demand • regulation
Sharing economy	EVOLVING	• creates jobs • reduces pollution • can improve health	• mobile phone access • social norms • economic development
Household-level composting	EVOLVING	• improves health by destroying pathogens • optimises soil productivity • maximises recycling potential	• education • social norms
Composting farm waste	EVOLVING	• improves health • raises crop yields • reduces need for external inputs	• education • separation of livestock and crop farming • market demand
Biochar	EVOLVING	• improves soil fertility • curbs deforestation • reduces indoor air pollution	• uncertainty over health impacts

3 A benefit-cost ratio is an indicator used in cost-benefit analysis of the overall value for money of a project. The higher the ratio, the better the investment.

4 Where cost-benefit analysis could be found, we have included it in our analysis

5 Industrial symbiosis (IS) is 'an association between two or more industrial facilities in which the wastes or byproducts of one become the raw materials for another', according to WRAP, 'What is industrial symbiosis?' Available at: www.wrap.org.uk/content/what-industrial-symbiosis [accessed June 2017]

Recommendations

- Multilateral and bilateral donors should increase aid to pro-poor waste management from 0.3 per cent to 3 per cent of Official Development Aid as a matter of urgency. This would provide waste collection for the 2 billion people who are currently without it.[6]
- Donors should establish a multilateral fund focused on promoting circular economy interventions throughout the value chain.
- Agriculture policymakers in developed and developing countries should support the mainstreaming and scaling-up of agroecology, anaerobic digestion and briquette programmes, and explore further how to overcome the barriers of composting and biochar.
- Policymakers with remits for business and economic growth should develop national and regional programmes for scaling up industrial symbiosis and large-scale anaerobic digestion to decrease pollution and greenhouse gas emissions while creating jobs.
- Donors should fund research into how the sharing economy can be harnessed to realise its development potential.
- All countries and companies that export large amounts of e-waste should accept their share of the responsibility to find pro-poor solutions, seeking to pilot best practice in this area.
- The EU should adapt its eco-design standards to make products easier and safer to disassemble, and should take into account electronic products' ultimate destination and associated health, livelihood and environmental impacts.[7]
- As the circular economy is scaled up in developing countries, practitioners and funders should strive to ensure that people in poverty benefit from its expansion.

6 This is based on calculations of the cost of providing waste management services per person through an Integrated Resource Recovery Centre model

7 See Tearfund's recent paper on this issue: Wilson S, Benton D, Brandmayr C and Hazell J (2017) *How will Europe's ecodesign measures affect the circular economy in low-income countries?* Available at: www.tearfund.org/circular

1 PROVEN INTERVENTIONS

1.1 Community-based recycling centres

The need

Developing countries, and especially cities experiencing rapid urbanisation, are struggling with burgeoning municipal solid waste (MSW) generation. This poses a challenge for overstretched and underfunded municipal governments. Globally, 2 billion people lack access to formal solid waste collection and 3 billion lack access to controlled waste disposal facilities.[8] What's more, the problem is worsening: in lower-income cities in Africa and Asia, MSW generation is expected to double in the next 15 to 20 years.[9]

OPEN BURNING OF WASTE IS ESTIMATED TO CAUSE 270,000 PREMATURE DEATHS A YEAR GLOBALLY

Waste that is burned in the open or left uncollected produces greenhouse gases (GHGs) and poses a serious risk to public health, causing respiratory illnesses, contaminating soil and groundwater, and increasing the spread of infectious diseases.[10] Open burning of waste is estimated to cause 270,000 premature deaths a year globally through particulate matter emissions.[11] (By comparison, malaria kills 580,000 people annually.[12]) Furthermore, open burning contributes as much as five per cent of global GHG emissions.[13] In many low-income countries such as Rwanda and Ethiopia, GHG emissions from open burning of waste probably exceed all other GHG emissions combined.[14]

Currently, recycling activities in developing countries are mainly carried out by the informal sector. Researchers estimate that a large range – from 12.5 to 65 million – of people are involved in informal waste management, with the largest numbers of people in China, India and Brazil.[15] Waste pickers are one of the most marginalised social groups who work under extremely hazardous conditions.

In addition to dealing with the immediate environmental and human health impacts from unmanaged waste, there is another set of economic and environmental benefits from increasing recycling rates: it reduces the need for primary resource use and manufacturing from scratch, thereby improving resource efficiency and helping to decouple economic growth from environmental degradation.[16]

What works

Integrated Resource Recovery Centres (IRRCs) are an example of community-based recycling centres operated by former waste pickers and/or waste and sanitation workers of municipal governments, in close cooperation with informal-sector workers. The model has been particularly successful. They are market based, create jobs for marginalised groups and generate significant health and environmental benefits. They offer a suitable approach for informal settlements in fast-growing cities.

8 UNEP (2016) *Global waste management outlook*. Available at: http://web.unep.org/ourplanet/september-2015/unep-publications/global-waste-management-outlook 'Controlled waste disposal facilities' refers to rubbish bins/containers for household waste disposal; 'solid waste collection' refers to waste collection services offered by municipalities or companies.

9 UNEP (2016) *Global waste management outlook*

10 Sankoh F, Yan X and Tran Q (2013) 'Environmental and health impacts of disposal of solid waste in developing cities: a case study of Granville Brook dumpsite, Sierra Leone', *Journal of Environmental Protection,* vol 4, no 7, pp 665–670; and Makoni FS, Ndamba J, Mbati PA and Manase G (2004) 'Impact of waste disposal on the health of a poor urban community in Zimbabwe', *East African Medical Journal* 81(8), pp 422–426

11 Kodros JK et al (2016) 'Global burden of mortalities due to chronic exposure to ambient PM2.5 from open combustion of domestic waste', *Environmental Research Letters*, vol 11, no 12, 124022

12 UNICEF (2015) 'Malaria fact sheet'. Available at: www.unicef.org/media/media_81674.html [accessed September 2017]

13 Wiedinmyer C, Yokelson R and Gullett B (2014) 'Global emissions of trace gases, particulate matter and hazardous air pollutants from open burning of domestic waste', *Environmental Science & Technology*, 2014, 48 (16), pp 9523–9530

14 Ibid

15 Linzner R and Lange U (2012) 'Role and size of informal waste management sector – a review', *Waste and Resource Management,* vol 166, no 2, p 72

16 International Resource Panel (2017) *Resource efficiency: potential and economic implications*. Available at: www.resourcepanel.org/reports/resource-efficiency

The IRRC intervenes along three axes:

- with households in the community to encourage waste separation at source
- with waste pickers to scale up door-to-door collection and operate a community-based processing plant
- with consumers and downstream businesses to sell organic compost and recyclables

A partnership with local government cuts across these three axes and often means establishing the IRRC on publicly-owned land. This ensures that the IRRC is aligned with regional or national waste management policy. In addition, local government can encourage (or even legislate for) source separation by local businesses and households, working closely with the IRRC and its employees.[17]

UNESCAP has been promoting IRRCs in the Asia-Pacific region since 2007, concluding that 'IRRCs create jobs for the urban poor and save costs for local government… mitigate environmental degradation… and contribute to better hygiene and an improved urban environment by reducing vectors and diseases'.[18]

COMMUNITY-BASED RECYCLING IMPROVES LIVELIHOODS, REDUCES GHG EMISSIONS AND DELIVERS SIGNIFICANT HEALTH BENEFITS

Tearfund and the Institute of Development Studies' benefit-cost assessment of an IRRC project in Pakistan[19] shows that the project improves livelihoods, and delivers major GHG reductions and significant health benefits by reducing open burning and dumping. The centre rapidly became self-financing (through a combination of selling compost and recyclate, and nominal household collection fees), and thus offers an exceptionally high benefit-cost ratio, delivering 10 USD of benefits for every 1 USD invested by the donor.

Overcoming the barriers

Open burning and dumping of waste is a systemic problem, which requires intervention along a number of axes.

Firstly, municipal governments – which are legally responsible for waste collection typically – often lack the funds to provide an adequate service. It is possible to overcome this barrier by creating a model that is largely or entirely self-financing (like the IRRC). However, this generally requires households to separate waste at source to some degree, which helps in the production of quality compost, biogas or recyclate.

Unfortunately, households may lack the knowledge, equipment or inclination to separate organic and recyclable waste, and this can constitute a significant barrier. Furthermore, access to functioning markets for recycled products is another key determinant of success for a (partially or wholly) self-financing system.

In addition to local government, the informal recycling sector is another key actor in this space. Any initiative must ensure that it does not inadvertently destroy informal sector workers' livelihoods, but their lack of (formal) organisation can pose a barrier to effective collaboration with the formal waste management sector.

The coordination of these groups (households, local government, waste pickers and upstream consumers of recycled goods) and the need for upfront investment in facilities are the major barriers to effective waste management in developing countries. The powerful innovation at the heart of the IRRC approach is the successful alignment of these four groups. Where waste management interventions in developing countries do not pay attention to these four key components of the system, they often fail.[20]

The profitability of IRRCs can also be enhanced by eliminating perverse subsidies. For example, in several countries chemical fertilisers are subsidised, such that the price the IRRC can charge for compost is significantly lower than it would otherwise be.

17 Storey D, Santucci L, Aleluia J and Varghese T (2013) 'Decentralised and integrated resource recovery centres in developing countries: lessons learnt from Asia-Pacific'. Paper presented by UNESCAP at the 2013 ISWA Congress; see also UNESCAP (2015) *Valuing waste, transforming cities*, UNESCAP and Waste Concern

18 Storey D, Santucci L, Aleluia J and Varghese T (2013) 'Decentralised and integrated resource recovery centres in developing countries: lessons learnt from Asia-Pacific'. Paper presented by UNESCAP at the 2013 ISWA Congress

19 Gower R and Schroeder P (2018) *Cost-benefit assessment of community-based recycling and waste management in Pakistan,* Tearfund and the Institute of Development Studies

20 Troschinetz A and Mihelcic J (2008) 'Sustainable recycling of municipal solid waste in developing countries', *Waste Management,* February 2009, vol 29, no 2, pp 915–923

1.2 Anaerobic digestion (biogas and fertiliser)

The need

Some 2.7 billion people rely on traditional biomass for cooking and heating.[21] Traditional biomass is problematic because it is time-consuming, causes ill-health (through indoor air pollution) and creates GHG emissions. At the same time, untreated animal waste has many negative impacts: air pollution (which can cause serious human and animal health problems, and acid rain) and reduced soil and water quality (which affects agricultural productivity and human health).[22]

What works

BIOGAS REDUCES DESERTIFICATION, SAVES TIME FOR WOMEN AND CHILDREN AND REDUCES INDOOR AIR POLLUTION

In a biogas digester, anaerobic microbial action breaks down manure or crop waste into biogas which can be burned for heat or electricity. It also produces a slurry that has a high nutrient content. Biogas as a fuel reduces the amount of woodfuel required, reducing desertification and saving time for women and children (who typically collect the wood). It is a clean fuel, reducing levels of indoor air pollution. The slurry can be used as a fertiliser, increasing crop yields. During the digestion process, dangerous bacteria are killed, which reduces the pathogens that are harmful to humans. Livelihoods are created through the production and maintenance of digesters and plants. Where a digester is linked with sales of the gas or fertiliser, it provides a source of additional income.

There is a wealth of literature on biogas technology, and in certain parts of the world (eg China and India), biogas is a widespread practice – on many different scales. It would seem that there is no barrier in terms of the existing technology – from farm-level digesters to huge biogas plants. However, this technology is still in its infancy in Africa.

Analysis of projects supporting the installation of small biodigesters (suitable for small-holder farmers) typically shows a benefit-cost ratio of approximately 6:1.[23] For larger biodigesters, a recent benefit-cost analysis for a farm of 2,000 pigs in Vietnam[24] suggested a ratio of 3:1, and this did not reference the social benefits arising from displacement of chemical fertiliser or reduced pollution from animal waste.

Overcoming the barriers

There are several non-technological barriers that need to be overcome if biogas is to be scaled up. These include: lack of finance to cover capital costs; poor institutional support in terms of information, capacity-building and technical support; and social norms around the use of animal waste. However, there are many successful biogas interventions that have overcome these barriers and could be replicated, ranging from local projects with small-scale farmers to national biogas programmes.

Successful interventions tend to involve a package of measures, which could include support to purchase and install a biodigester (including, crucially, micro-credit for small-scale farmers) alongside education, knowledge dissemination and technical support among rural communities, to ensure appropriate use and maintenance.

National programmes have the added advantage of building a market for biogas that can compete with other sources of energy. For example, where biogas is promoted at scale, it is possible for biogas to be bottled and sold for use by other households beyond the source household. This allows for the health benefits of reduced

21 www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase

22 Castel V et al (2006) *Livestock's long shadow: environmental issues and options,* FAO. Available at: www.europarl.europa.eu/climatechange/doc/FAO%20report%20executive%20summary.pdf

23 Internal assessment by DfID of a project in Ethiopia, and by Tearfund of a project in north-eastern Brazil: both show a ratio of 6:1 over a 20-year timeframe, with a discount rate of ten per cent. Other assessments based on different assumptions yield similar results – for example, see Smith MT, Goebel JS, Blignaut JN (2014) 'The financial and economic feasibility of rural household biodigesters for poor communities in South Africa', *Waste Management,* vol 34, no 2

24 Over a twenty-year timeframe and with a discount rate of ten per cent. Solh M (2010) *The economics and policy of biogas production: a Vietnamese case study*, Wageningen University, MSc Thesis

indoor air pollution to be shared more widely, and can also displace fossil fuels such as kerosene. However, it is only possible where biogas is adopted at sufficient scale for a market to develop in the required equipment (such as suitable gas bottles, lamps and cookstoves).

Finally, there is also a need for knowledge disbursement and greater sharing of best practice in this area, particularly in Africa. At present, many successful projects are poorly publicised.

1.3 Industrial symbiosis

The need

Industrial symbiosis (IS) is 'an association between two or more industrial facilities in which the wastes or byproducts of one become the raw materials for another'.[25] IS schemes are often introduced for purely economic reasons.[26] The concept allows firms to reduce input costs and generate revenue from waste, fostering competitiveness and underpinning job creation. Through IS, surplus resources generated through one industrial process are captured, rather than discarded or destroyed, and redirected for use as an input for another organisation. In this way, IS can divert waste from landfill, reduce pollution from waste and reduce carbon emissions.[27]

INDUSTRIAL SYMBIOSIS CAN DIVERT WASTE FROM LANDFILL, REDUCE POLLUTION FROM WASTE AND REDUCE CARBON EMISSIONS

What works

Regional or national IS programmes have a proven record in creating synergies through bringing together a number of successful interventions:[28]

- building a network of participating companies
- resource mapping: recording materials used/created to identify potential synergies
- building an online collaboration platform: collecting and managing details of participating companies and their resources
- facilitating synergies: identifying opportunities, facilitating negotiations, providing technical expertise and identifying investment opportunities

The UK's National Industrial Symbiosis Programme, which has generated £1.1 billion in savings and created 10,000 jobs,[29] has provided a replicable model used in other places such as China[30] and South Africa. The Western Cape IS Programme (WISP) in South Africa is funded by the regional government and provides a free service for connecting companies. For every 1 rand invested, 2.65 rand of benefits were generated.[31] Over five years the WISP generated 45 million rand in economic benefits, created 145 permanent jobs, diverted 10,253 tonnes of waste from landfill and saved 64,000 tonnes of GHGs.[32] Where benefit-cost

25 WRAP, 'What is industrial symbiosis?' Available at: www.wrap.org.uk/content/what-industrial-symbiosis [accessed June 2017]

26 Gingrich C (2012) 'Industrial symbiosis: current understandings and required ecology and economics influences', *Engineering Dimensions,* September 2012

27 For example, IS in Ulsan, South Korea, saves 227,000 tonnes of carbon emissions every year. Source: Behera SK et al (2012) 'Evolution of "designed" industrial symbiosis networks in the Ulsan Eco-industrial Park: "Research and development into business" as the enabling framework', *Journal of Cleaner Production,* vol 29–30, pp 103–112

28 Switch Asia (2014) 'Facilitating industrial symbiosis in Chinese industrial parks to reduce environmental impact: industrial symbiosis in Tianjin Binhai New Area', Impact Sheet

29 Laybourn P (2015) 'Mutual benefits of industrial symbiosis', *The Environmentalist*, August 2015

30 Switch Asia (2014) 'Facilitating industrial symbiosis in Chinese industrial parks to reduce environmental impact: industrial symbiosis in Tianjin Binhai New Area', Impact Sheet

31 This includes additional revenue, cost savings and private investments but not GHG savings or health benefits from reduced emissions. O'Carroll S et al (2017) 'The nature and role of industrial symbiosis in South Africa'. Paper presented at the Trade & Industrial Policy Strategies Annual Forum 2017

32 Ibid

analysis exists, the net benefits revealed are often substantial. In one thoroughly assessed example in Puerto Rico, for example, the annualised financial benefits of coordinating steam production amounted to 11.7 million USD against costs of 3.4 million USD (a ratio of 3.4 to 1).[33]

Overcoming the barriers

Lack of information about waste or by-products is a challenge to identifying IS opportunities or understanding the potential market for the products of a synergy. Information failures can be a particular challenge in conflict or post-disaster contexts.[34] Furthermore, IS relies on the coordination of industrial processes, and coordination failures can be caused by commercial confidentiality or by lack of trust between firms. Poorly designed environmental legislation can also disincentivise IS: for example, the absence of a landfill tax can make it cheaper to send waste to landfill rather than set up a synergy. Finally, lack of technological, financial or human resources capacity can be a barrier, particularly for small to medium-sized enterprises.[35]

Nevertheless, the four successful interventions outlined earlier – when delivered as a package – have a good track record in overcoming these coordination, information and legislative barriers and in helping build capacity among potential participants.

1.4 Agroecology

The need

Agroecology can be defined as 'the application of ecological concepts and principles to the design and management of sustainable agro-ecosystems'.[36] With an agrocecological approach, 'the agro-ecosystem is regarded as one and its health as a whole is valued more than the productivity of single crops'.[37] Such sustainable agriculture systems often recycle farm wastes as nutrient sources, leaving most of the crop residues on or close to the soil surface rather than removing or burning them. The permanent crop and weed residue mulch protects the soil, mineralisation is reduced and soil organic matter is built up and maintained.[38] Agroecology avoids the unnecessary use of agrochemical and other technologies that adversely affect the environment and human health.[39] The evidence for the multifunctional benefits of agroecology is increasingly compelling. These include better resilience to climate change, environmental change and pests, but also importantly, through focusing on integrating ecology and agriculture, farmers also see increased productivity and optimised yields.[40]

THROUGH FOCUSING ON INTEGRATING ECOLOGY AND AGRICULTURE, FARMERS ALSO SEE INCREASED PRODUCTIVITY AND OPTIMISED YIELDS

What works

Interventions to promote conservation agriculture (one example of agroecology) have proved successful. In Zimbabwe, the FAO has initiated a programme of training and demonstrations, and introduced labour-saving mechanical planters to win over farmers. As a result, Zimbabwe has seen 'spontaneous adoption',

33 Chertow M and Lombardi R (2005) 'Quantifying economic and environmental benefits of co-located firms', *Environmental Science & Technology,* vol 39, no 17

34 Radilova S and Juned S (2015) 'Sustainable resource management post-disaster and post-conflict: exploring the role of industrial symbiosis'. Workshop report, International Synergies Ltd

35 Blottnitz H von, Kothuis B and Petrie J (2001) *Improving the environmental performance of small and medium-sized manufacturing enterprises in South Africa. Networks and industrial symbiosis assessments*

36 Altieri MA (1995) *Agroecology: the science of sustainable agriculture*, Boulder CO, Westview Press. Cited in: Silici L (2014) *Agroecology: what it is and what it has to offer*, IIED Issue Paper, IIED, London

37 Silici L (2014) *Agroecology: what it is and what it has to offer*, IIED Issue Paper, IIED, London

38 www.fao.org/ag/ca/1a.html

39 Silici L (2014) *Agroecology: what it is and what it has to offer*, IIED Issue Paper, IIED, London

40 Ibid

FARMERS SEE GAINS ON THEIR NEIGHBOURS' FARMS AND MAKE THE DECISION TO ADOPT CONSERVATION AGRICULTURE

meaning farmers see gains on their neighbours' farms and make the decision to adopt conservation agriculture. Today more than 300,000 Zimbabwean farmers are practising this method and have nearly tripled their production.[41] Other successful approaches to promoting agroecology include 'farmer field schools' or farmer-to-farmer training.[42]

The Oakland Institute has published 33 agroecology case studies. In its own words, 'they demonstrate with facts and figures how an agricultural transformation respectful of the farmers and their environment can yield immense economic, social, and food security benefits while also fighting climate change and restoring soils and the environment'.[43]

Overcoming the barriers

Barriers include the initial increase in labour required, farmers not fully understanding the approach, and the amount of time needed to see results, as well as short-termism on the part of the agencies supporting them. However, the FAO's work in Zimbabwe has shown that these challenges can be overcome.[44]

1.5 Briquettes

The need

Using organic waste for briquette production supports efficient use of biomass energy, and reduces deforestation, indoor air pollution and time spent collecting firewood. It also improves livelihoods.[45]

What works

Agricultural waste can be used in the production of briquettes that are used as a fuel. There are two types of briquettes: carbonised briquettes where kilns carbonise agricultural waste to produce charcoal powder, and non-carbonised briquettes that are made directly by solidifying/compacting the raw material.

THE PROJECT HAS CREATED 13,300 JOBS, AND 115,000 HOUSEHOLDS ARE SERVED DAILY WITH BRIQUETTES, BRINGING IMMENSE BENEFITS

There are several examples of pro-poor businesses making briquettes from agricultural waste. Eco-Fuel Africa (EFA)[46] produces and distributes briquettes through a micro-franchising model to its clients, which mainly comprises households in rural and urban areas. The briquette value chain involves three actors: farmers, micro-franchisees and women retailers. By mixing the char that cannot be sold with compost to create biochar, it has also helped more than 3,500 farmers in Uganda increase their food harvests by over 50 per cent. This has also reduced malnutrition and increased food security. The project has created 13,300 jobs, and 115,000 households are served daily with briquettes, bringing immense benefits in terms of time and money saved. The project also boasts huge impacts on CO_2 emissions, deforestation and indoor air pollution.[47]

Jellitone Suppliers Ltd (KJS) in Uganda, originally a coffee roaster, now also produces and sells non-carbonised briquettes made from agricultural residues along with improved cooking stoves.[48] According to its website,

41 www.fao.org/in-action/conservation-agriculture-contributes-to-zimbabwe-economic-recovery
42 Bogdanski A (2012) 'Integrated food–energy systems for climate-smart agriculture', *Agriculture & Food Security*, 1(1), pp 1–10
43 www.oaklandinstitute.org/agroecology-case-studies
44 Bogdanski A (2012) 'Integrated food–energy systems for climate-smart agriculture', *Agriculture & Food Security*, 1(1), pp 1–10
45 Bernice A et al (2016) *A review on production, marketing and use of fuel briquettes*, CGIAR Resource, Recovery and Reuse Series 7, CGIAR Research Program on Water, Land and Ecosystems, International Water Management Institute (IWMI)
46 Ibid
47 Ibid
48 www.jellitone.com/fuelfromwastesresearchcenter.htm

'schools, hospitals and factories across the country are buying 130 tonnes a month of briquettes, along with efficient stoves for heating and cooking. The business is set to double over the next two years and hoping to expand to other African markets.'[49]

Overcoming the barriers

Lack of access to finance is a major bottleneck during start-up and operation of briquette businesses.[50] There are also barriers related to information failures and market challenges: briquettes and/or their benefits are unknown to many biomass fuel users, which makes tapping into the potential market challenging and costly. Effective marketing strategies and good distribution systems are needed: an example is Eco-Fuel Africa, which has successfully implemented a decentralised production and distribution system through a franchise model.

Briquette businesses have also faced regulatory barriers. Although many developing countries have renewable energy strategies, briquettes are seldom mentioned in the strategies or policies of these countries. Thus, important aspects of the briquettes are not regulated, resulting in substandard briquettes being produced. This creates a negative reputation for briquettes, which affects their use.

49 www.jellitone.com/index.html

50 Bernice A et al (2016) *A review on production, marketing and use of fuel briquettes*, CGIAR Resource, Recovery and Reuse Series 7, CGIAR Research Program on Water, Land and Ecosystems, International Water Management Institute (IWMI)

2 EVOLVING INTERVENTIONS

2.1 Sharing economy

The need

The sharing economy is a well known phenomenon in developed countries, with applications such as Uber and Airbnb disrupting established sectors of the economy. This has created winners (eg consumers, owners of assets) and losers (established hotel chains, taxi drivers, those without assets). The role of regulation in this context has also been hotly debated.

In developing countries, however, the role of the sharing economy has barely been considered. A number of sharing economy businesses are already emerging (particularly in transport, human resources and agriculture) but the role of regulation or development assistance in maximising the benefits and minimising costs is little understood. For example, the rights of participants in the sharing economy is a hotly contested area as they are not considered employees, and they receive fewer benefits and lower job security. Participants may also be subject to greater legal liabilities as they are required to obtain their own licences and insurance.[51]

Our research suggests that in developing countries, the sharing economy has the potential to assist with economic development, enable entrepreneurship, reduce pollution and potentially even assist with regulation and business formalisation. In situations where sharing businesses enable sharing of tangible assets among multiple users, sharing economy businesses can also reduce resource use and lower the environmental impacts of consumption. However, an enabling environment for the sharing economy in general, and support for the most pro-poor applications in particular, will be required to maximise these benefits.

THE SHARING ECONOMY HAS THE POTENTIAL TO ASSIST WITH ECONOMIC DEVELOPMENT, ENABLE ENTREPRENEURSHIP, REDUCE POLLUTION

What works

Existing applications show the potential of the sharing economy: in India, competing car-sharing firms have provided 30,000 jobs for the unemployed and created training programmes for 50,000 women. In agriculture, the Hellotractor app connects poor farmers in Africa and enables them to rent tractors for short periods. And in transport, apps in Rwanda and Kenya allow commuters to select motorcycle taxis based on their safety record.

Currently, there are few examples of governments promoting and encouraging the sharing economy but several lessons can be drawn from the existing literature. Firstly, interventions to support pro-poor applications of the sharing economy need to create the right enabling environment, for example by supporting development of mobile payment systems and accessible technology platforms. Secondly, pro-poor approaches could also specifically target particular types of business or particular sectors: for example, platform cooperatives or peer-to-peer sharing platforms (because these share the benefits widely) or sectors such as motorcycle taxis (where safety can be improved) or agriculture (where access to assets can make a big impact for the poorest people). Finally, interventions can also examine how to use sharing economy applications to facilitate workers' access to social security and training, such that the sharing economy encourages formalisation rather than informality.

51 Erickson K and Sorensen I (2016) 'Regulating the sharing economy', *Internet Policy Review: Journal on Internet Regulation*, 5(2), pp 1–13

Barriers

The most significant barrier in most developing countries is access to mobile technology or mobile payment systems (although access to these services is increasing rapidly, from a low base). Other barriers are cultural: social norms regarding ownership, or a lack of trust. Some are economic: fewer assets to share (in contrast to developed countries), lack of skills (eg literacy) and a lack of appropriate regulations.

Despite these barriers, however, the sharing economy already appears to be taking off in developing countries, creating opportunities for development practitioners to shape this phenomenon so that it benefits people living in poverty.

2.2 Household-level composting

The need

Organic materials, or biodegradables, account for the largest proportion of MSW in developing countries. For example, in Ghana organics account for about 61 per cent of MSW,[52] while in Brazilian cities organic waste constitutes about 51 per cent of MSW.[53] For the organic elements of MSW, such as kitchen scraps and food waste, organics diversion at household level is an important measure that is not practised widely in most countries, both developed and developing. Strategies to promote diversion to higher and better uses of organic contents of municipal waste are urgently needed to address the growing public health crisis resulting from uncollected MSW.

What works

Household-level composting of all organic materials can improve soil and facilitate home-grown production of vegetables or fruit. Separating and composting organic waste also maximises the opportunities for recycling solid waste by promoting source separation, and reduces ill-health caused by uncollected waste. In addition, it can increase household food security.[54]

A specific composting technology that can be applied at the household level is the Howard-Higgins system, a highly efficient method that can turn organic wastes into pathogen-free compost/fertiliser in 30 to 90 days.[55] The approach has been applied in various developing country settings including Uganda, South Africa and India, as well as in earthquake disaster refugee camps in Haiti. It can be used in permaculture and other agricultural/horticultural systems. It has significant potential in developing countries, where often there is no sewage or waste management infrastructure in place.[56] A large number of similar approaches exist that can be adapted to specific local conditions and climate without costly technology investments. However, there is a lack of documented evidence of specific projects demonstrating good practice that could be scaled up.

Overcoming the barriers

General lack of awareness about the practices and benefits of composting is an important barrier. Overcoming this barrier can, however, be achieved through community initiatives and educational activities. Social norms around hygiene are another barrier as most people are not willing to handle organic waste. In some fast-urbanising cities in low- and middle- income countries, the lack of private gardening space and the lack of appropriate facilities are additional obstacles to household-level composting. Yet, these can be overcome

52 Miezah K et al (2015) 'Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana', *Waste Management*, vol 46, December 2015, pp 15–27

53 IBGE – Instituto Brasileiro de Geografia e Estatística (2010) *Pesquisa Nacional de Saneamento Básico 2008.* Ministério do Planejamento, Orçamento e Gestão, Rio de Janeiro, p 219

54 Hoornweg D, Thomas L and Otten L (2000) *Composting and its applicability in developing countries*, World Bank Working Paper Series 8, Washington DC, World Bank 22007

55 www.permaculture.org.uk/user/richard-higgins

56 www.lowimpact.org/revolutionary-super-fast-composting-technique

through the use of semi-public or communal spaces attached to residential compounds (eg green space around residential car parks) and linked to urban community gardening projects.

2.3 Composting farm waste

The need

Untreated animal waste has many negative impacts (see Section 1.2). Composting of both crop residues and the solid portion of livestock manure reduces the volume of agricultural waste, and the use of compost on land can lead to more productive soils, higher yields and lower dependence on inorganic fertilisers, supplemental water and pesticides. It also reduces the potential for soil erosion.

What works

There were few examples in the literature of interventions focused on composting agricultural waste. This perhaps reflects the fact that investment in small-scale agriculture in developing countries has been neglected by both donors and national governments for decades. Some NGOs, such as the One Acre Fund, provide training for farmers in composting,[57] but other interventions were difficult to find. However, there is great potential for investment in this area. 'Farmers within a community can join together to adopt larger scale centralized facilities to enable them to realise economies of scale. This will be a more efficient way of generating income from composting, especially for those farmers having small amounts of on-farm wastes.'[58]

Barriers

Despite the clear gains of composting, the literature suggests that in many countries there are information failures (a lack of knowledge and understanding about composting) and coordination failures (the separation of crop and livestock farming), and hence the decrease in the on-farm use of manure. In the more general literature on composting in low-income countries (ie not specific to agricultural waste), the potential market challenges relating to compost are often highlighted, particularly the cost of transport.[59]

2.4 *In brief:* Biochar – pyrolysis or gasification

Biochar refers to the carbon-rich product that results when biomass – including manure or crop residues – is burned under oxygen-deprived conditions (pyrolysis). Biochar may be added to soils to improve soil productivity. The carbon in biochar resists degradation and biochar can hold carbon in soils for hundreds to thousands of years. Sustainable biochar practices can produce oil and gas byproducts that can be used as fuel, providing clean, renewable energy. It has the potential to contribute to food security, improve soil fertility, curb deforestation and reduce indoor air pollution and time spent collecting firewood. It has great potential, but more exploration is needed because of concerns around the large-scale production of biochar leading to landgrabbing. Some literature has highlighted uncertainty around the possible toxicity of biochar in soils.[60]

57 https://oneacrefund.org/blog/why-one-acre-fund-trains-farmers-composting

58 Mohee R (2007) *Waste management opportunities for rural communities. Composting as an effective waste management strategy for farm households and others*, FAO, Agricultural and Food Engineering Working Document 6

59 For example: Rouse J (2008) *Managing organic municipal waste:* http://answers.practicalaction.org/our-resources/item/managing-organic-municipal-waste; Peters K (1998) *Community-based waste management for environmental management and income generation in low-income areas: a case study of Nairobi, Kenya:* www.cityfarmer.org/NairobiCompost.html

60 Scholz S et al (2014) *Biochar systems for smallholders in developing countries: leveraging current knowledge and exploring future potential for climate-smart agriculture*, World Bank Study, Washington DC, World Bank

3 SPECULATIVE INTERVENTIONS

3.1 E-waste

The need

E-waste is the world's fastest-growing waste stream and is rapidly emerging as a critical environmental and public health issue because of the dangers associated with e-waste recycling.[61] Many developing countries already import more used electronics than new electronics (twice as much in the case of Ghana),[62] and government policies and infrastructure are unable to keep up with the pace of change.

MANY DEVELOPING COUNTRIES ALREADY IMPORT MORE USED ELECTRONICS THAN NEW ELECTRONICS

E-waste is a double-edged sword for developing countries. On the one hand, imports of used electronics are creating livelihoods in the repair sector and helping to bridge the digital divide. For example, in 2011, the Basel Convention estimated that e-waste repair and refurbishing was responsible for 30,000 jobs in both Accra (Ghana) and Lagos (Nigeria), and many students in Ghana only have a laptop because of these industries.[63] However, when electronic goods eventually end up in the waste stream, recycling practices create major health and environmental problems. Only a small part of this e-waste, about 16 per cent in 2014, is recycled with methods that are efficient, environmentally sound and not harmful to human health.[64]

In developing countries most e-waste is dealt with through open burning and acid bath recycling by the informal sector, both of which have serious negative impacts on processors' health and residents in the areas surrounding the e-waste dumps. Of exposed groups, children are particularly vulnerable to many of the toxins in e-waste.[65] Furthermore, even if the valuable materials are extracted, the remaining toxic residues are mostly dumped in unregulated landfills and waterways, posing additional environmental and health risks.

What works

The question of how to deal with these negative impacts (while maximising the benefits from repair and reuse) is a classic systemic problem, involving a large number of different actors. A comprehensive solution would require action along five different axes:

1 interventions at the design stage of electronics to allow for easy disassembly and reduced toxicity[66]

2 appropriate environmental (and health and safety) regulation of e-waste recycling

3 appropriate and well calibrated incentives for informal operators to participate in formalised recycling sectors[67]

4 capacity building with the informal repair and recycling sectors to reduce occupational health and safety issues

5 engagement with industry, especially large multinational electronics manufacturers, on effective schemes for sustainable e-waste management, such as Enhanced Producer Responsibility[68]

61 Kumar S and Jain A (2014) 'E-waste: health impacts in developing countries', *EHS Journal*

62 Amoyaw-Osei Y et al (2011) *Ghana e-Waste country assessment*, Secretariat of the Basel Convention

63 Basel Convention Secretariat (2011) *Where are WEee in Africa? Findings from the Basel Convention E-waste Africa Programme*

64 Ottaviani J (2016) 'E-waste Republic', *Spiegel Online.* Available at: www.spiegel.de/international/tomorrow/electronic-waste-in-africa-recycling-methods-damage-health-and-the-environment-a-1086221.html

65 Perkins et al (2014) 'E-waste: a global hazard', *Annals of Global Health*, vol 80, no 4, pp 286–295

66 Wilson S, Benton D, Brandmayr C and Hazell J (2017) *How will Europe's ecodesign measures affect the circular economy in low-income countries?* Tearfund

67 Lines K, Garside B, Sinha S and Fedorenko I (2016) 'Clean and inclusive? Recycling e-waste in China and India', IIED Issue Paper, March 2016

68 'Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products', according to www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

There are a few examples of interventions along one or two of these axes, but none that has successfully dealt with the issue in all its complexity as yet.

For example, the Samsung-UNIDO e-waste partnership in Cambodia shows how collaboration between multinational electronics companies and development cooperation programmes can contribute to improving occupational health and safety (OHS) in both the e-waste repair and the recycling sector.[69] NGO AMP are trialling another innovative approach in Agbogbloshie, Ghana, providing health and safety training to 'makers' (informal e-waste recyclers) and creating 'a 21st-century digitally-connected community workshop and lab open to entrepreneurs and anyone interested in learning, designing and making together in a collaborative environment'.[70]

In India, successive rounds of E-Waste Management Rules (2011 and 2015) have focused on introducing Extended Producer Responsibility and more stringent environmental regulation of recycling. However, they have ignored the role played by the informal repair or recycling sectors that handle the vast majority of e-waste in India. As a result, new 'formal' facilities have struggled to access sufficient quantities of e-waste, and existing livelihoods have been put at risk.[71] The new 2016 E-Waste Management Rules go some way to overcoming these problems, but it is too early to say how successful they will be.

In the EU, the Ecodesign Directive could be amended to ensure products are safer and easier to disassemble in the developing world, but at present the policymaking process does not take development impacts into account. It has, however, been successful in improving the energy efficiency of a number of products.[72]

THE ECODESIGN DIRECTIVE COULD BE AMENDED TO ENSURE PRODUCTS ARE SAFER AND EASIER TO DISASSEMBLE IN THE DEVELOPING WORLD

Barriers

It has proved difficult to find comprehensive and well evidenced examples of good practice because the five axes mentioned earlier cut across scales (informal to multinational) and geographies. It is also possible that existing examples of good practice are poorly publicised at present.

However, the main challenge in addressing e-waste recycling is that failure along one axis can threaten success on the others. For example, if incentives offered to informal operators are too low, then the informal system cannot compete with formal recycling centres, depriving them of inputs (ie waste electronics) and making them uneconomical (as seen in India).[73] Similarly, if capacity building is not offered at the same time as introducing more stringent regulations, the informal economy will be pushed even further underground, with negative consequences for those operating in that space.

Unless attention is paid to this problem, the health and environmental damage associated with e-waste recycling will only increase. Already, Chernobyl has been surpassed as the most toxic site in the world by an e-waste dump in Ghana.[74] And with the second-hand smartphone market increasing in size by 50 per cent between 2015 and 2016, the amounts of waste channeled to developing countries may grow exponentially in the near future.[75]

69 Adapon G (2013) *The UNIDO-Samsung Partnership: transforming e-waste into job creation and business opportunities*

70 https://qamp.net/2016/12/31/partnership-with-impact-hub-accra

71 Lines K, Garside B, Sinha S and Fedorenko I (2016) 'Clean and inclusive? Recycling e-waste in China and India', IIED Issue Paper, March 2016

72 Wilson S, Benton D, Brandmayr C and Hazell J (2017) *How will Europe's ecodesign measures affect the circular economy in low-income countries?* Tearfund

73 Lines K, Garside B, Sinha S and Fedorenko I (2016) 'Clean and inclusive? Recycling e-waste in China and India', IIED Issue Paper, March 2016

74 Parameswaran S (2013) 'Toxic waste "major global threat"', BBC. Available at: www.bbc.co.uk/news/science-environment-24994209 [accessed September 2017]

75 Deloitte (2016) 'Used smartphones: the $17 billion market you may never have heard of'. Available at: www2.deloitte.com

3.2 *In brief:* **Second-generation bioethanol**

As well as being made from sugars and grains, bioethanol can also be made from agricultural waste. Bioethanol is produced through a process of fermentation. While much global bioethanol production has had negative social and environmental consequences, it may be that using agricultural waste as the feedstock would mitigate these detrimental impacts. The sustainable production of bioethanol in a way that does not negatively impact food production could lead to huge benefits in terms of the environment, livelihoods and human health.

3.3 *In brief:* **Biocomposite materials from agricultural waste**

There is potential for agricultural waste to be used in the development of other biocomposite materials, for use in the automotive, green packaging and construction sectors. While some specific projects were found, such as one in Nigeria developing building materials from plant-based agricultural wastes from the cultivation of rice, maize and cassava crops, it would appear that this is a relatively new area. Literature tends to give greater attention to the ***potential*** application of agro-waste as the basis for alternative sustainable construction materials.

4 CONCLUSION

Our world's natural resources are under increasing pressure, as waste and pollution grow exponentially. People in poverty feel the impact of both trends – on their health, livelihoods and environment. The development sector has yet to respond adequately to these twin problems and funding opportunities for circular economy approaches are few and far between.

This paper provides compelling evidence for the economic, health and environmental benefits – and cost-effectiveness – of several circular economy interventions. These approaches are suitable to be replicated at scale. They include community-based recycling, industrial symbiosis, anaerobic digestion, agroecology and briquettes.

Other interventions show promise but require further piloting and research. Perhaps the most pressing of these relate to e-waste. This fast-growing waste stream causes major public health and environmental problems but the electronics repair and refurb sector could also create decent jobs at scale and bridge the digital divide. More immediate action can and should be taken to pilot best practice in the field and amend the design standards of electronic products, in order to take into account their ultimate destination, and associated health, livelihood and environmental impacts.

The circular economy has the potential to be implemented in a way that empowers marginalised and poor communities, and Tearfund partners are already using several of these methods in the field.

Thus far, attention has focused on the gains developed countries and MNCs can make from the circular economy by creating value through producing more from less. It is equally if not more important for people in poverty, and developing country governments, to have the opportunity to create value from the circular economy, if the circular economy is not to exacerbate global economic inequalities and power imbalances.

Recommendations

- **Multilateral and bilateral donors should increase aid to pro-poor waste management from 0.3 per cent to 3 per cent of Official Development Aid as a matter of urgency. This would provide waste collection for the 2 billion people who are currently without it.**[76]
- **Donors should establish a multilateral fund focused on promoting circular economy interventions throughout the value chain.**
- **Agriculture policymakers in developed and developing countries should support the mainstreaming and scaling-up of agroecology, anaerobic digestion and briquette programmes, and explore further how to overcome the barriers of composting and biochar.**
- **Policymakers with remits for business and economic growth should develop national and regional programmes for scaling up industrial symbiosis and large-scale anaerobic digestion to decrease pollution and greenhouse gas emissions while creating jobs.**
- **Donors should fund research into how the sharing economy can be harnessed to realise its development potential.**
- **All countries and companies that export large amounts of e-waste should accept their share of the responsibility to find pro-poor solutions, seeking to pilot best practice in this area.**
- **The EU should adapt its eco-design standards to make products easier and safer to disassemble, and take into account electronic products' ultimate destination, and associated health, livelihood and environmental impacts.**[77]
- **As the circular economy is scaled up in developing countries, practitioners and funders should strive to ensure that people in poverty benefit from its expansion.**

76 This is based on calculations of the cost of providing waste management services per person through an Integrated Resource Recovery Centre model.

77 See Tearfund's recent paper on this issue: Wilson S, Benton D, Brandmayr C and Hazell J (2017) *How will Europe's ecodesign measures affect the circular economy in low-income countries?* Tearfund

FURTHER READING

Gower R and Schroeder P (2018) *Cost-benefit assessment of community-based recycling and waste management in Pakistan*, Tearfund and the Institute of Development Studies

Gower R and Schroder P (2016) *Virtuous circle: how the circular economy can create jobs and save lives in developing countries*, Tearfund and the Institute of Development Studies

Joogzaad J (2017) *Circular economy strategies for Lao PDR*, UNDP

Preston F and Lehne J (2017) *A wider circle? The circular economy in developing countries*, Chatham House

PAGE (2016) *Practitioner's guide to strategic green industrial policy,* UNIDO

UNIDO (2017) *Circular economy.* Available at: www.unido.org/sites/default/files/2017-07/Circular_Economy_UNIDO_0.pdf

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