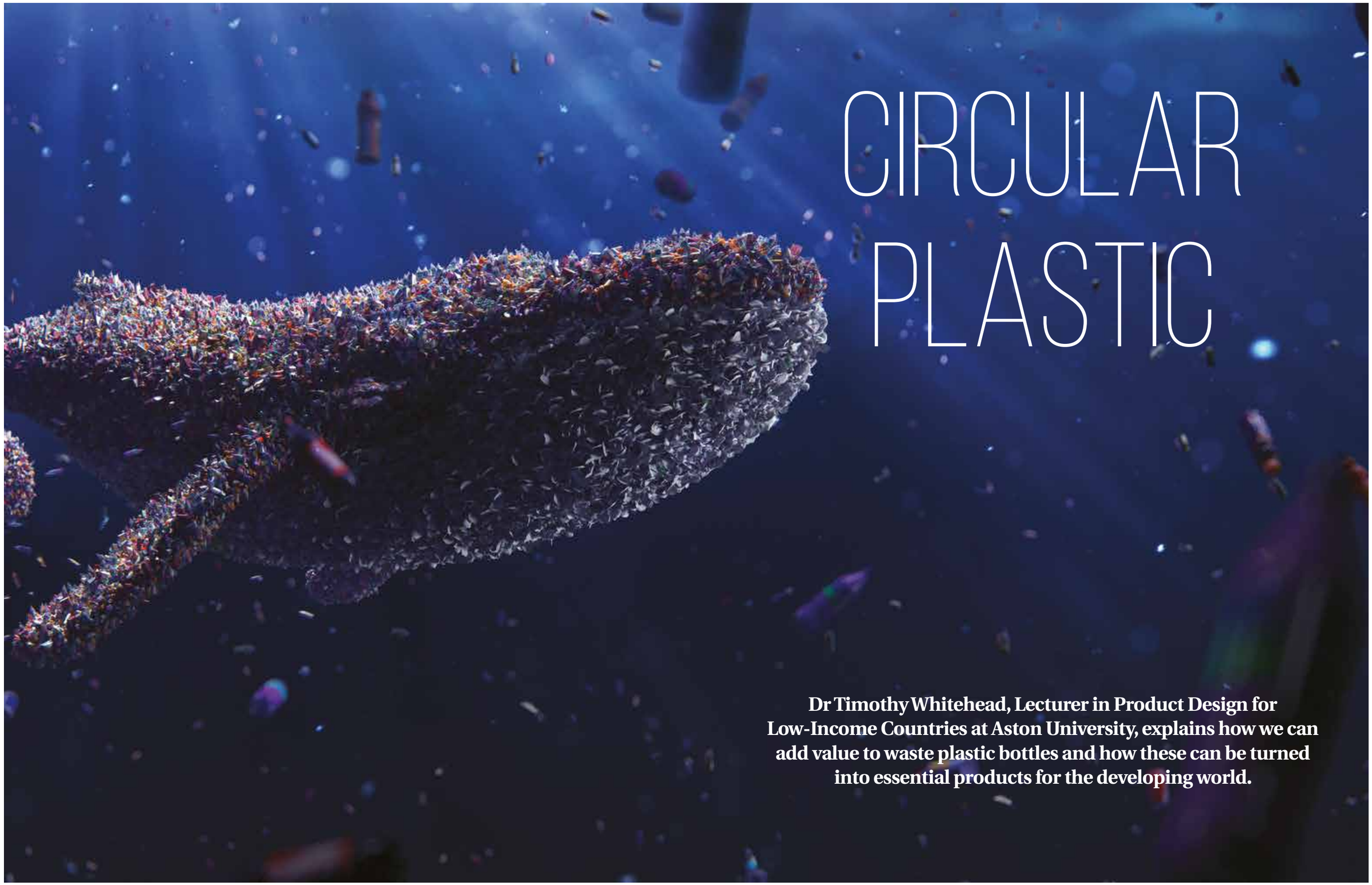

# CIRCULAR PLASTIC

**Dr Timothy Whitehead, Lecturer in Product Design for Low-Income Countries at Aston University, explains how we can add value to waste plastic bottles and how these can be turned into essential products for the developing world.**

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**It is hard to avoid awareness of plastic pollution throughout the world, with an estimated eight million tonnes dumped into oceans every year, which chokes out wildlife, there is an urgent need to provide global solutions to this crisis.**

Timothy Whitehead has identified that one of the main reasons plastic is put into landfill or just dumped into the ocean is that it is not seen as a valuable resource, worth saving and reusing, especially in the developed world.

In developing countries, there is a greater need and necessity to reuse all resources which creates a thriving informal network of plastic recyclers. This often starts with local waste pickers collecting bottles and cartons from the streets and bins. These are sold to small recycling shops, which in turn sell to larger agitators which sort, wash and pelletise a range of plastic to re-enter the manufacturing cycle. At each stage of this process, each of the stakeholders will add value. A plastic bottles which is typically made from PET are in abundance and a commonly found in post-consumer waste streams: (approximate costs, based on global data in 2018).

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| Mixed plastic bottles (recovered off the street) | £50 per tonne |
| Clear PET bottles (PET sorted into colour types) | £150 per tonne |
| Hot washed PET flake (PET flaked and washed) | £500 per tonne |
| Recycled PET pellets (ready for remanufacture) | £1200 per tonne |

Researchers at Aston and De Montfort University are investigating ways PET (plastic bottles) can be used for 3D printer filament. This will not only increase the value of recycled PET but also enable people around the world the opportunity to decentralise the manufacture of products and will allow anyone to create products which meet their specific needs.

The process of 3D printing is simple; firstly 3D geometry is created using specialist 3D modelling software. This geometry is then virtually sliced into layers and outputted as a numeric code. This code is read by the 3D printer, which prints layer by layer to create the final part. In recent years, there has been a growth in the number of desktop machines, including a Fuse Deposition Modelling (FDM) machine built from e-waste in Kenya, by AB3D and cost in the range of 400USD.

The first challenge in this research is to create reliable and consistent filament which can be produced anywhere in the world using widely available technology. Ethical Filament, which is part of Tech for Trade has developed the Thunderhead extruder, which is capable of creating reliable filament using simple components found, or easily manufactured, in developing countries. If this can be replicated in other countries then this will open the door for local production which could be linked to local recycling facilities and in turn, increase the value of recycled PET thirteen times.

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| Average global 3D Printer filament cost ($20 per kg) | £15,700 per tonne |

In Chennai, India, Kabadiwalla Connect has developed an app which tracks and monitors the price of plastic waste through the informal sector. This works in a similar way to the fair trade system and ensures that at each stakeholder in the supply chain is paid a reasonable price for their waste. If aggregators of the recycled PET can produce 3D printing filament, this will increase their revenue which in turn would help the litter pickers at the bottom of the chain and help to raise them out of poverty and add value to a resource which is typically thrown into landfill or the oceans.

3dprinted microsope - from plastic bottles

Plastic recycling centre

However, it not just the price of recycled PET which is essential to this research, but the application of 3D printing technology in the developing world. Although developing countries may not be the most obvious place to adopt 3D printing, the rapid uptake of mobile phones and mobile banking demonstrates how new technologies can be used to leapfrog developed nations, and there are many examples of products which have been produced locally, in areas which lack robust supply chains.

e-NABLE is a prosthetic hand which was established in 2013 as part of a community of makers and has now spread across 80 countries, including many developing nations. Prosthetics aren't often available in the developing world due to limited resources, restricted access in rural areas and lack of experience or expertise. Using 3D printing overcomes these barriers and allows the e-NABLE hand to be printed on the AB3D printer. The typical cost of a prosthetic can range from £4000 - £50000. So to be able to print one locally dramatically reduces this to around £40 per prosthetic.

Dr Richard Bowman developed a 3D printed microscope which replicated high-performance mechanism found in expensive models; it is small and cheap enough to be left in an incubator or fume hood for days or weeks. For example, this will enable the observing cells as they grow in an incubator. As this microscope is open source and available globally it has been used in Kenya in schools to introduce Biology. At the cost of £100 per microscope, it is three times cheaper than an equivalent and can be manufactured locally.

These examples demonstrate the potential for 3D printing in the developing world and how it can have a significant impact on the cost of products, and live of those living in poverty. If these products are made using recycled PET this will add additional value to the material and create a sustainable, circular model, which the developed world can learn from.

Although still at an early stage there is a real opportunity to add significant value to plastic waste and enable people in developing countries to locally manufacture products which meet their specific needs, while not polluting the oceans.