Ending Plastic Waste Symposium 2023

A community-driven 3D printing micro-factory aims to democratize plastic recycling

Transforming plastic trash to treasure through community-driven smart fabrication

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A mobile net-zero manufacturing lab that enables communities to design and create unique, customizable and sustainable products by 3D printing directly from locally sourced plastic waste. The project will reward end-users for recycling wider range of plastic waste while reducing landfill and other waste management costs for the local governments. Further value will be added through recreational, educational and future skills training opportunities.

Research Need

- In 2017–18 alone Australia consumed 3.4 million tonnes of plastics
- Australia has a recycling rate of only 12% (Schandl et al. 2020)
- The world generates around 350 million tonnes of plastic waste per year.
- Marine debris costs Asia-Pacific economies US$10.8B annually (McIlgorm et al. 2020)
- Damage costs to 2050 will exceed US$216B unless action is taken
- Every year more than 100,000 fish, birds, cetaceans and turtles die from ingestion, strangulation, and abrasion from plastic debris.
- 21% Plastics Production Increase Since 2010
- 10 Million Tons of Furnishings Landfilled per Year

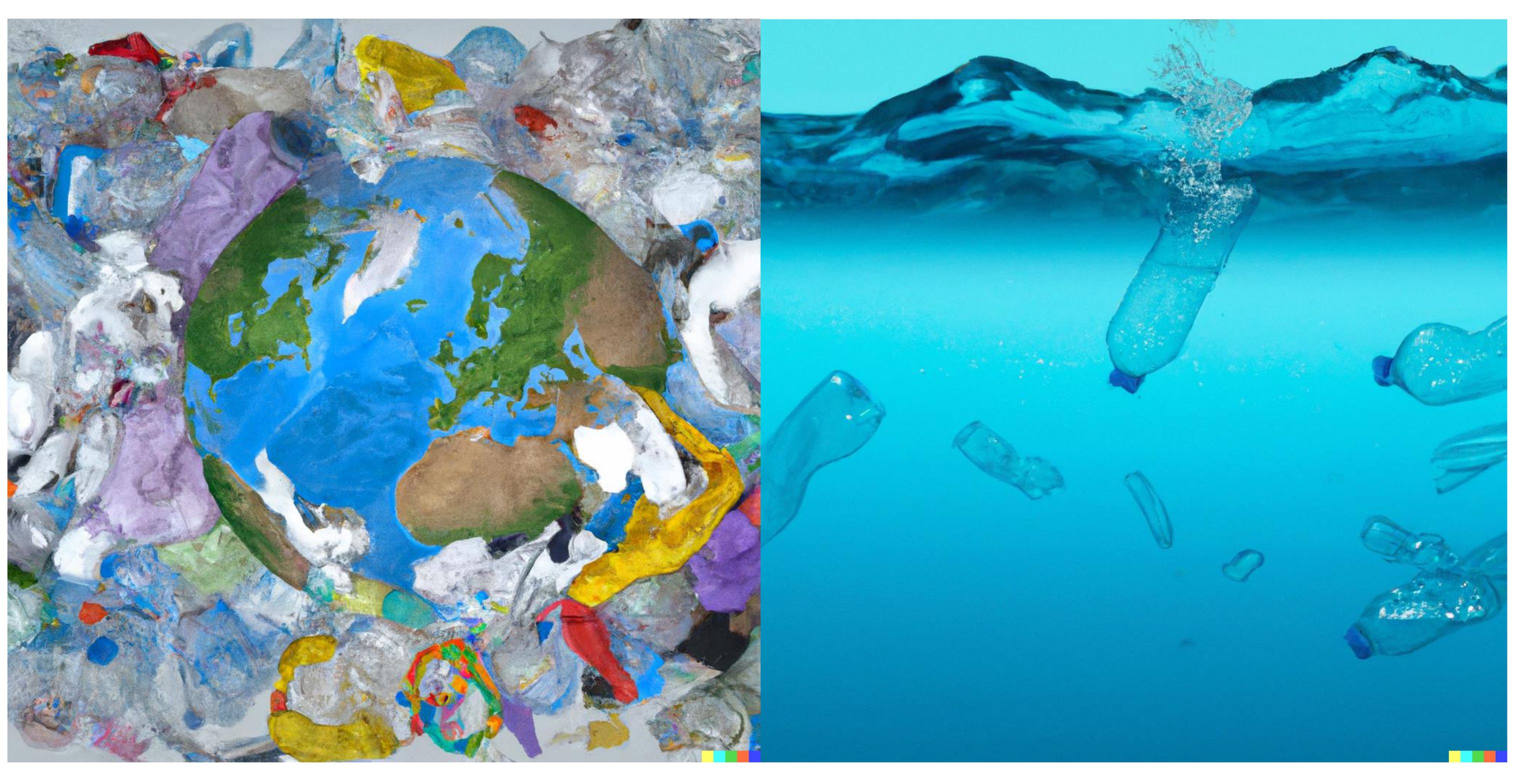

Figure 1: AI generated artists impression of a world drowning in plastic waste (left), plastic bottles contaminating our oceans (right).

The Proposed Solution

The proposed concept aims to empower communities to recycle plastic waste and transform it into value-added products using 3D printing technology. The approach encompasses several key elements. **Firstly**, ***a reward point system*** will incentivize community members to recycle and sort plastic waste. **Secondly**, an ***online co-design platform*** will allow individuals with limited 3D design experience to select and customize a variety of household items for 3D printing. **Thirdly**, ***a net-zero 3D printing micro-factory*** will be established at the community level, equipped with all necessary tools and comfortable workspaces for recycled-plastic-based 3D printing. **Fourthly**, selected members of the community will receive ***training to operate the equipment***. The system will be designed for ***low maintenance and operating costs***, ensuring its sustainability in the long run. Community members can redeem their reward points to obtain 3D printed versions of their customized designs. The initial investment for the micro-factory could be jointly funded by government agencies and plastic product manufacturers, with the aim of promoting sustainable practices and reducing plastic waste in the community.

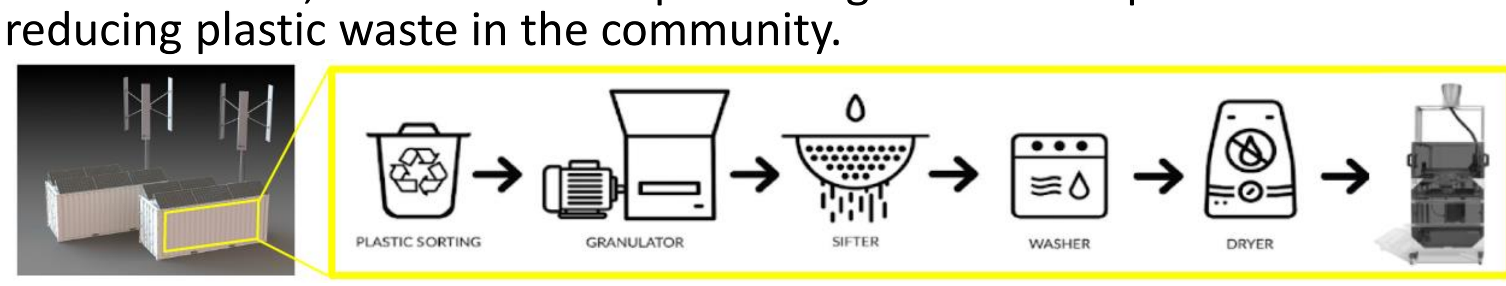

Figure 2: An all inclusive 3D printing based plastic recycling micro-factory, Gigalab concept by re:3D

The International Inter-disciplinary Team

The interdisciplinary research focuses on four, interconnected pillars:

1. 3D printing from waste and associated material science
2. Design of a minimum footprint, mobile, recycling and 3D printing system - the Gigalab
3. Life cycle analysis and sustainability metrics
4. Design in collaboration with end users: digital design tools with integrated LCA data

Research collaborations between re:3D Inc, The University of Texas at Austin (UT Austin), **Western Sydney University (WSU)** and the **University of Wollongong (UOW).**

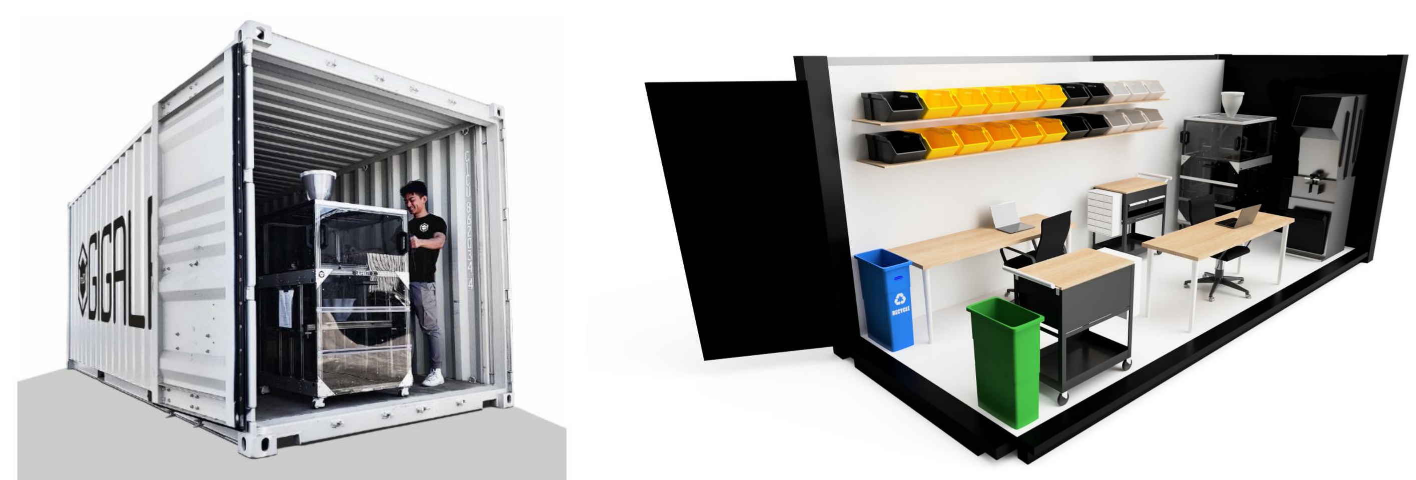

Figure 3: Containerised Gigalab: an all inclusive plastic recycling facility

Value Proposition

The project aims to value-add on many levels

1. Reduction in land-fill and waste management cost
2. Reduction in plastic waste clean-up cost
3. Reduction in environmental impact costs
4. Increase in plastic recycling
5. Higher value product creation through 3D printing's customization and advanced manufacturing capability
6. Enabling repair and reuse of products through parts printing
7. Recreational value for families by enabling the kids to create unique products from waste plastic while learning about sustainability
8. Future skills training opportunities for additive manufacturing industry

Funding Model

1. Initial fixed cost borne by Federal-state and local government agencies from the potential cost reductions mentioned in value propositions 1-3.
2. End-users pay a small amount for their printed items to support the minimal operating cost due to net-zero, low maintenance design of the micro-factory
3. Ticket sales from organising exhibitions and educational tours
4. Skilled workers salary supported by offering commercial printing service
5. Sponsorship income from entities aiming to enhance their sustainability credentials.

FOR FURTHER INFORMATION

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REFERENCES/ACKNOWLEDGEMENTS

[McIlgorm, A., K. Raubenheimer and D.E. McIlgorm (2020). Update of 2009 APEC report on Economic Costs of Marine Debris to APEC Economies. A report to the APEC Ocean and Fisheries Working Group by the Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Australia.
Schandl H, King S, Walton A, Kaksonen AH, Tapsuwan S and Baynes TM (2020) National circular economy roadmap for plastics, glass, paper and tyres. CSIRO, Australia. ISBN 978-1-4863-1495-9.]