New Product Development for Upcycling and Circular Economy

Project Brief

Project background

Most existing products in the market have been designed and made without much consideration of the end-of-life options towards the circular economy – an alternative economic model and industrial system (of production and consumption) designed to be restorative or regenerative. In other words, these products are not easy to disassemble, repair, upgrade, remanufacture, or recycle in a technologically feasible and financially viable way. Single material products such as plastic bottles or paper books are relatively easy to be returned back to the production cycle. Electronic products with mixed materials and multiple components are more difficult to remanufacture, recycle, etc. There have been some great, successful projects around upcycling and circular economy such as:

- Case studies showcased in Ellen Macarthur Foundation (mostly on plastics, food and fashion): https://ellenmacarthurfoundation.org/
- Trash to cash project (taking waste and making new fibres in textiles) as part of Horizon 2020 research and innovation programme: https://www.trash2cashproject.eu/
- Perpetual Plastic for Food-to-Go (circular business model for food-to-go packaging): https://www.lboro.ac.uk/schools/design-creative-arts/research-innovation/projects/perpetual-plastic-for-food-to-go/
- Precious Plastic project (open source for starting a business from plastic waste): https://preciousplastic.com/

Most existing studies and projects have focused on one kind of materials or one waste stream as it is already challenging to deal with one. In this project, NPD4CE (New Product Development for Upcycling and Circular Economy), we would like to be more exploratory, adventurous and ambitious as we are creative designers who are best positioned to (re)solve wicked problems. We will reverse-engineer and analyse some of our everyday use electronic products with mixed materials and multiple components, and suggest radically new products for upcycling and circular economy.

This NPD4CE project is a short-term project between November 2022 and July 2023 funded by DMU HEIF (Higher Education Innovation Funding), £11,086.30, most of which is salary for the three hired student designers who are working on the project under supervision: Joe Shade, Thomas Wylam, and Tony Lorance. As HEIF is funding to support research and innovation activities to contribute to DMU's submission especially for KEF (Knowledge Exchange Framework), engagement of industry experts/stakeholders throughout the process is one of the key success indicators. Ideally, we are looking for patentable ideas, concepts, and designs that could lead to a spin-out company and/or attract companies for future consultation/collaboration projects.

Project aim, scope and expected outcomes

Project aim:

"This project aims to make radical innovations in new product development (NPD) for upcycling and circular economy focusing on everyday use electronic products with mixed materials and multiple components."

Project scope:

- Targeting electronic products with mixed materials and multiple components (preferably, classified as complex, multi-body products)
- Radical innovation (c.f. incremental innovation – mere redesign or slight improvement of existing products)
- Product development (c.f. service innovation, process innovation, product-service system design)
- In line with the principles, philosophies and practices of upcycling and circular economy

Expected outcomes:

i. a comprehensive research report based on desk research, reverse engineering and product analysis, and expert interviews (illustrating best practices, innovation gaps, and expert opinions on the direction of innovation in terms of material use, structural change, new technology adoption, etc.)
ii. innovative ideas and concepts of new products for upcyclability and the circular economy (with idea sketches, 2D digital drawings, 3D modelling and renderings, and technical drawings)
iii. prototypes and presentation models as a proof of concept
iv. a complete design journal to show design processes and outcomes and discuss lessons learned and recommendations for future projects

Project meetings and work arrangement

Project meeting arrangement:

- Main supervisor: Dr Kyungeun Sung
- 2nd supervisors or project advisors: Dr Abhishek Tiwary and Mr Mik Pieniazek
- Bi-weekly progress one-to-one meeting: individually arranged with the main supervisor (e.g. 1st week, 3rd week, …)
- Bi-weekly progress group meeting: three students and the main supervisor (e.g. 2nd week, 4th week, …)
- Monthly progress team meeting: three students, main supervisor and project advisors (end of each month) – students are required to present formally using PowerPoint slides.
- Ad hoc meetings: in students' request

Work arrangement:

- No office provided
- Working from home
- Use of DMU facilities and equipment (e.g. workshops) individually arranged and managed
- Flexible hours (minimum 0 hours to maximum 10 hours a week depending on personal circumstances)

Project timeline

January

- Project kick-off meeting
- Mandatory online training
- Product selection

February-March

- Desk research
- Product purchase
- Project planning (and additional individual research ethics application)
- Reverse engineering and product analysis
- Identification of relevant industry experts/stakeholders
- Friday 31 March: deadline for the first research report (either word document or ppt)

April-May

- Expert/stakeholder interviews (and other primary research)
- Idea generation
- Concept development
- Digital simulation and testing
- Single concept proposal
- Monday 29 May: deadline for the design journal (ppt)

June-July

- Single concept embodiment and finalisation
- Physical prototyping and model making
- Friday 14 July: deadline for physical prototypes, presentation models, and final presentation slides
- Knowledge transfer and networking event between Monday 17 and Friday 21 July
- Monday 31 July: deadline for final design journal including reflective essay

Project expenditure

- Staff hours in kind
- Student hours (10 hours per week x 23 weeks) - UNITEMPS
- Three products for reverse engineering and product analysis: £100 per product (x3)
- Material cost for physical prototyping and model making: £100 per product (x3)
- Knowledge transfer event catering service: £90
- Travel for the involved industry experts/stakeholders: £450