University of South Australia | Creative People, Products and Places Research Centre (CP3)

Dr Guy Keulemans
University of South Australia
City West Campus (Kaurna Building – K4)
GPO Box 2471 | Adelaide SA 5001

Re: AUSTRALIAN GOVERNMENT PRODUCTIVITY COMMISSION INQUIRY INTO OPPORTUNITIES IN THE CIRCULAR ECONOMY

I am a researcher of sustainable design at the University of South Australia with a focus on circular economy and practices of repair and reuse. I publish research on circular economy in scholarly journals but also produce non-traditional research in the form of prototypes and exhibitions that test ideas for creative forms of repair, sustainable materials and redesign of waste. There is national and international recognition of my work; I was named a Top 100 Game Changer in Design by Architectural Digest Italia in 2021, and won the University of South Australia's Creative Innovation in Research Award in 2024. I am writing this submission as Craft and Design Team Leader at Creative People, Products and Places (CP3), an internationally recognised interdisciplinary research centre undertaking high quality humanities and creative practice research at the University of South Australia.

In this submission I will:

Firstly, discuss conceptual aspects of circular economy with relevance to government policy from the perspective of design and the built environment. There are great opportunities for Australia in circular economy, but these lay less in recycling, which has been overemphasised, and more in applications of repair and reuse involving creative and professional design labour. Opportunities also exist for new applications of digital tools that help inventory, sort and manipulate waste materials so that redesign of waste integrates with existing digital workflows in the design industry. This first part of my submission relates mostly to the reuse of waste from the largest single contributor to landfill: the building, construction and demolition industry.

Secondly, noting that repair is a significant but under-invested activity in circular economy, I will introduce my prior submission to the Productivity Commission's Inquiry into Right to Repair in 2021. The issues of that highly inquiry are relevant to this current inquiry, but unresolved, so I add that submission here as an appendix.

Thirdly, I will provide a list of brief recommendations for government policy drawn from the preceding discussions.

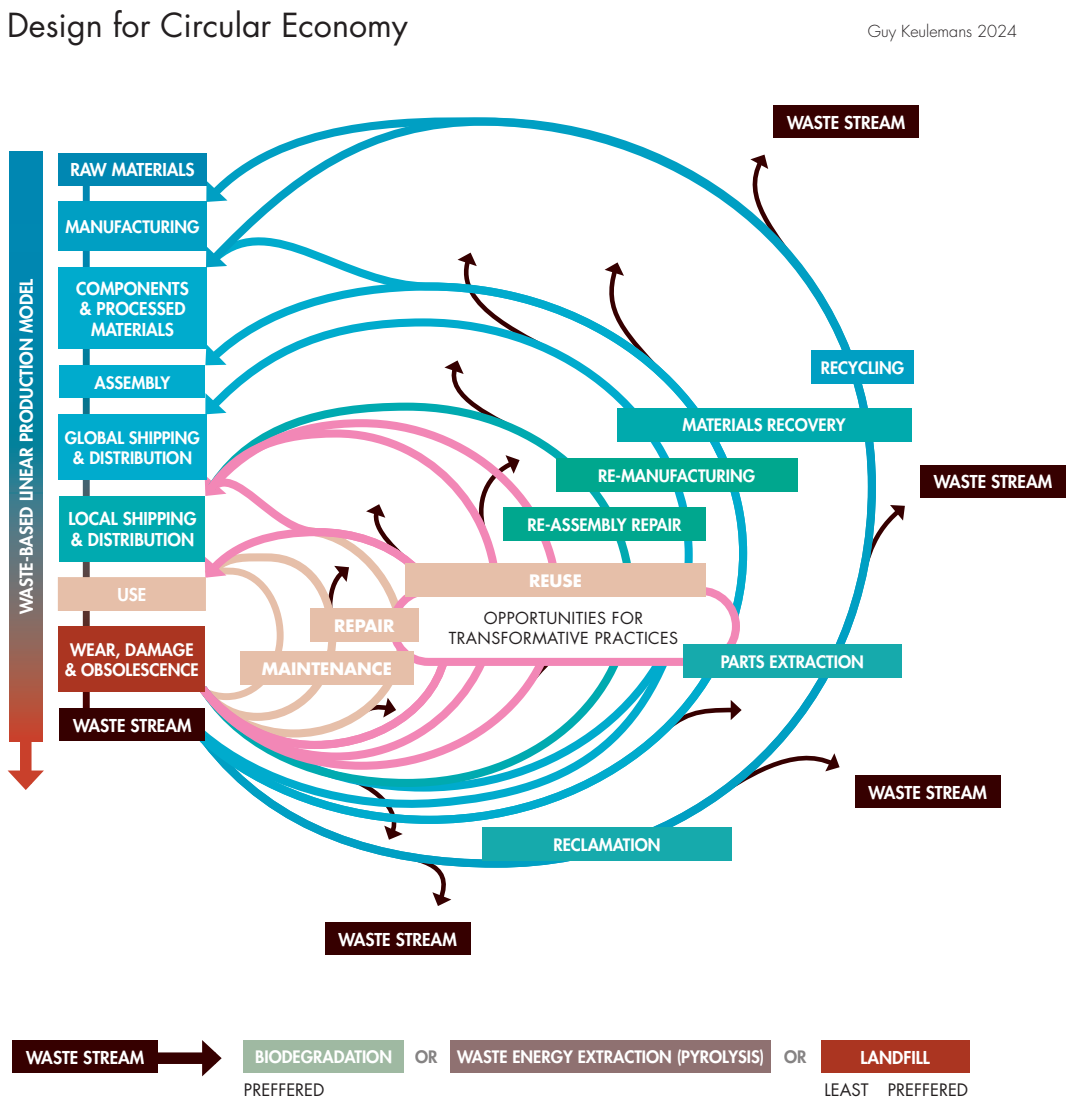
1. Opportunities for Circular Economy through creative and professional labour, and emerging technologies

The problem with 'recycling' and 'downcycling'

The early conceptualisation of circular economy by Walter Stachel (1976) envisioned the re-circulation of materials and products across a full spectrum of designed products, but also services and practices.[1] Materials and products achieve longer life through careful provision of services and practices across design, maintenance, repair and, once a product or its materials have reached a transition point marked by loss in function or value, then reuse. This logical order of circular economy practices is to slow the fragmentation and granularisation of materials, preserving embodied energy, cost and carbon. Reuse is placed before recycling. Across the range of reuses, reuse that privilege less destructive forms of reuse are preferred.

It important to mention that simplified diagrams like the one listed as 'Figure 2' in the Call for Submissions (p. 5) conflates the system of loops in circular economy theory and may convey the assumption that recycling is privileged as an inevitable phase of circular economy. In actuality, waste streams are not avoided by privileging recycling as a phase of circular economy, because waste flows are created from all loops and activities within circular economy, even including maintenance. My circular economy diagram below illustrates this, indicating the many "narrow", "slow" and "closed" loops discussed in the Call for Submission (p. 5). Circular economy practices should prioritise the smaller and slower loops, being maintenance, repair and reuse, as a means to conserve the material integrity and value chain of products. "Transformative practices" are highlighted; these are areas in which there is great opportunity for skilled design professionals to innovate via design-led reuse of waste materials, transforming materials, components and old products into new products with new functions or purposes.

[1] Stahel, W. R. & Reday, G. (1976) The potential for substituting manpower for energy. *Report to the Commission of the European Communities*.



However, it is important to consider that design-led reuse is not recycling or downcycling. Unfortunately, the emphasis of industry and government globally over the past decades has been on recycling, and this has failed: circular practices are actually declining, with material circularity dropping from 9% to 7% since 2018.[2]

To give an example that illustrates the problem generally, in Australia *if* glass waste products, such glass panels from construction waste and consumer products like glass bottles, are circularised, then they typically are 'recycled' by being crushed and downcycled into purpose with less material integrity. Waste glass used in substrate for new roads is one example. However, glass is an extremely durable material, glass bottles can be washed and reused, and glass panels might have potential for reuse in new buildings. Glass can also be melted down and recycled into new glass products. Yet, the complexity and cost of managing the assorted glass waste stream for such outcomes is considered prohibitive and this has led to an indiscriminate, non-circular, *down-cycling* solutions that mix glass with asphalt and other materials into a composite material from which the glass can likely never be extracted.

[2] Circle Economy (2023) *The Circularity Gap Report 2023*, 1–64: https://www.circularity-gap.world/2023

For this reason, circular economy proposals involving 'downcycling' industrial or consumer waste into new products by shredding, chemical dissolution and/or micro-factory composition with other natural or synthetic binders (polymer composites) should be viewed with caution. These processes lower the value chain of the material and may prevent future reuses. Circular economy principles intend for natural materials to retain their biological integrity so they can be safely biodegraded, and industrial materials, such as metals and synthetic plastics, should be designed to remain in separate material categories within product components to retain their reuse potential over multiple transformations. This is a key concept of 'Cradle to Cradle' designing.[3]

Recycling processes typically implement at scale with minimal sorting of waste, thereby requiring destructive and energy-consuming processing (for example shredding or boiling) that deplete material integrity, such as effecting a build-up of impurities in metals, or shortening plastic polymer and plant fibre lengths. Rather, taking a wholistic circular economy approach, Australia should discretely apply highly attenuated sorting practices to whole products, components and materials *before* they are degraded beyond possibility of repair or reuse. In other words, preserving whole products or components and conserving the value-chain of material lifespans. This will require new practices of labour and new applications of technology.

Fostering new applications for creative and professional labour in circular economy:

The key challenge is to encourage better design of *new* products according to circular economy principles (design for 'x' - x being repair/reuse/remanufacturing etc), but also activate new practices for identifying, sorting and redesigning waste streams into new products (design-led reuse). Both of these practices concern the design industry.

There is a strong history of designers and craftspeople transforming waste back into functional products in isolated and often short-run products, and the reusing of building shells and structures (adaptive reuse) is well established for architecture. However, as the large volumes of construction, demolition and renovation waste in landfill indicate, reuse of discrete building materials and components, but also fittings and furnishings, is lacking. Currently, the waste sector is associated with lower socio-economic employment. Waste work is pushed towards the low end of the labour market, such as non-professional trade workers in demolition or scrapyard industries for building products. There is great opportunity for professional designers and architects to apply their expertise in managing and redesigning waste, but they struggle with the complexity of the task due to the scale of the sector, the complex assortment of waste, and lack of material information they can process in ways that are known to them. To resolve this conundrum, the problem of waste and its assorted complexity must come into the remit of professional designers with skills to not just design with waste, but also design the systems to *capacitate* the design of waste with more efficiency, precision, ease, material (value-chain) conservation, and creativity.

In short, the majority of professional designers are trained and work within technological paradigms of linear economy, creating new products from new materials. The challenge is

[3] McDonough, W., & Braungart, M. (2002). *Cradle to cradle : remaking the way we make things* (1st ed). North Point Press.

to transition designers towards operating in paradigms of circular economy, involving maintenance, repair and the creation of new products from existing materials.

Encouraging new uses for digital tools to help redesign with waste

Designers can become better at managing the difficulty of transformation of waste by considering the discrete steps required; disassembly and deconstruction, inventory, specification, design conceptualisation, visualisation, prototyping and fabrication or building. For circular design practices to expand and become paradigmatic, they must become easier and more readily adoptable through alignment with the way designers are generally trained to work.

Currently the broad toolset of information communication technologies used by designers, such as computer-aided design and manufacturing (CADCAM) and building information management (BIM), are created for linear economy (waste-making) workflows. In fact, their uptake, by making design labour more efficient and quicker, has led to increased material waste by decreasing design and construction costs.

Rather, these tools need to refocus into circular practices involving identification and data capture of suitable waste materials; collaboration with salvage industry to reclaim, transport and store these materials; understanding their material properties, plus regulation and insurance implications; digitally modelling, designing and documenting the reclaimed materials in design using BIM; advocating to clients the use of reclaimed materials, facilitating the approval of design-led reuse, and; developing relationships with tradespeople, builders and fabricators who can materialise design elements that require specialist construction, potentially using CADCAM techniques. There is also great but under-explored potential for new parametric and generative AI tools to design dynamically with the assorted properties of waste materials.

In conclusion, the transition from linear to circular economy requires transition of activities and practice in professional design and co-dependent development of their digital tools. The development of these future-facing practices should be active area of exploration by academia and industry.

I refer you to my paper "Emergent digital possibilities for design-led reuse within circular economy" co-authored with Roxane Adams for more details of this discussion.[4]

[4] Keulemans, G., Adams, R. Emergent digital possibilities for design-led reuse within circular economy. *npj Urban Sustainability* 4, 31 (2024). https://doi.org/10.1038/s42949-024-00164-x

2. Right to Repair and Product Stewardship in context of Circular Economy.

The 2021 Productivity Commission's Inquiry into Right to Repair had a number of terms of inquiry relevant to Circular Economy and the need to reduce waste and circularise the economy. My submission (number 144) argued that manufacturers should have agency in deciding how much they wish to facilitate or inhibit consumer repair in respect of the sophistication, intellectual property value and technological stability of their products, but *only* if any rights to repair denied their customers are balanced by increased product stewardship involving manufacturer-funded programs that reclaim and *re*manufacture such products at the end of their consumer service life.

On one hand, rights to repair are suitable for conventional, repairable, technologically stable products that can be sold in the conventional sense, with both rights and responsibilities for repair passing to consumers. On the other, advanced, innovative products with patented technologies, technologies that are rapidly progressing or technologies that manufacturers otherwise want to protect for competitive reasons are better suited to subscription models, for which, the responsibility of the product's material integrity remains with the manufacturer (supported by deposits or other pricing mechanisms that give value to waste).

Fundamentally this means that 'Right to Repair' and 'Product Stewardship' exist at opposite ends of an axis of manufacturer responsibility. This concept appears absent from contemporary policy discussion on sustainability and waste management. It means product stewardship models should allow manufacturers to integrate consumer repairability into their product lifecycle in varied and dynamic ways that ensure their competitiveness in the market, protect intellectual property when needed, and ensure that design innovation is incentivised.

For me more detail please see my submission number 144 submitted to that enquiry, which I attach here as an appendix.[5]

[5] Keulemans, Guy. 2021. "Submission 144: Right to Repair." Right to Repair Inquiry. Accessed February 1, 2021: https://www.pc.gov.au/__data/assets/pdf_file/0003/275133/sub144-repair.pdf

3. Recommendations:

Following from this discussion of the role the design industry can play in bringing about circular economy, my recommendations for government activity include:

- Foster new practices of design informed by circular economy principles in collaboration between education and industry via multiple means: accreditations, grants and subsidies. Use subsidies, grants or tax concessions to encourage designers to develop new, creative applications for waste materials.

- Inhibit indiscriminate demolition of buildings and foster careful deconstruction and storage of deconstructed materials. Encourage greater collaboration between the manufacturing, design, architecture, deconstruction and salvage industries. Explore policies and opportunities that improve inventory, storage and distribution of industrial byproduct and reclaimed materials.

- Address the assortment problem of waste by funding research into methods of digital inventory interoperable with design software. Encourage the digitisation of waste materials by deconstruction and salvage operators, and fund research into new methods for doing this efficiently and automatically, so that digital proxies or twins can be used within digital design workflows.

- Facilitate the adaptive reuse of buildings to sort and store construction, industrial and consumer waste materials, so they can be accessed in a range of timeframes by designers, correspondent with the 'urban mining' concept. Cost of storage is a key inhibitor of reuse in design when burdened onto single firms or clients, but when distributed across multiple private and public sector actors, with materials inventoried and available to these actors dynamically by project or need, the economies of reuse should become more attractive.

And recommendations in regard to the prior Inquiry into Right to Repair:

- Develop policy encouraging greater repair of products, including tax concessions for repair services and a repairability index and/or rating system for products. This would help align Australian policy with emerging policy from the European Union.

- Explore the interrelation between Right to Repair regulation and Product Stewardship regulation so that manufacturers have agency and choice in how to position their products in the market in respect of service life, third party repairability and/or reclamation and remanufacturing.

Thank you for this opportunity to advise the Productivity Commission,

Dr Guy Keulemans
Enterprise Fellow, UniSA Creative
Craft and Design Team Leader at the Creative People, Products and Places Research Centre
University of South Australia.