Minerals, metals and innovation in the circular economy

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Factors underpinning current modes of production and consumption are changing. Ore grades are declining in Australia, requiring more energy for processing and creating more environmental impact. Both resource and energy constraints are driving the need for innovation focussed on doing ‘more with less’. Geographies of production are also changing and this is opening up new opportunities for increased recycling in the circular economy – however these are yet to be systematically evaluated.

This paper provides an overview of the research agenda for understanding required innovation in the way minerals and metals are managed in a circular economy in Australia. It begins with an overview of the *Vision 2040: Innovation in mining and minerals* [1] developed by multiple stakeholders and which focused on the need for a national minerals strategy and sovereign, transformational technology including that for recycling, and the potential for ‘brand Australia: responsible minerals’.

It then presents ‘Wealth from Waste’, the name of a new three year research collaboration between CSIRO, UTS, University of Queensland, Swinburne, Yale and Monash exploring ways to harness value from above ground stocks of metals in Australia with a focus on industrial ecology and circular economy, considering (i) the size and value of the available resource (ii) socio-technical systems needed to overcome barriers to industrial ecology and (iii) new business models which would facilitate the harnessing of wealth from waste.

The circular economy has significant overlap with concepts of industrial ecology. Whilst first described by Pearce and Turner in 1990 [2] its prominence has risen recently with its inclusion in China’s Twelfth Five Year Plan as well as via publications from the Ellen Macarthur Foundation in the UK. Circular economy concepts can be considered at several spatial scales, from that of an industrial complex where wastes from one site may provide raw material inputs to another – all the way to the level of a region or national economy. In each case the focus is on circular flows of resources (via reuse and recycling).

Finally illustrative cases of iron, copper, gold and lithium are used to illustrate key questions in the future research agenda. Areas requiring focus include (i) the tension between developing increasingly complex products manufacture which are harder to recycle and simpler designs (ii) a broader conceptualisation of value (including social and environmental dimension) to underpin the economics of recycling in a circular economy and (iii) the need for a transition plan to guide integration between disciplines and sectors to harness opportunity for Australia in the circular economy.

References
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