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Material Democracy: An action plan for realising a redistributed materials economy

The last 60 years has seen a profound transformation of the human relationship with the natural world. The exponential growth in human population and resource demand is now being felt at the earth system level (Steffen et al., 2015). A wholesale shift in the global economy towards a fundamentally sustainable state is now an imperative. We must transition to a circular economy where we meet our needs through production/consumption practices that operate safely within the planetary boundaries (RSA, 2014; Ellen MacArthur Foundation, 2015).

The increasing interoperability between online platforms and digital fabrication technologies is catalysing a redistribution of the means of production - in so doing, enabling practices that are more socially equitable and environmentally responsible than those of 20th-century mass manufacture/consumption (Seyfang and Smith, 2007; Seravalli, 2014; Policy Connect, 2015; Kohtala, 2016; Stewart and Tooze, 2016). However, technological innovation is just one piece of the equation. As a study of 19th-century coal or 20th-century steel will illustrate, there is real material influence and consequence, risk and reward to any industrial transition (Ashton, 1963; Allen, 2010). Without a wholesale redistribution of the global materials economy - from extraction to processing, transference to recapture, aspirations for a 21st-century circular economy will stall.

Through blockchain technologies, global development data, and real-time data analytics, new tools for the generation and management of materials in the global economy are now possible (Garmulewicz, 2015; Diez, 2015). To date, such tools have predominantly been developed by large corporates and are often proprietary or prohibitively expensive to access. Should this continue, we risk creating virtuous monopolies, where only large companies are able to develop circular practices --rendering small entreprises unable to thrive and compete.

This paper sets out a proposal for the development of an underlying common architecture and set of protocols for the generation, aggregation and tracking of materials information in ways that are open, interoperable and incorruptible. As such, materials information is envisioned as an open web of interconnected databases. Central to such a web would be;

(1) Digital signatures for raw materials so that primary material information can be carried throughout use- and life- cycles.
(2) Protocols that connect layers of primary information in stacks --relaying and connecting such with secondary information about material processing and use.
(3) Analytical systems that relate stacks of material information (primary and secondary) to global environmental data and sustainable targets in real-time.
(4) Open APIs that leverage, visualise and translate stacks of materials information in relation to sustainability targets in machine- and human- readable formats that incentivise sustainable decision-making.

Such a materials information commons could empower stakeholders at all levels to make more effective decisions. A concerted and coordinated effort across all scales and sectors must be incentivised for such an infrastructure to be operable and effective. This paper will lay out the opportunities and challenges of such an undertaking, as well as discrete projects that, if done now, could generate momentum for wider systemic development. The paper will survey existing projects including ChemHub (reference image one and two), Pattern Web (reference image three), Fab City Dashboard and the Materials Library to expand upon and characterise a recommended criteria for key material, technological and behavioural functionalities. Lastly, the paper will pose a number of targeted research questions in order to shape next steps.