Dematerialization of plastic demand by digital technologies

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Prevention of plastics by digital technologies

Plastic prevention is a mandatory action to fulfill the requirements of reduction of greenhouse emissions from the material sector. So far, discussions of industry emissions have focused on the supply side: reducing the emissions from the production of steel, cement, chemicals, etc. Far less attention has been given to the demand side: how a circular economy could help reducing emissions through better use and reuse of the materials already existing in the economy.
Supply side actions are not enough to reach the target fixed by COP 21 (Paris Agreement). Specifically, the carbon budget of the material sector is of about 300 Gton cumulative CO_2 emissions by 2100. The carbon budget is the maximum amount of emissions that should be released in the atmosphere until 2100, if there is supposed to be a good chance of keeping the increase of average temperature with respect to pre-industrial age, below 2°C.
Plastic waste prevention applies to re-using, re-manufacturing or dematerialization. However, industries face several barriers to adopt these solutions. In facts, their adoption might require companies to re-design their business model and in some cases these solutions can be perceived as a risk in terms of the reduced turnover. Re-use and re-manufacturing processes highly benefit from the enhanced coordination between material and information flow. Specifically, the quantity and quality of products and of their raw materials must be gathered and retained throughout the lifetime. This would allow interoperability between materials and goods. Digital technologies are required to manage the information flow, to store information onto the material with reliable coding along the value chain, and to retrieve it with suitable data protection and accessibility.

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Interoperability requires a few digital tools/ processes:

1) Signature or coding of information onto the material. This is a very critical process, as the signature shall be highly resistant to the manufacturing and distribution processes, low-cost, and protected by suitable coding. The signature shall be made of different layers, in order to track the different phases of the plastic value chain.
2) The coding system must be available at any stage of the plastic value chain. The information shall be coded for polymers, for additives, for converters, for the final product, for the distribution, and for end-of-life.
3) There should be a receiver available which is low-cost, effective and with a suitable signal to noise ratio.

These technologies are individually available, however, many innovation processes are required to adapt them to circular economy and to plastic prevention.

Blockchain applications to foster circular economy

Nowadays, digital technologies have innovated the marketplace through centralized platforms, such as eBay and Airbnb. These platforms are based on two constraints: third-party centralised marketplace systems that control the flow of information and currency among participating parties; and firm-centric service. Can this approach be adapted to circular economy business models? Yes, it can. However, a major flaw is that consumers are typically degraded to no more than users.
Hence, the consumers are relegated to simple roles, using, sharing and/ or separating waste for reuse or recycling . The model would be much more effective if the consumer can be empowered to engage and participate more actively in product reuse and recovery processes.
Blockchain may be the missing link that allows such consumer empowerment for achieving circular economy tomorrow. Blockchain-supported platforms facilitate peer-to-peer transactions without any middlemen. It means consumers can transact and pay each other directly and securely through a decentralized or globally distributed network.

In 2018, B.E. Eikmanns (Frankfurt School Blockchain Center, Germany) has grouped blockchain applications for promoting circular economy into four categories: Resource efficiency enhancement; Resource tracking; Resource pricing; and Complementary currency.

Resource efficiency enhancement: The application of the blockchain technology can help enhance resource efficiency at societal level. The introduction of IoT – a network of smart devices – to various materials will further increase resource efficiency. Peer-to-peer transactions without any intermediaries including the sharing of under-utilised assets such as ride-sharing applications and direct non-bank lending to finance sustainable assets) can accelerate the progress towards a sharing economy and hence to circular economy.

Resource tracking: Blockchain technology tracks transactions (i.e. flows of materials) and creates tamper-proof validation systems without the necessity of centralised authorities. Since they are not alterable, transactions are infinitely and transparently recorded, which increases public trust in the data stored on a blockchain. For example, PEFC (Programme for the Endorsement of Forest Certification) relies on blockchain to track the origin of timber. Provenance, a start-up engaged in supply chain transparency, is designing a blockchain system able to track and trace all second-hand materials along the entire supply chain in real time with a digital passport for every product. This includes the dimensions of quality, quantity and ownership. The seamless digital records will make digital certifications, such as emission allowances or proof of origin records to raw materials possible. Another example is BHP Billiton, who is in partnership with Everledger to track the origins of diamonds to augment compliance with regulations governing 'blood diamonds'.

Blockchain is conducive to the enhancement of transparency of the global supply chains, which in turn discourages individual manufacturers from concealing any details of their supply chains. It also reinforces the circularity and sustainability of the economy.

Resource pricing: Blockchain can support the implementation of resource pricing systems through cap-and-trade or Pigouvian taxes. It offers a cradle for a cap-and-trade system, which is a regulatory instrument comprising the issuance of limited credits to use a certain resource and the creation of a market to trade these credits. A blockchain-supported cap-and-trade-system will be an efficient credit management platform. For instance, the IBM is collaborating with the Energy Blockchain Lab to introduce blockchain to carbon credit management in China, which will increase the transparency, auditability and credibility of the Chinese Emissions Trading Scheme. A system automated with smart contracts can avert policymakers from interfering the marketplace with regard to self-serving political agendas. The potential of blockchain in this aspect can be fully exploited if AI is employed to create a market stability mechanism that coordinates the issuance of credits to avoid a disequilibrium of resource credits and to maintain the market prices in a pre-defined range without any arbitrary administrative interventions.

Complementary currency: Blockchain allows the implementation of complementary currency systems which incentivise sustainable behaviours by individuals and businesses through 'tokenisation'. 'Tokens' will reward their participation in the new circular economy with customised currency and work units, which can address the weakest link of the peer-to-peer, crowd-sourced and sharing economy. Cryptocurrencies, though, should not intend to replace but to complement fiat currencies. EcoCoin, for instance, envisions a community-based cryptocurrency, which allows their Community to decide what to support and purchase on a case by case basis, despite its limited ecological impact. EarthDollar aims at transforming the entire economic system and facilitate the attainment of the *Sustainable Development Goals* by supporting *Natural Capital Accounting* rather than conventional financial accounting. These cryptocurrencies are, however, possibly not asset-backed and of bottom-up approach in nature. Ultimately, the world needs a top-down approach through government-backed cryptocurrency that carries both financial and socio-environmental values.

The advent of blockchain technology provides an unparalleled driver for peer-to-peer Circular Economy Business Models (CEBMs) to thrive. This technology applied to plastic waste prevention can support innovative tracking procedure that is able to improve transparency and to facilitate recycling, re-use and re-manufacturing processes. Finally, Blockchain technology can support information flow among multiple sectors increasing circular economy both at local and global value chain levels.

eCircular programme aims at enhancing regional and global ecosystems (i.e. Industry, Public institutions, Academia and Research Centres), commitment towards blockchain technology and other digital solutions contributing to plastic waste prevention. If you are interested in receiving further details on our strategies and innovation solutions portfolio, please contact Alberto Bellini, eCircular Programme coordinator

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