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# Can Digital Technologies Deliver the Circular Economy?

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Digital technologies and the circular economy are both characterised as disruptive influences in industry and in society at large, and company executives, industry researchers and academics are now starting to study the relationship between the two concepts. However, current studies indicate a lack of understanding of how digital technologies enable organisations to improve their resource flows and value creation to promote the circular economy. Can the move to digitalisation in industry and society at large usher in a truly circular economy?

## **The Digital Technologies**

Digital technologies comprise a range of computing tools, environments and applications, some of which have been around for 20 years or more, but only now are some of them starting to have a major impact on business and society. The two acronyms of SMAC (Social media, Mobile, Analytics/Big data, Cloud) and BRAID (Blockchain, Robotics, Artificial intelligence, Internet of things and Digital fabrication) are often used as umbrella terms in this context. These technologies are constantly evolving, and their potential for reshaping business practices, and in changing the everyday world in which we live, continues to gather momentum. Businesses and organisations have the opportunity to benefit from the growing pace of digitalisation, as these technologies are implemented in a wider range of their operations. The potential transition to a circular economy is one such opportunity.

## **The Circular Economy**

The concept of the circular economy is not new, but like some of the digital technologies, it is starting to feature in industry strategy documents, and in a growing number of companies' environmental, social and governance (ESG) reports. The circular economy is "an economic model that was first proposed in the mid-1960s as a means of ensuring

that resources which enter the economy are able to remain a part of it for as long as possible”, and it aims to reduce both natural resource depletion and waste. The circular economy concept is thus differentiated from the traditional linear economy, in which the production process turns raw materials into waste, which in turn generates a range of environmental problems and leads to the loss of natural capital. It embraces all stages of the product life cycle from product design through production, marketing, consumption to waste management, recycling, and re-use. Eight specific business activities can be identified in transitioning to a circular economy, namely, improving product design, attracting target customers, monitoring and tracking product activity, providing technical support, providing preventive and predictive maintenance, optimizing the product usage, upgrading the product, enhancing renovation and end-of-life activities.

### **Will Digital Technologies Progress the Transition to a Circular Economy?**

A growing number of authors maintain that digital technologies have a central role to play in the transition to a circular economy. Sullivan and Hussein, for example, point out that companies such as Danone, H&M Group, and DS Smith are “already leveraging these newer technologies to design waste and pollution out of their value chains while keeping products and materials in use to create positive economic, environmental, and societal impact”, and the EIT Climate-KIC Consultancy recently concluded that “digital solutions such as artificial intelligence, blockchain and the Internet of Things can redefine production and consumption in the 21st century, powering a new circular economy that works for people and planet alike”. However, other authors are more cautious and Cagno et al. for example, maintain that the linkages between digital technologies and the circular economy remain relatively undeveloped.

There is a general consensus that digital technologies are bringing about greater efficiencies, improved processes and better data management, which are supporting and enabling sustainability objectives. Most organisations are using some of the digital technologies to support their operations and core business processes, and certainly sustainability is seen to be connected to digital technology deployment (Table 1). But recent research indicates the link to the circular economy is less in evidence in many organisations at present, but that this is likely to change in the short to mid-term. As

Kristoffersen et al. noted, “effectively using this digital transformation will be pivotal for organizations in transitioning to, and leveraging, the circular economy at scale”.

Table 1. Sustainability benefits from Digital Technologies

A survey of 8 companies (C1 – C8) indicated a clear connection between digital technology deployment and sustainability objectives, but the linkage to a transition to the circular economy was not compelling.

Sustainability benefits/Technology used	Social Media	Mobile Apps	Analytics /Big Data	Cloud	Block-chain	Rob-otics	AI/KW auto	IoT	Digital Fab
1. Waste reduction							C2		
2. Reduction of energy consumption				C5					
3. Reduction of transportation costs									C2 C5
4. Augment circular economy knowledge and awareness	C7 C4		C6						
5. Sustainability monitoring			C2	C8					
6. Systems, data management, and process improvements			C4	C3	C7	C3 C6 C7	C3 C6 C7	C3 C2 C4 C7	C3 C7
7. Other efficiency gains		C7 C3 C2 C6 C4	C7 C3	C7 C4					C2

There is another dimension to this debate. A truly circular economy will encompass the upstream (and downstream) activities of suppliers (and customers). This is part of what is sometimes termed “sustainable supply chain management”, an emerging field of research that examines all functions across the supply chain. This is of particular relevance in industries such as clothing and apparel (Figure 1), where there are wider socio-economic implications of transitioning to a circular economy in developing world environments, where the production and processing of the raw materials used in clothing manufacture in the developed world often take place.

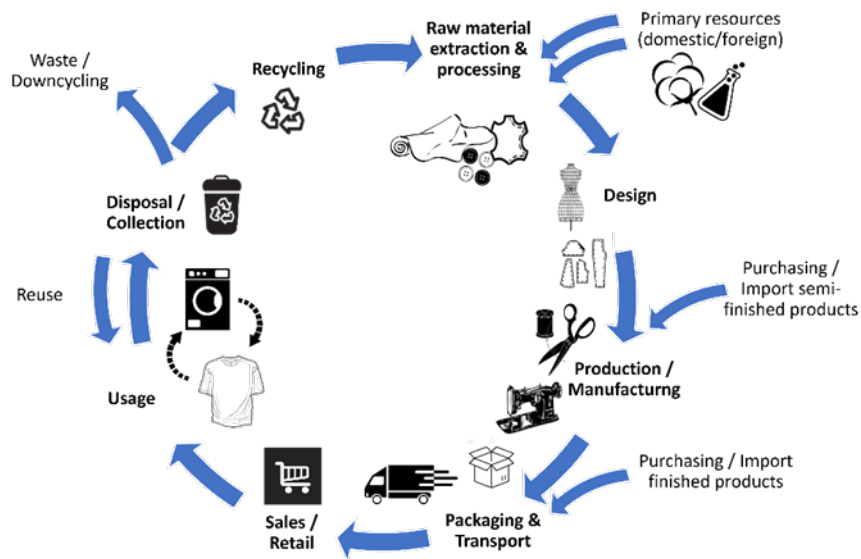


Figure 1. The circular economy in the clothing and apparel industry

The circular economy will involve changes in the production practices of primary resource suppliers and imported finished and semi-finished goods, as well as in the domestic manufacturing process

Source: Based on Eionet, 2019 (p.28).

The transition to a circular economy is a complex issue that “involves changing the way things have been done for decades”, and it may be that a change in the attitude of consumers and society at large will be needed to push companies into changing their business practices. Technology, however, will be a key enabler of such a transition. As Sullivan and Hussain noted, “technology has incalculable potential to enable humanity to be the best stewards of the biosphere, and usher into existence a truly inclusive circular economy faster, more effectively, and more efficiently to create positive economic, environmental, and societal impact”. As such, the digital technologies can facilitate and support the transition to a circular economy and to a sustainable future.

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**References: Web links from underlined text.**

Circular economy Link to: <https://www.computerworld.com/article/3452603/what-is-the-circular-economy-and-how-can-the-it-industry-adopt-it.html>

[Trueman, C. (2019) What is the circular economy and how can the IT industry adopt it? *Computer World*, 2019, November 8.]

Eight specific business activities Link to:

[https://www.researchgate.net/publication/328538864\\_Challenges\\_in\\_supply\\_chain\\_redesign\\_for\\_the\\_Circular\\_Economy\\_a\\_literature\\_review\\_and\\_a\\_multiple\\_case\\_study](https://www.researchgate.net/publication/328538864_Challenges_in_supply_chain_redesign_for_the_Circular_Economy_a_literature_review_and_a_multiple_case_study)  
[Bressanelli, G., Perona, M., & Saccani, N. (2019). Changes in supply chain redesign for the circular economy: A literature review and multiple case study. *Int. J. of Prod. Res.*, 57, 7395-7422.]

Sullivan and Hussain Link to: <https://www.greenbiz.com/article/how-technology-unlocks-new-value-circular-economy>

[Sullivan, J., & Hussain, B. (2020). *How technology unlocks new value from the*

*circular economy*. 2020, May 19. GreenBiz. Paradigm Shift series, produced by non-profit PYXERA Global, on the diverse solutions driving the transition to a circular economy.]

EIT Climate-KIC Consultancy Link to: [https://www.climate-kic.org/wp-content/uploads/2018/08/ClimateKICWhitepaperFinalDigital\\_compressed.pdf](https://www.climate-kic.org/wp-content/uploads/2018/08/ClimateKICWhitepaperFinalDigital_compressed.pdf)  
[EIT Climate-KIC. (2019). *Digitalisation – unlocking the potential of the circular economy*.].

Cagno et al. link to: <https://www.mdpi.com/2076-3417/11/8/3328>  
[Cagno, E., Neri, A., Negri, M., Bassani, C. A., & Lampertico, T. (2021), The role of digital technologies in operationalizing the circular economy transition: A systematic literature review. *Applied Sciences*, 11, 3328].

recent research and A survey of 8 companies Link to: <https://www.mdpi.com/2071-1050/14/15/9077>  
[Wynn, M., & Jones, P. (2022) Digital Technology Deployment and the Circular Economy. *Sustainability*, 14 (15). Art 9077. doi:10.3390/su14159077]

Kristoffersen et al. Link to:  
<https://www.sciencedirect.com/science/article/pii/S0148296320304987>  
[Kristoffersen, E., Blomsma, F., Mikalef, P., & Jingyue, L. (2020). The smart circular economy: A digital-enabled circular strategies framework for manufacturing companies. *Journal of Business Research*, 120, 241-261].

Sustainable Supply Chain Management Link to:  
<https://doi.org/10.1016/j.clscn.2021.100016>  
[Seuring, S., Aman, S., Hettiarachchi, B. D., Lima, F. A. de, Schilling, L., & Sudusinghe, J. I. (2022). Reflecting on theory development in sustainable supply chain management. *Cleaner Logistics and Supply Chain*, 3, 100016].

Eionet, 2019. Link to: <https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-wmge-reports/textiles-and-the-environment-in-a-circular-economy>  
[Eionet, 2019. *Textiles and the environment in a circular economy*. Eionet Report - ETC/WMGE 2019/6]

Involves changing way things done for decades. Link to:  
<https://www.mapfre.com/en/insights/sustainability/technology-circular-economy/>  
[Mapfre (2021). *How can technology help achieve a circular economy?* June 10]