Adopting a Circular Economy to Build a Purpose-Driven Digital Enterprise

Abstract

An increased urgency around the global sustainability dialogue and the unprecedented crisis presented by COVID-19 have accelerated enterprise focus towards circular economy initiatives. Organizations are therefore increasingly leveraging opportunities presented by digital technologies and focusing on transformation initiatives to demonstrate their leadership in the circular economy. This paper explores how companies can leverage a digital-plus-contextual knowledge solution to achieve their vision of a circular economy.

The circular economy: New ways to deliver on inter-generational equity

Interconnected ecosystems and innovative business models driven by Industry 4.0, along with an increased focus on climate change, sustainability, and accelerating resource depletion and the COVID-19 global pandemic have highlighted the need to build resilient, anti-fragile, and purpose-driven global enterprises. The concept of a circular economy, that is restorative and regenerative by design, has been reinforced as a key component to deliver on the promise of inter-generational equity.

Key dimensions to building a successful circular economy

The principles of a circular economy focus on waste from the perspective of regeneration and reuse. They are an extension of traditional lean principles and can be applied to different types of waste (see Figure 1). In the manufacturing value chain, various entities can leverage the principle to transform themselves from a traditionally linear 'take-make-use-dispose' process to a circular 'reduce-reuse-recycle' process. Such a strategy builds long-term resilience, generates business and economic opportunities, and provides significant environmental and societal benefits.
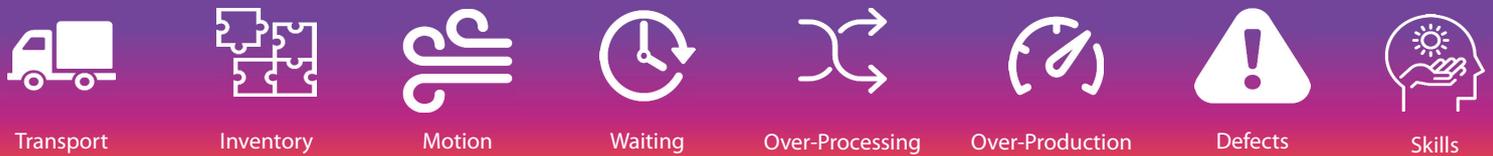
Transport	Inventory	Motion	Waiting	Over-Processing	Over-Production	Defects	Skills

Figure 1: The eight dimensions of waste as aligned to Muda from Kaizen

A reduce-reuse-recycle loop (see Figure 2) will not only uberize resources across the value chain but will also maximize the remaining useful life of assets with techniques such as condition-based monitoring while ensuring reuse, remanufacturing, and recycling.
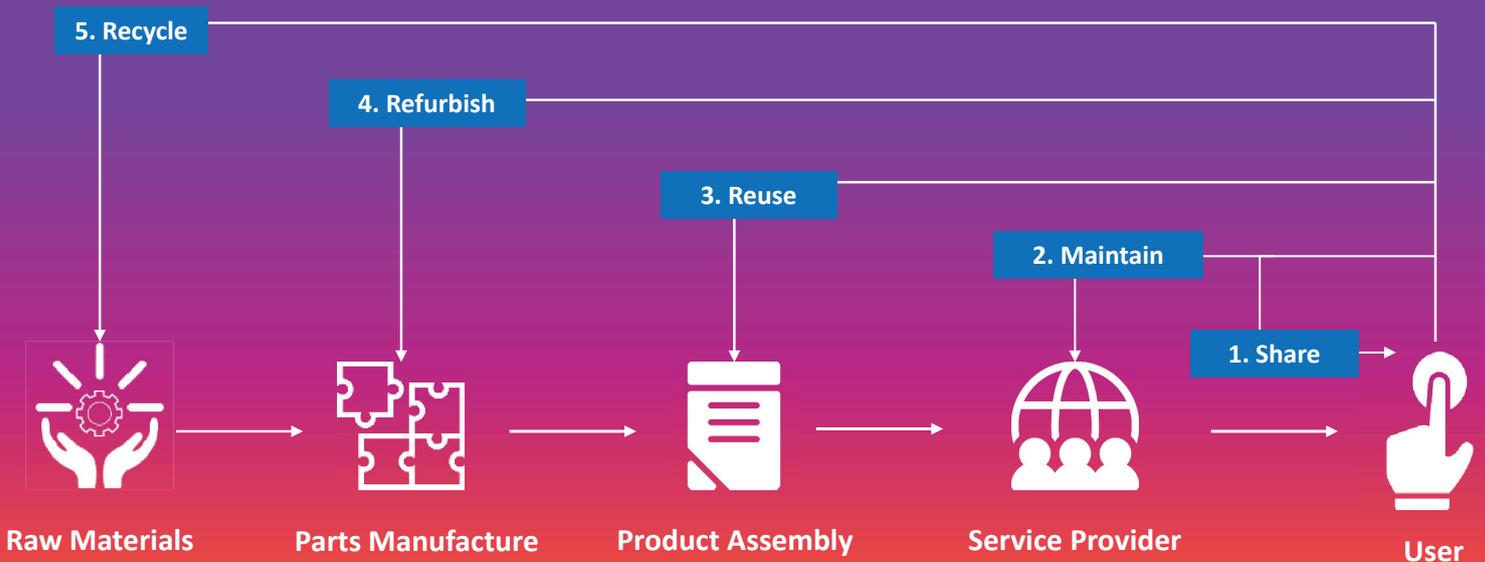
5. Recycle

4. Refurbish

3. Reuse

2. Maintain

1. Share

Raw Materials — Parts Manufacture — Product Assembly — Service Provider — User

Figure 2: Circular economy loops

This is crucial to reduce cost, increase revenue streams, reduce footprint on the environment and natural resources, and create jobs as part of an acceleration towards a service-based economy and remote working practices.

Leveraging digital transformation to build a circular economy solution canvas

The circular economy is estimated to the reach $4.5 trillion by 2030[1]. Creating a successful circular economy requires building a solution canvas for digital transformation, helping enterprises accelerate initiatives. As underlying technologies for these building blocks continue to mature rapidly, increasingly sophisticated and pervasive solutions will evolve to help enterprises realize the true benefits of the circular economy. The key building blocks for a digital solution canvas include the following:

- **Design-led experience transformation:** Organizations can leverage design thinking across all stages of product development and implementation, including defining problem statements, brainstorming on ideas, presenting a solution, and piloting validation and transformation scale-out across the business value chain and ecosystem. This can deliver maximum impact and transform localized, departmental challenges to group-wide or industry-wide solution blueprints. Some of the scenarios where design thinking practices can be leveraged to ideate and deliver innovative solutions aligned to the circular economy include the following:

  a. **Inventory management:** Organizations can use gamification techniques to encourage, incentivize, and drive behavioral changes across diverse teams to tap into and search existing inventory across the enterprise, reducing procurement costs and inventory obsolescence impact.

  b. **Parts re-marketplace:** Building an ecosystem-wide marketplace can help firms monetize and reuse refurbished assets and parts, generating incremental revenue streams for the seller and substantially reducing acquisition costs for the purchaser.

- **Intelligent connected ecosystems:** Leveraging the power of data with rapidly evolving internet of things (IoT) and cloud technologies can help firms conceptualize and deliver solutions for real-time visibility and tracking of asset performance and health. Potential solutions include:

  a. **Digital twins:** Intelligent, data-driven, and IoT-based solutions can enhance asset life cycle, enable parts reuse, and build sustainable manufacturing enterprises. For instance, companies can analyze real-time sensor data from assets and equipment to visualize the performance of industrial assets and processes to design interventions that can prolong the life of critical equipment.

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[1] *World Economic Forum; Circular Economy and Material Value Chains; https://www.weforum.org/projects/circular-economy; Accessed November 24, 2020*

b. **Parts intelligence hub:** Data science and machine learning algorithms can help firms with parts classification and standardization. The algorithms can identify how parts can be reused and how they might differ in terms of their material composition or source but can be reliably used to serve the same functional purpose. For large manufacturing enterprises that cater to complex equipment and have part inventories running into hundreds of thousands of parts, the benefit of using such techniques to identify demand aggregation and reuse can drive substantial benefits.

- **Blockchain-based system of record:** Firms can use blockchain to build a single, unified system of record for creating lineage traceability and transparency, enabling reduce-reuse-recycle and closed-loop supply chains.

- **Additive manufacturing:** Moving the needle from sustainable manufacturing to additive manufacturing can help evaluate material choice, such as the use of sustainable polymers early in the product life cycle, thereby directly driving the circular objective.

- **Remote and immersive experiences:** COVID-19 and the resultant shift to remote working operations have pushed the debate on mixed reality technologies into the mainstream. Manufacturing firms that adopt mixed reality technologies for large-scale rollouts will be better positioned to enable field service technicians to visualize, control, and diagnose conditions of complex equipment. This will reduce the overheads associated with remote travel, minimize employee health and safety (EHS) risk exposure for initial diagnosis, enhance career longevity for an aging workforce, and provide expert training to technicians and service workforce. The end result - reducing the cost of travel and minimizing equipment downtime.

Achieving the circular economy vision

Digital transformation initiatives and evolving technologies have been transforming the way citizens, enterprises, and governments interact and operate. When coupled with the right mix of contextual, industry-relevant knowledge and creative, inclusive design practices, it can help build a digital store of solutions, accelerating enterprises in their journey of delivering on their purpose-driven missions.

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