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## Economic Commission for Europe

### Steering Committee on Trade Capacity and Standards

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Item 2 of the provisional agenda

#### Regional Conference on the Circular Economy

## **Accelerating the transition towards a circular economy in the Economic Commission for Europe region: focus on harnessing digital solutions\***

**Submitted by the secretariat**

#### *Summary*

The Economic Commission for Europe (ECE) has taken important steps to advance the transition to a more circular economy. At its sixty-ninth session in April 2021, ECE member States requested relevant sectoral committees and bodies to scale up their efforts to promote circular economy approaches and the sustainable use of natural resources. Member States also asked to consider how to enhance the impact of existing ECE instruments, including by proposing ways to identify, evaluate and address gaps in governance and best practices (E/ECE/1494). In its more recent seventieth session, in April 2023, the Commission addressed progress made and invited to mainstream digital and green transformations for sustainable development as a cross-cutting priority (E/ECE/1504).

As part of the response, the Economic Cooperation and Trade Division has been implementing a United Nations Development Account project on “Accelerating the transition towards a circular economy and sustainable use of natural resources in the ECE region” (2021–2024). The project aims to support the design and implementation of national policies, programmes and strategies in key areas of intervention for the circular economy relating to waste management, public procurement, innovation, trade and traceability of value chains.

This note summarizes key findings from a draft policy paper on digital solutions developed under the project. The document is presented to inform discussions at the ninth session of the Steering Committee.

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\* This document has not been formally edited by ECE.



## I. Introduction

1. Climate change, environmental degradation, and the overconsumption of natural resources are some of the greatest challenges facing the world today. Global resource consumption is set to double by 2050 (from 2015 levels), and waste production is predicted to grow by 70 per cent,<sup>1</sup> fuelled by higher consumption rates linked to improved standards of living.
2. A cornerstone of modern consumption patterns is the prevailing linear economic model, which follows a “take-make-waste” philosophy, and in which the overarching objective of economic growth is intertwined with increased consumption, including consumption of resources and production of waste. These patterns have led to increasing scarcity of essential natural resources, such as drinking water and fossil fuels, and critical environmental pollution, resulting in health issues and irreversible harm to ecosystems.
3. The circular economy proposes a transformative solution to the current economic dilemma, decoupling socioeconomic growth from resource consumption by minimizing waste and pollution, maximizing the circulation of products and materials, and regenerating nature. Adopting circular economy models entails the introduction of new business models, redefining value propositions, and transforming value chains to achieve not only economic outcomes but also to meet environmental and social objectives.
4. Digital solutions have an enormous potential to help scale up circular economy models. This includes leveraging the transformative power of new technologies to develop new value propositions that would previously have been unviable. By allowing for the large-scale collection, management, and processing of data, digital tools can generate actionable insights, inform decision-making, and automate or semi-automate action across value chains. Digital technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain technology, online platforms, verified credentials, and decentralized identifiers are the building blocks to develop solutions for more circular and sustainable use of assets and resources.

## II. Key trends and challenges in harnessing digital solutions for the circular economy transition

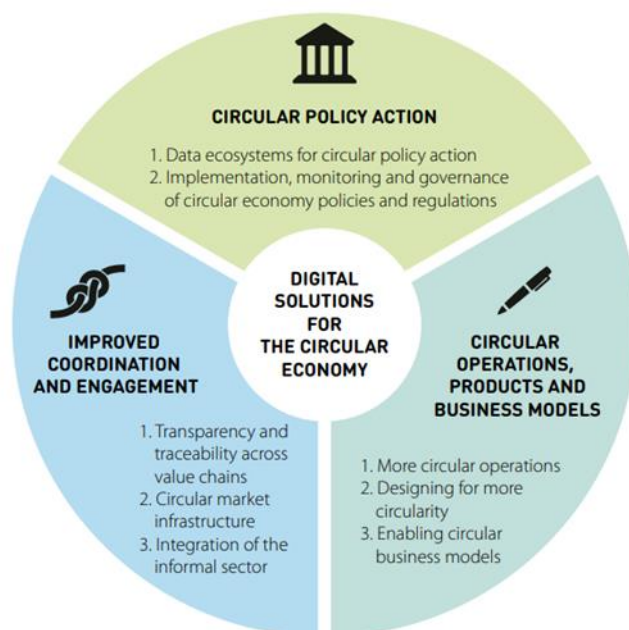
5. The global surge in digital access and changing consumer behaviours was accelerated by the COVID-19 pandemic, laying a robust foundation for digital solutions to drive circularity. Digitalization offers promising solutions to overcome information gaps hindering the circular economy, facilitating better data use, and enhancing coordination and collaboration within complex value chains. This is particularly evident in countries with economies in transition within the ECE region, where internet penetration has significantly increased, offering opportunities for technological leapfrogging and innovation. At the same time, this approach also introduces challenges concerning the need to acquire new skills, address ethical considerations, and mobilize new infrastructure investments.
6. Broadly, digitalization is the use of innovation to create new business processes, market offerings, or models with digital technology. Digitalization can be distinguished from digitization, which generally involves the direct conversion of physical or analogue products, services, or processes into electronic forms. While digitization can deliver advantages such as reduced cost and increased efficiency, digitalization aims to more fully leverage the transformative potential of novel technologies. Put differently, digitalization involves rethinking processes, offerings, and business models through the lens of digital technologies and, as a result, creating new market opportunities. For instance, digitization of equipment maintenance activities might involve tracking repair and maintenance intervals in electronic instead of paper form, whereas digitalization could leverage machine learning to predict the most optimal time to do repairs and replace parts. A non-exhaustive list of key opportunities

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<sup>1</sup> World Bank, “Solid waste management”, 11 February 2022, <https://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>

of digital solutions for accelerating the circularity transition is summarized in the figure below, which is explained in the sub-sections below.

### Opportunities of digitalization for scaling up the circular economy



Source: ECE, “Accelerating the Transition Towards a Circular Economy in the UNECE Region: Leveraging Digital Solutions for the Circular Economy”, 2023 (not published)

### Digital solutions for circular operations, products, and business models

7. The transition to more circular operations, involving leveraging IoT sensors, data analytics, and network connectivity, can significantly enhance production efficiency by enabling lean and agile processes. These digital technologies, powered by real-time monitoring with historical data and machine learning algorithms, provide descriptive, predictive, and prescriptive insights for better planning and forecasting, optimizing resource use and waste reduction. These technologies can also facilitate predictive maintenance, reducing unnecessary actions and extending asset life. Finally, they can be utilized in the organization of internal circular marketplaces within organizations, which can improve the visibility and utilization of surplus assets and materials, promoting reuse and reducing waste.

8. Designing for circularity involves optimizing across technical, environmental, social, and economic criteria, a challenge that can be potentially addressed by using computational methods. The design phase is crucial in the circular economy, determining over 80 per cent of a product’s environmental impact.<sup>2</sup> Initiatives such as the European Union’s Ecodesign Directive and Regulation, stress the importance of upstream innovation in the product design stage to eliminate waste and enable circular strategies. Digital technologies, such as AI and information libraries, assist product designers in material selection and design by providing data on environmental impacts and facilitating compliance with environmental regulations. Furthermore, computational methods and AI play a key role in developing new, sustainable materials, and enhancing the efficiency of research and development processes.

9. Enabling circular business models through digital solutions focuses on fulfilling customers’ actual needs rather than pushing product ownership. This shift enables more sustainable and efficient alternatives, such as renting or sharing, reducing waste, and

<sup>2</sup> European Commission, Directorate-General for Environment, “Proposal for a regulation establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC”, 30 March 2022, available at [https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation\\_en](https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation_en)

encouraging producers to extend product lifespans. Digital technologies facilitate these models by linking supply with demand, enabling the monetization of underutilized assets through marketplaces and platforms; monitoring and managing product use through IoT devices, and connecting the broader ecosystem of value-added services.

### **Digital solutions for improving coordination and engagement of stakeholders**

10. Fragmentation in the information value chain across stakeholders hinders the closed-loop flow of materials in the circular economy. Information often remains within organizational siloes, limiting cross-chain visibility. Digital solutions for unlocking this information to enable better decision-making among stakeholders include ensuring the provenance and authenticity of materials (e.g., using IoT, and blockchain for critical raw materials like cobalt), enhancing the sharing of information necessary for circular value chains (detailing product composition, quality and recyclability), and enabling digital product passports to consolidate and access product information, supporting informed decisions by consumers and stakeholders. Effective traceability systems demand identification, processing, and sharing of information, tailored to specific contexts. Voluntary Sustainability Standards and innovative identification technologies such as quick response (QR) codes or chemical deoxyribonucleic acid (DNA) markers can improve traceability, although challenges remain, particularly for micro-, small- and medium-sized enterprises (MSMEs) in developing countries, necessitating coordination for fair traceability system coverage.

11. Digital market infrastructure can enhance the efficiency of circular markets by reducing transaction costs and addressing information barriers, bringing together buyers and sellers, thereby facilitating the exchange of secondary products and materials. These platforms provide tools such as search recommendations, analytics, and traceability to aid in the discovery of circular materials and pricing and implement measures to de-risk transactions, including vetting, guarantees, ratings, and dispute resolution mechanisms. Marketplaces cater to various transaction types – business-to-business (B2B), business-to-consumer (B2C), and consumer-to-consumer (C2C). They also include marketplaces for circular offerings and e-commerce, enabling buyers and sellers to discover sustainable alternatives for products and materials, facilitating material exchange, and leveraging algorithmic matching to overcome traditional barriers and facilitate collaboration and resource reuse.

12. In many countries, especially developing and countries with economies in transition, the informal sector significantly contributes to waste collection, processing, and recycling.<sup>3</sup> Digital solutions, including mobile apps and social media, offer potential support by providing informal workers with access to knowledge, tools, and connections, enhancing traceability which can be instrumental in the transition towards formalization. Implementing these solutions requires careful consideration of access challenges (i.e. the digital divide).

13. Consumers are pivotal in advancing the circular economy, yet their engagement in circular practices like reuse, resale, and recycling remains limited. Digital platforms can enhance consumer access to circular offerings with verified information, enabling informed decisions about the environmental and social impacts of their purchases. While digital and internet penetration in the ECE region offers a pathway to improve engagement through digital technologies, efforts are needed to make circular options more accessible, affordable, and convenient.

14. Circular economy models require enhanced coordination, engagement, collaboration and information exchange across stakeholders, including manufacturers, raw material suppliers, service providers, regulatory and policy actors, end customers, and others. Among the many initiatives across the ECE region pursuing this mission, three are hosted by ECE. These are the UN-ECE Transformative Innovation Network (ETIN), a strategic platform for peer learning and policy exploration to accelerate sustainable societal transformation through evidence-based analyses and international collaboration, the ECE Stakeholder Engagement

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<sup>3</sup> However, countries face challenges due to its unregulated, low-wage nature, including worker health and safety concerns and economic exclusion.

Platform (Circular STEP), a platform designed to accelerate the circular economy transition by filling gaps and creating synergies among initiatives within the circular economy, and the ECE Sustainability Pledge, representing a series of policy recommendations, guidelines and standards that enable industry actors to authenticate their sustainability claims<sup>4</sup>.

### **Digital solutions for enabling circular policy action**

15. The rise of digitalization offers policymakers the chance to use diverse data ecosystems for crafting effective policies, drawing on public, private, and citizen-generated data for insights on issues such as waste reduction and urban mobility. Platforms such as the European Environment Agency's LitterWatch, along with private and non-profit organization initiatives, contribute valuable real-time data.<sup>5</sup> However, utilizing such data comes with challenges regarding quality, privacy, cybersecurity, and the public good designation of private sector data. Addressing these concerns necessitates multi-stakeholder cooperation and regulatory framework adjustments.

16. Implementing and monitoring circular policies and regulations are crucial for observing progress. Automated remote monitoring through digitalization, such as IoT devices and remote sensing technologies, provides efficient and accurate data collection methods, enhancing environmental oversight and compliance verification. Advanced digital tools such as digital twins can simulate systems or entire cities, providing insights into the potential impacts of policy changes before their real-world application. Additionally, digital solutions support organizations in staying compliant with evolving sustainability regulations by providing timely updates on legislative changes, thereby easing the complexity of navigating the regulatory landscape.

## **III. Recommendations and the way forward**

17. Digitalization can support the transition to the circular economy by filling knowledge gaps, helping to improve coordination and stakeholder engagement, and enabling policies for the circular economy. However, economic, technological, social, environmental, and legal challenges need to be addressed for digitalization to effectively contribute to the circular economy.

18. Digitalization can be a strong enabler for the circular economy transition. To maximize synergies between digitalization and circularity, policymakers can reform national policies by focusing on several areas: economic, technological, social, environmental and legal, and regulatory.

19. The following recommendations could help authorities leverage digital solutions to accelerate the transition to a circular economy in the ECE region:

- Increase education and awareness. Build knowledge, awareness, and capacity across public and private sectors as a foundation and as a soft infrastructure for digitalization and the circular economy.
- Foster cross-sectoral collaborations. Share knowledge, support cross-sectoral collaboration, and develop standards related to digitalization and its role in the circular economy, involving diverse stakeholders from the public, private, and academic sectors across multiple industries.
- Provide innovation incentives and support. Provide financial and technical support to encourage, facilitate, and de-risk the development and adoption of novel digitalization solutions for circularity. This also includes support to overcome potential barriers that

<sup>4</sup> Companies can join the Sustainability Pledge by implementing ECE toolbox, including opensource blockchain and DNA tracking solutions. To date, it has received more than 100 pledges from companies and stakeholders, from across 28 countries, involving a larger network of about 750 industry actors.

<sup>5</sup> Eva Barteková and Peter Börkey, Digitalization for the Transition to a Resource Efficient and Circular Economy, OECD Environment Working Papers No. 192 (Paris, OECD, 2022).

organizations face in investing in the development and adoption of novel technological solutions, including lack of access, resources, and capabilities, and low technological maturity.

- **Harness innovation-enhancing public procurement.** As major buyers, public sector organizations can play a significant role in promoting sustainable production and consumption through green and circular public procurement policies. Public procurement can drive demand for and stimulate innovation in digital solutions by setting circularity requirements in public projects such as digital product passports, materials traceability, and the use of sustainable products and services. Public investment is also needed to develop common-good infrastructure such as connectivity.

- **Develop conducive policy frameworks.** Develop policy and regulatory frameworks to incentivize the use of digital solutions for circularity while also mitigating risks. Differentiated approaches are needed based on market maturity. During the early stages of market development, there is greater uncertainty about what specific solutions will emerge as viable standards. At this stage, Governments should consider more technology-neutral policy approaches to encourage innovation related to circularity goals over a narrow focus on specific technologies and to facilitate a convergence towards standards. When standard solutions emerge, policy action is needed to facilitate and remove barriers to scaling up.

20. The ECE Economic Cooperation and Trade Division stands ready to assist its member States in leveraging the potential of digital solutions for a circular economy transition. It provides a variety of tools that can support digital transformation, including norms, standards, legal instruments, and policy advice. For example, ECE supports member States in establishing digital certificates and guarantees of origin, providing guidance on the use of blockchain and digital tools to conduct lifecycle analyses.<sup>6</sup> Capacity building by ECE on the circular economy transition through its various tools depends on extrabudgetary funding. Delegations to the Steering Committee are invited to consider making funding pledges in line with available ECE instruments for resource mobilization.

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<sup>6</sup> Furthermore, ECE provides a shared environmental information system (SEIS) that organizes environmental information into online systems that facilitate improved decision-making and provides a modelling tool for analysing possible impacts of climate change on transport networks, among other tools and services.