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Article

The Circular Economy as a New Production Paradigm to Enhance Resilience of MNEs and the Economic System

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The consumption of natural resources has dramatically increased over the last 50 years and is expected to continue to rise. Also, environmental and geopolitical issues expose the economic system to uncertainty and risk. We claim that the circular economy approach is a potential solution that enables multinational enterprises to enhance their resilience by reducing the reliance on raw materials and the fragility of the supply chain, improving efficiency, and generating new revenue streams. This, in turn, affects the global value chains and the economic system. Lastly, we outline the role of all global economic actors in the circular transformation.

The economic system is consuming natural resources at a rate that is not any more sustainable; the Global Footprint Network estimates that we are consuming 1.75 times more resources than the planet can regenerate,[1] producing negative impacts on several natural ecosystems ranging from the depletion of resource stocks to biodiversity losses. In an effort to address environmental degradation and prevent potential supply shortages while supporting economic growth, many solutions have been proposed (e.g., UNCTAD, 2020); in this paper, we specifically introduce the circular economy (CE) approach. We aim at illustrating how this approach can increase resilience at a company and economic system level; also, we aim at providing clear and practical insights into how multinational enterprises (MNEs) and other actors of the global economy such as consumers, suppliers, policymakers, and international organizations can contribute to the implementation of the CE framework.

RESILIENCE IN THE CONTEXT OF RESOURCE SCARCITY

Resource extraction has more than tripled since 1970, from 27 billion tons to 92 billion tons in 2017, while the annual average material demand grew from 7 tons to over 12 tons per capita in the same period (Fig. 1).[2] Global emissions almost quadrupled in the last decades, reaching now 35 billion tons of CO2 emission per year, and the amount of waste produced has reached over 2 billion tons of municipal solid waste every year; by 2050, this value is expected to increase to 3.4 billion tons.[3] Also, climate-related issues and geopolitical tensions are increasingly determining disruptions in the supply of raw materials and volatility of their price, thus showing the vulnerability of the economic system towards resource scarcity–related risks.

In this context, resilience – the capability to anticipate, cope, recover from, and adapt to both periodic shocks and major disruptions – is becoming increasingly crucial (Dau & Moore, 2020; Linkov et al., 2013). In particular, multinational corporations that operate on a global scale are at higher risk of disruptions and should develop a robust resilience strategy, i.e. should be able to prevent and minimize the negative impact of scarcity-related shocks, recover from them quickly, adapt to the changes that may follow, and maintain or even improve competitiveness by taking advantage of emerging opportunities (Oh & Oetzel, 2022; Sutcliffe & Vogus, 2003).

CIRCULAR ECONOMY AS A PATHWAY TO RESILIENCE

The CE framework is rising as a feasible option to transit to a more resource-efficient system in which economic growth is decoupled from material and resource depletion and supply risk, and to achieve resilience at a company and system

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1 www.footprintnetwork.com

2 www.resourcepanel.org/reports/global-resources-outlook

3 www.datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

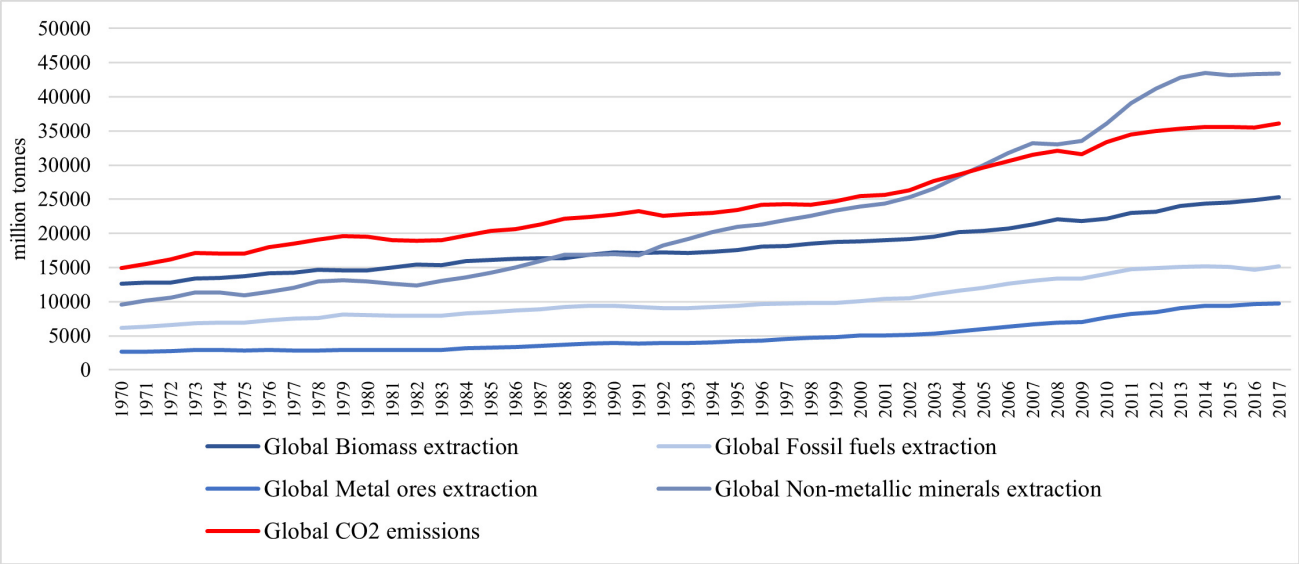

Figure 1. Global CO2 emissions and resources extraction by typology (1970-2017)

Source: elaboration on data from International Resource Panel and Global Carbon Project.

level (Garcia-Saravia Ortiz-de-Montellano & van der Meer, 2022; Kennedy & Linnenluecke, 2022). CE is a systemic change whereby economic and business opportunities can be combined with environmental and social benefits and generate long-term resilience (Ellen MacArthur Foundation, 2015). Specifically, the CE paradigm aims to replace the linear take–make–use–dispose production pattern and aims to reduce the amount of resources used and waste generated, keep products and materials in use for as long as possible, and recover valuable materials and resources from waste (Bocken, De Pauw, Bakker, & Van Der Grinten, 2016). In doing so, it emphasizes the implementation of the 3R principles of Reduce, Reuse, and Recycle in production and consumption processes (Kirchherr, Reike, & Hekkert, 2017). All this suggests a shift in the way resources are used and waste is managed toward a system that minimizes resource consumption and negative environmental impacts and maximizes resource efficiency.

However, this transition from a linear to a circular economy cannot be implemented through scattered actions; the far-reaching scale of the compulsory changes necessitates the support and coordination of lead actors of the global economy (Fehrer & Wieland, 2021) and MNEs are in the position to be at the forefront of this transition given their scope and power.

THE KEY ROLE OF MNES IN CE TRANSITION

Several MNEs are embracing the CE paradigm and have already introduced circularity in their business models and global activities. For instance, Stellantis,[4] one of the leading global carmakers and mobility providers, has recently announced the creation of a CE Business Unit to introduce circular principles in its business model. Namely, the aim is to extend the life of vehicles and parts ensuring that they last for as long as possible, and to return materials and end-of-life vehicles to the manufacturing loop for new vehicles and products. Also, it aims to create within-country loops for products and materials, and to quadruplicate revenues from recovered and remanufactured parts, as well as revenues from recycling in the coming decade.

MNEs adopting a circular approach are not limited to the manufacturing industry. Several cases can be found also in the agri-food sector and among service providers and energy and commodity producers (Ku, 2022). For instance, Arla, one of the largest international dairy cooperatives in the world, while committing to the mainstream circular projects related to food packaging, is also investing in a bio-economic project to reconvert resources and waste streams into value-added products.[5] Schneider Electric, a multinational provider of automation digital solutions, introduced circular solutions that cover its entire value chain activities, from the sourcing of green materials to the design of products easy to disassemble, reuse and recycle at

4 www.media.stellantis.com/em-en/corporate-communications/press/stellantis-fosters-circular-economy-ambitions-with-dedicated-business-unit-to-power-new-era-of-sustainable-manufacturing-and-consumption

5 In particular, the cooperative treats and re-uses water extracted from whey during production processes, reducing the need to use drinking water supplies (www.arlafoodsingredients.com/about/responsible-nutrition/stronger-planet/circular-bioeconomy/wastewater-reuse/). Also, taking the whey waste created during cheesemaking, the company is producing food, feed, bio-based products, and bioenergy (www.arlafoodsingredients.com/about/responsible-nutrition/stronger-planet/circular-bioeconomy/).

the end of life, and the offer of several services of repair/refurbishment/recycling. In 2020, the company claimed that thanks to the take-back and recycling program they avoided 157,000 metric tons of primary resource consumption.[6]

In the energy industry, Enel,[7] an Italian MNE operating in the electricity sector, has increasingly adopted the CE paradigm since 2016 and its circular approach covers all the company's business areas from power generation to distribution and infrastructure development. The company also collaborates with suppliers in the redesign of the value chain toward circularity.

Thus, the CE paradigm is a means for the MNE to develop resilience as it reduces the dependence on raw materials and the fragility of the supply chain by diminishing the exposure to disruptions, and provides MNEs with new profit opportunities and product differentiation strategies. First, CE can enable MNEs to prevent and minimize the negative impacts of a shock since it allows cost saving and optimization of the company processes, reducing the need for new materials and fuel supplies and, hence, the exposure to supply chain risks. Second, adaptive responses range from the extension of product life cycle through repair and reuse strategies to inner recovery and recycling loops of energy and materials. This reduces the revenue losses or cost increases caused by supply shortages of all kinds. Third, by adopting a CE approach, MNEs can maintain competitiveness even in the face of shocks, by increasing their profit opportunities through the generation of new revenue streams deriving from the sale of components and from the control of the second-hand markets after the extension of the useful life cycle of their products, and from waste management and diversification into new markets of recycled materials or products.

In addition, by improving the value chain's transparency, the CE paradigm promotes better control of supply chain criticalities and quick identification of bottlenecks; in fact, robust collaboration among partners favors adaptation, flexibility, and speed of response to any possible emerging issue. Lastly, the CE approach encourages companies to innovate and develop new business models that are based on circular principles increasing their resilience to market competition by taking advantage of emerging opportunities.

Moreover, in so doing, MNEs also promote community and societal resilience. In fact, by shifting to a CE paradigm, MNEs not only improve their own resilience, but also may produce a cascading effect on the global value chains (GVCs) they orchestrate. They can support the development of local circular loops and the reduction of greenhouse gas emissions of the entire GVC. Also, the new circular loops extend the number of activities and actors operating in the value chain, and favor greater collaboration and coordination among partners, as well as monitoring of materials and supply flows. An example is offered by the partnerships between fashion and textile companies that adopt voluntary standards toward circularity and online platforms or providers of new materials.[8] Finally, increased monitoring of activities, which is required in the circular approach, contributes to the accounting of corporate social and environmental achievements. This, in turn, allows the company to fulfill the interest of consumers, employees, and stakeholders and demonstrate its compliance with existing regulations (or stimulate the introduction of new standards).

Companies are increasingly conscious of the necessity to adopt environmentally and socially responsible practices and identify solutions to manage a rising number of risks (Cuervo-Cazurra, Doh, Giuliani, Montiel, & Park, 2022). Large corporations have the required economic and human resources to enable, finance, push and inspire other value chain actors to evolve according to the circular paradigm. However, many of them are simply not aware of the potential of CE strategies yet (Benito & Fehlner, 2022).

The shift toward the CE paradigm and the related resource efficiency and resilience requires innovation in technologies; MNEs play a crucial role also in the development of such innovations both investing directly in R&D activities and collaborating with innovative start-ups or research centers. The recent report on *Patents for Tomorrow's Plastic* (EPO, 2021) shows that traditional big MNEs are technological leaders in recycling technologies for plastic (waste recovery, plastic-to-product recycling, and chemical and biological recycling) and alternative to plastic solutions (biodegradable and compostable plastics or plastics designed for easier recycling). Top innovators include Procter & Gamble, which in the period 2010-2019 applied for 38 International Patent Families[9] (IPFs) related to waste recovery inventions, 91 related to product recycling, and more than 1600 related to bioplastic technologies in the three sectors of healthcare, packaging, and cosmetics and detergents. In the same period, Sabic and Honeywell are the top applicants in the field of chemical and biological recycling with 309 and 287 IPFs, respectively.[10]

6 www.se.com/ww/en/download/document/SustainabilityReport2020EN/

7 www.enel.com/company/our-commitment/circular-economy/circular-economy-position-paper

8 Over the last decade, Patagonia, the US producer of outdoor apparel, has been piloting a few second-hand and rental initiatives and recycling experiments, collaborating with new ventures and established partners (https://www.patagonia.com/stories/our-quest-for-circularity/story-96496.html).

9 Each international patent family (IPF) covers a single invention and includes exclusively patent applications sought in more than one country.

10 It is worth observing that the field is highly concentrated, as 12% and 19% of all IPFs are generated by the top five and top ten applicants, respectively.

THE NEED FOR GLOBAL COLLABORATIVE EFFORTS

MNEs are not the only enabler of the CE shift. Indeed, the circular paradigm requires the involvement and support of several actors, namely consumers and the public sector, operating at different levels. Consumers can orientate MNEs toward the adoption of a CE paradigm by demanding products that are designed for longevity, repairability, and recyclability. Additionally, they can support the CE transition by choosing to buy second-hand products, participating in sharing economy platforms and recycling their products. As an European Commission report of 2018 indicates, consumers are willing to engage in CE practices and the lack of information regarding product durability and reparability as well as the lack of sufficiently developed markets (e.g., for second-hand products, renting, leasing, or sharing services) is one of the main barriers for a behavioral shift (Cerulli-Harms, Porsch, Suter, et al., 2018).

In addition, consumers can also exert pressure on MNEs by demanding greater transparency and accountability for their actions, and by participating in collective actions or supporting organizations such as NGOs or consumer groups that advocate for more sustainable business practices. For example, in 2010, reports by NGOs exposed Nestle's palm oil sourcing practices as being linked to deforestation and human rights violations, leading to widespread consumer backlash. As a result, Nestlé pledged to only source traceable palm oil and support the conservation and restoration of forests.[11]

On the side of public policies, governments and public authorities are central to setting directions, rethinking the taxation system, and developing infrastructures and services that stimulate transparency and actions of the private actors. Also, governments' actions are necessary to support MNEs in addressing trade-offs they may experience in the CE transition. For instance, the introduction of CE technologies can be initially difficult and expensive for MNEs before becoming cost-effective, as shown by the renewable energy example.[12] Also, the transition to a CE paradigm may not be equally smooth in all the economic sectors and new circular solutions may need time to become profitable. Thus, it may not be desirable for all to pursue CE objectives. In this respect, several countries and regions all over the world recognize the support that CE can give to the construction of a resilient society and have already introduced frameworks and plans to support its implementation. China identified the CE as a national priority in the late 2000s developing since then 14 five-year plans.[13] As a part of its strategy, China supports vehicle remanufacturing sector by providing financial incentives for enterprises to increase collection rate of components and creation of circular loops. The government is also supporting the development of technological advancement and standards and the collaboration among industrial actors and research institutions.

Likewise, Japan released its Circular Economy Vision[14] in 2020, and among other objectives, it aims to enhance the dialogue between companies adopting the CE principles and technologies, and investors and financial institutions, thus recognizing the necessity of a multi-stakeholder approach in this transition.[15]

At a transnational level, the European Union recognizes the shift to a CE as one of the main strategies to prevent and face potential shortages of critical raw materials and construct a resilient European supply chain. In fact, the new European Circular Economy Action Plan,[16] published in 2020, presents a detailed set of measures to be implemented in the next five years to enhance the circular transition in Europe. Among the principal measures, it aims to enhance the durability, reusability, and reparability of products in the electronics, ICT, and textiles industries, increasing their recycled content and restricting single-use and premature obsolescence.

However, to accelerate the shift to the CE paradigm, national and transnational policies are not sufficient, as UNCTAD, UNIDO, and World Bank show with their commitment to multilateral cooperation in circular economy initiatives and the uptake and dissemination of circular practices.[17]

An inspiring example from a close sector is a program developed in 2019 by the UNCTAD in collaboration with the UK Foreign Commonwealth and Development Office (FCDO) aimed at supporting Sub-Saharan African and South Asian countries.[18] The primary objectives of the project include funding research and technology development

11 https://www.greenpeace.org/usa/research/caught-red-handed-how-nestle/ and https://www.nestle.com/sustainability/sustainable-sourcing/palm-oil

12 The UN's Human Development Report (2022) shows that prices of utility-scale solar photovoltaics decreased by 89% between 2009 and 2019 and compared to 1991, lithium-ion batteries are 97% cheaper (https://hdr.undp.org/system/files/documents/global-report-document/hdr2021-22pdf_1.pdf).

13 https://ellenmacarthurfoundation.org/circular-examples/advancing-vehicle-remanufacturing-in-china-the-role-of-policy

14 https://www.meti.go.jp/shingikai/energy_environment/junkai_keizai/pdf/20200522_03.pdf

15 https://www.meti.go.jp/english/press/2021/0119_004.html; https://unctad.org/topic/trade-and-environment/circular-economy

16 https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en; https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF

17 https://www.unido.org/our-focus-cross-cutting-services/circular-economy; https://www.worldbank.org/en/region/eca/publication/squaring-circle-europe-circular-economy-transition

18 Sustainable Manufacturing and Environmental Pollution Programme (SMEP). More information is available at: https://smepprogramme.org

Table 1. Principal actors of the CE transition and examples of good practices.

Actors of the CE transition	Examples of good practices
MNEs	• Introduction of circular activities in the business model such as waste valorization, and diversification into new markets of recycled materials, components and/or products (e.g. Arla case) • Development of robust collaborations with sustainable suppliers (e.g. Enel and Patagonia case) • Reduction of the dependence on raw materials introducing circular loops of secondary raw materials (e.g. Schneider Electric case) • Development of circular-oriented innovations (see EPO data)
Suppliers	• Introduction of recycling technology and circular oriented blueprints • Development of collaboration with the MNEs (e.g. Enel case)
Consumers and civil society	• Purchasing of durable and repairable products; • Purchasing of second-hand products and participation in sharing economy platforms; • Maximization of recycling; • Participation in collective actions or support of the sustainability-oriented activity of NGOs and consumer groups (e.g. Nestlè case)
Transnational and national governments	• Encouragement of collaboration and dialogue among companies, investors, and financial institutions through a multi-stakeholder approach (e.g. Japan's policy) • Facilitation of the development and adoption of new technologies through collaboration among industry players and research institutions (e.g. China's policy) • Introduction of manufacturers' responsibility regulation for the environmental impact of products (e.g. EU policy)
International organizations	• Dissemination of CE practices (e.g. UNCTAD and FCDO program) • Commitment to the development of multilateral cooperation (e.g. UNCTAD, UNIDO and World Bank activity)

aimed at mitigating the negative impacts of manufacturing activities, with a particular focus on addressing the issue of plastic pollution.

Table 1 provides an overview of the key stakeholders involved in the transition to a circular economy, along with examples of best practices that represent some essential actionable insights for achieving this shift. To further advance the achievements of the single actors, it is crucial to develop an internationally coordinated policy framework that, taking into account the global nature of value chains and production systems, facilitates the trade of circular products and materials through harmonization of standards, promotes a change in consumption behavior through labeling and learning programs, and stimulates MNEs to adopt the CE principles in various contexts and institutional settings.

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