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Circular Economy Solutions and Strategies for the Furniture Sector in the European Union

Mauro Attilio Ceconello

Politecnico di Milano

mauro.ceconello@polimi.it

ORCID 0000-0002-4217-5912

Abstract

The paper analyses thematic areas of the circular economy, reflecting the goals of the European Green Deal. The purpose is to explore guidelines, tools, and assessment criteria for how the design and manufacturing of furniture can contribute to a climate-neutral Europe by 2050.

EU is the leading promoter of environmental policies and thus pushes towards disseminating the circular economy paradigm in the furniture sector, identifying current trends and strategies.

In addition to product design, system design solutions are emerging to support new service-oriented business models. The adoption of the circular economy requires a change of business, territorial, and individual visions and to rethink ways of producing and consuming.

By developing the knowledge base for greener and more innovative manufacturing processes, it is possible to understand which strategies are most promising for the sector and to plan for a sustainable and more democratic European furniture design culture.

Keywords

Circular economy

Furniture design

Sustainable development

Europe's Path to a Sustainable Growth

The paper focuses on Circular Economy (CE) strategies in the furniture industry and how European furniture companies can respond to this transition toward a more socially democratic, healthier, and sustainable future. It is conceivable to envision a sustainable European design culture that achieves the aims specified in the *European Green Deal*, shifting toward a more critical environmental challenge than ever. Industry and designers need to consider sustainable design (Fuad-Luke, 2010) practices and processes to consume less energy in resources, manufacture, distribution, and reuse/recycling of furniture products.

The impact of significant crises and economic shocks in recent years affected the EU's economy and society: the pandemic and recovery actions and the Ukraine war outline the urgent need to rethink the financial model and redesign the energy system to respond to new challenges. Smart strategies can serve as a foundation for innovative solutions that benefit society, regional and global economies, and the environment. There is a need to develop further guidelines and utilise assessment criteria leading European furniture companies to achieve climate neutrality by 2050: the European Union has begun that process.

Making sustainable products the norm in a more resilient Single Market



European Commission (EC) launched its first *Circular Economy Action Plan* in 2015. Closing the loop (EC, 2015) defined concrete actions, covering the whole life cycle: from production and consumption to waste management and the market for secondary raw materials and a revised legislative proposal on waste. Member states are encouraged to participate in EU action, integrating and complementing it with national initiatives and global commitments, such as the United Nations *2030 Agenda for Sustainable Development* and

Fig. 1
Overview of initiatives in the Circular Economy package (EC, 2022). Source: https://eur-lex.europa.eu/resource.html?uri=comnat:COM_2022_0140_FIN.ENG.xhtml.COM_2022_0140_FIN_ENG_01002.jpg

the G7 *Alliance on Resource Efficiency*. This action plan will play a critical role in achieving the Sustainable Development Goals (SDGs) by 2030, particularly Goal 12: Promoting sustainable consumption and production practices.

Since then, many measures have helped stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth, and generate new jobs.

On 11 December 2019, the EU Commission announced the *European Green Deal* (EC, 2019) to transform Europe into the first climate-neutral continent by 2050. The plan is to improve the economy by turning climate and environmental challenges into opportunities. The *Green Deal's* goals should result in a competitive circular economy, where there are no net emissions of greenhouse gases by 2050 and economic growth is decoupled from resource use. Following the creation of the European Innovation Council (EIC), the European Commission launched a €1 billion call for research and innovation projects that respond to the climate crisis, support the *European Green Deal* initiative and help protect Europe's unique ecosystems and biodiversity.

The European Commission approved a new *Circular Economy Action Plan* (CEAP) (EC, 2020). This is one of the cornerstones of the *European Green Deal*: the transition to a circular economy will minimise natural resource pressure while generating long-term growth and jobs. The new action plan tries to prevent waste and keep resources utilised in the EU economy for as long as feasible by focusing on product design, promoting and encouraging sustainable consumption through actions that span the whole product life cycle.

In December 2020, the European Parliament finalised *Next Generation EU*, a program to stimulate investments that drive recovery and reforms to increase the sustainability of individual European economies, making them more resilient to the changes looming in the years of recovery from the Covid crisis. Through the *Recovery and Resilience Plans* established in February 2021 (EC, 2021), the European Commission prioritises a green transition supported by reforms and investments.

The proposal for an *Ecodesign for Sustainable Products Regulation* (EC, 2022) addresses product design Fig. 1, which determines up to 80% of a product's lifecycle environmental impact. It establishes new standards to make products more durable, reliable, reusable, upgradable, repairable, easier to maintain, refurbish and recycle, and energy and resource-efficient. The recommendations expand on the success of the EU's existing *Ecodesign guidelines* (EC, 2014), which have resulted in significant reductions in energy use and savings for consumers. According to the press release of the package, existing Ecodesign regulations alone saved customers €120 billion in 2021. The guidelines have also resulted in a 10% reduction in annual energy consumption for the products covered. By 2030, the new framework may save 132 million tons of oil equivalent, or nearly 150 billion cubic meters of natural gas, almost equal to the EU's Russian gas imports.

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Pierce further distinguishes six types of frictional tendencies: divergent friction; oppositional friction; accelerational friction; counterfactual friction; and analogical friction.

Opportunities for a Circular European Furniture Sector

CE is gaining interest as a new industrial paradigm which demonstrates a more rational alternative to the linear economy (Murray, Skene & Haynes, 2017). Korhonen et al. (2018) define CE as “a sustainable development initiative with the objective of reducing the societal production-consumption systems linear material and energy throughout flows by applying material cycles, renewable and cascade-type energy flows to the linear system” (p. 547). The linear economy is a process of making, using, and discarding products. It has been the paradigm for most worldwide industrial output, including furniture manufacturing. CE is an industrial system of manufacturing, distribution, and consumption that is restorative and regenerative by design (Ünal et al., 2019). Restorative suggests a closed-loop cycle that encourages more product output and utility than a linear economy. In a restorative system, technical materials and products are recovered and given new life (Ellen MacArthur Foundation, SUN & McKinsey Center for Business and Environment, 2015).

CE is not a new concept, but it has taken time to develop a conceptual framework with obtainable goals: to extend the life and value of furniture through innovative manufacturing processes enabling reuse, repair, refurbishment, and remanufacturing cycles that respond to the environmental challenges outlined in the *European Green Deal*. The novelty of CE relies upon products designed and manufactured to live longer, applying strategies extending the product's value beyond its conventional End-Of-Life (EOL) use (Ellen MacArthur Foundation, 2013 chiedere ad autore se è giusta data 2013). It is a change in thinking in the approach to how we think about making things. A concept that puts re- in front of use, make, and manufacture, placing value on innovative ways to reuse items. It is valuable and complementary to the Cradle-to-Cradle (C2C) concept (McDonough & Braungart, 2003 manca la reference chiedere all'autore) that has influenced thinking about values in design and manufacturing and has set the stage for today's discussion on the CE.

The Ellen MacArthur Foundation developed a diagram illustrating two intersecting economic systems, linear and circular Fig. 2 showing two closed-loop cycles in distinct sectors: biological and technical. Both hemispheres of the diagram are exciting and effective for the furniture sector. The right hemisphere refers to the design domain, while the left is important for wood, the material that characterises the sector. The central vertical axis represents the linear economic model, while the rest of the diagram illustrates the continuous flow of materials and processes referred to as *value cycles*. A combination of value cycles manifests a traceable impact on the economy and the environment. These two models are often defined as cradle-to-grave (linear economy) versus cradle-to-cradle (circular economy) (Ellen MacArthur Foundation, SUN & McKinsey Center for Business and Environment, 2015).

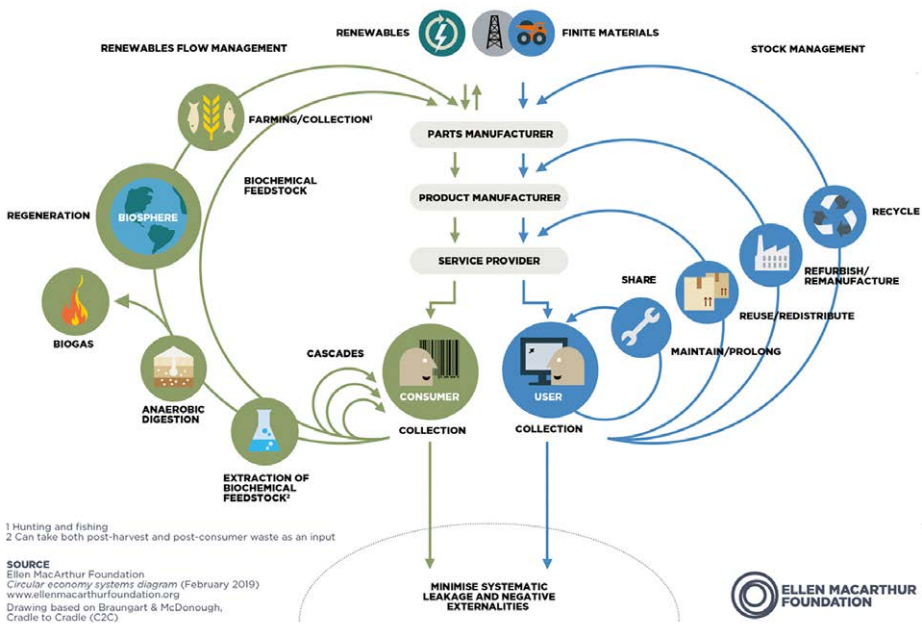


Fig. 2
The Butterfly Diagram for Circular Economy. Circular economy systems diagram. Drawing based on Braungart & McDonough, Cradle-to-Cradle. © Ellen MacArthur Foundation, 2019, www.ellenmacarthurfoundation.org

Addressing the critical problem of natural global resource depletion, the Ellen MacArthur Foundation (2013) has summarised four principles of the CE as *points of action* to revitalise existing material value throughout one or more stages in the manufacturing of products:

- 1 Optimise the use of resources and energy throughout all life cycle stages.
- 2 Maintain production and components in use over a longer time.
- 3 Cycle materials through the production system as many times as possible.
- 4 Utilise pure materials to improve the quality of post-life use.

CE achieves more efficient production and consumption outcomes by moving products and components through continuous use cycles to cause the minimum residual as waste or in a landfill at the product's EOL (De los Rios & Charnley, 2017). The adoption of the circular economy requires a change in how industry and society consider it valuable and accept new ways of consuming products through various cycles, finding ways to recycle a product to exploit all its reiterations of use. Cyclical, closed-loop processes allow for a broad range of strategies and actions for furniture, such as:

- Refurbishing: remanufacturing a product to optimise its life.
- Restoring: refinishing or re-upholstering to extend the condition of a product.
- Repairing: corrective repair of a product.
- Maintaining: preventative maintenance to maximise product life.
- Reusing: redistributing products through a change in ownership.
- Repurposing: changing the functionality of a product.
- Recycling: recovering the value of materials and components in products for reuse.
- Regenerative: a process of regrowing (renewing).

A CE is suitable for industries because it creates opportunities for intelligent and innovative ways of using closed-loop processes to reduce raw materials and energy consumption, waste and emissions generation in the production processes. Adopting the circular economy model does require a change in business practices and consumer behaviour.

Resources for the Furniture Sector

Resources and tools are available to advance sustainable furniture design, build adoptable strategies and strengthen knowledge in the sector. Annotated projects also help benchmark sustainability. The *Ecomind* project was coordinated by Centro Legno Arredo Cantù CLAC with Material Connexion and Istituto Europeo di Design (2006). It was the result of collaborative work that highlights ecological furniture solutions and material strategies. A second is *Eco-Design* (Fuad-Luke, 2010), cataloguing a broad range of products and furniture solutions designed for a sustainable future. Both sources strengthen knowledge about sustainable and eco-sensitive strategies that benefit the environment and argue that eco-sustainability criteria should be given the same consideration as technical, functional, aesthetic, ergonomic and economic considerations in the design process.

Surveys and assessments serve to measure practices and attitudes that assist in adopting the Life Cycle Assessment (LCA), a sustainable methodological design approach for innovative solutions in the various stages of the product life cycle (Ceschin & Gaziulusoy, 2016). The *Ecodesign Directive* by the European Commission (EC, 2005) provides directions for companies to use LCA to evaluate their production processes and products. This self-evaluation tool helps identify sustainable practices and suggests new ones. Many companies in the wood furniture sector can adopt this approach to raise quality standards and be more competitive in a market increasingly attentive to energy use, materials and certifications. The link between sustainability and innovation is growing stronger all the time. A report from Federlegno Arredo and Symbola (2016) highlights the latest trends in the production of the furniture sector among leaders in the European market: it reports on low energy consumption, emissions reduction, waste reduction, and materials recycling. Furniture enterprises are identified by their green practices.

In recent years legislation at the European and international levels has defined rules for the certification of raw materials from responsibly managed and environmentally sustainable sources. The most important is the Programme for Endorsement of Forest Certification (PEFC) schemes and the Forest Stewardship Council (FSC). These programs guarantee that the raw material used in production comes from the controlled cultivation of plants, guarantee protocols that avoid deforestation and commit to maintaining biodiversity in the areas of origin. According to *European Regulation 995/2010* (EC, 2010), materials are verified and certified, defining their origin and compliance with the standards provided. Furniture manufacturers and designers who source certified raw materials can add the endorsement programs to their marketing materials.

The *SAWYER* project, funded by the European Commission and coordinated by CENFIM (2021), analysed the primary legislative and voluntary instruments and how they can affect and transform the European furniture sector in 2030 toward a more circular economy and its Digital and Green Transition. Sustainability and circularity drivers will impact the organisation of work: new production processes and technologies will require new skills and additional training and generate new business models and new market opportunities, ensuring the industry's competitiveness.

The final report analyses the circular economy's state of the art EU furniture sector state of the art (2020 chiedere all'autore qual è la reference corretta e di chiarire il periodo precedente, per confuse uso di "state"). It illustrates general forecasting of the sector in 2030 as the result of a two-step process involving experts in the Circular Economy and the Furniture Sector through online surveys and a workshop. The project team identified the changes expected in eleven key occupational profiles, reporting how the current industries' knowledge, skills, and competencies (KSCs) need to change, and offering recommendations for stakeholders, policymakers and regulatory entities.

From the perspective of the circular economy, designers can use an eco-sustainable approach to design using strategies that consider various factors in product development (Pigosso, McAloone & Rozenfeld, 2015). Focusing not only on the formal and material characteristics of a sustainable product, but also considering the link to other processes such as packaging, marketing, and social performance. This business solution in the design phase can impact waste issues in localised markets. Chiu and Kremer (2011) provide an exhaustive analysis of *Design for X* guidelines and a toolkit, where X stands for any attitude in the design process (Manufacturing, Assembly, Disassembly, Logistics) to supply practitioners with an index for each DfX concept and method. A variety of resources and tools to strengthen CE knowledge in the furniture sector: undoubtedly, there will be more to come.

Remarks and Conclusion

Sustainability and circularity drivers will continue to impact manufacturing processes, new business models and new production processes to ensure the European industry's mid and long-term competitiveness with implications for workers and their safety. In an environmental context, a circular economy approach could drive innovative strategies to prevent and minimise resource consumption, build into the continual product maintenance of materials in time-based cycles, and recycle potential waste into new uses. In addition, the adoption of circular practices results in financial savings. Developing the knowledge base for greener and more innovative manufacturing processes makes it possible to achieve a sustainable and more democratic European design culture. Long term green designs embrace innovative and creative CE values involving social, economic, and ecological systems and require a process-based and multi-scale systemic approach to planning and sustainability guided by a target vision (Bagheri & Hjorth, 2007). Designers, industry,

institutions, and consumers need to consider sustainable design strategies and circular economy models when making decisions and placing value on furniture design (Andrews, 2015). Therefore, it would be desirable to have an agreed-upon standard set of criteria for the furniture sector, complementary to the *Circular Indicators Project* developed by the Ellen MacArthur Foundation and related to the *Green Furniture Mark GFM* (EEB, 2017). The *GFM* deployed alongside other existing EU instruments, such as the EU *Ecolabel* and *Green Public Procurement* criteria, would provide consumers and procurers with a simple means of assessing product circularity. Guidelines and assessment criteria encourage the adoption of CE models for furniture manufacturing in Europe. They can help the industry achieve social, economic, and environmental sustainability and contribute towards reaching the ecological goal of carbon-neutrality outlined in the EU *Green Deal* initiative. The furniture industry had been encouraged to adopt a systemic transition from a linear economy to a circular economy as a more responsible model for achieving the sustainability goals to which many European institutional entities aspire. The takeaway is that there appears to be a gap between the positive attitude towards CE systems and implementation strategies, which suggests potential growth for both institutions and managers involved in sustainable development processes.

In addition to the directions and initiatives analysed here, where might it be appropriate to work? One possible direction could be to invest in training and creating customised tools for the supply chain that promote knowledge, techniques, and culture on these issues. One could hypothesise a driving role for these initiatives on the part of federations and consortia, given that the SME fabric is the predominant sector in Europe. Unfortunately, by their very nature, SMEs often lack the resources to promote these initiatives. Moreover, it is precisely in this context that the Design Department of the Politecnico di Milano presented a proposal for an EU Project coordinated by CENFIM to guide companies in the furniture value chain to deploy their transition strategy for a more circular economy. The Project will deliver an innovative training toolkit to train furniture professionals to lead this transition successfully across the entire value chain. It involves 29 sector stakeholders as full or associated partners with complementary expertise making it possible to achieve project objectives and results.

By developing the knowledge base for greener manufacturing processes, it is possible to plan for a sustainable and more socially democratic European furniture design culture.

Mauro Attilio Ceconello
Architect and Associate
Professor at the Design
Department of Politecnico
di Milano. His teaching
activity focuses on Product
and Industrial Design. Head
of the Design Labs System
of the Design Department,
he is the scientific coordi-
nator of research projects
concerning the valorization
of culture through digital
technologies and interac-
tion tools.

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