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Designing Low-carbon Innovation: Slowing Design Loops for Sustainable Resource Usage and Products.

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The Paris Agreement in 2015 resulting from COP21 and the launch of the European Commission's Circular Economy Action Plan in 2020, have set the vision to low-carbon innovation, emphasising the importance of regenerative design principles, systemic thinking, and intentional methodologies that shift innovation away from linear, outcome-oriented approaches. Design, as one of the oldest traditions of human inquiry and action, is a cultural practice that shapes our ability to imagine and create new conditions and systems based on chance and necessity. Yet, there are weaknesses in design's academic and business frameworks to enable an inclusive transition towards sustainable modes of development, production, and consumption.

This article explores the concept of 'slowing design loops' as a pathway to low-carbon innovation. It hypothesises that existing circular approaches [resource efficiency, longevity, and durability] could be applied to the innovation phases by drawing on the intersection of systems thinking and context-sensitive practices that account for the complexities of global sustainability challenges. By addressing this gap, this article aims to extend innovation's role beyond the creation of new ideas and artefacts to include the design of conditions, systems, and narratives, providing practical guiding strategies for designers and innovators to transform into agents of sustainable cultural and systemic change.

Central to this discussion is the need for storytelling and narratives of change that challenge prevailing ideologies of freedom, independence, and entrepreneurialism often associated with high-carbon systems driven by the oil economy and industry. In this context, it intends to support a new generation of innovation designers who embrace design approaches that are intentional and eradicates waste through responsible and careful design to align cultural, situational, and contextual systems with ecological priorities.

This study employs a mixed-methods approach to explore *a)* how can slowing design loops enable practitioners to reflect on the temporal, cultural, and contextual implications of their decisions? *b)* how can integrating intentional methodologies contribute to low-carbon innovation while fostering narratives of change that challenge linear, high-carbon paradigms? By prioritising intentionality, directionality, and ethical considerations, this study seeks to develop alternative approaches to Western, linear knowledge systems and create space for more inclusive, pluralistic design practices.

The findings of this study contribute to the understanding of how responsible and careful design and innovation processes can foster systems and products that support low-carbon futures while addressing the urgent need for narratives that inspire cultural and systemic transformation. It offers actionable insights for practitioners, researchers, and policymakers seeking to align design practices with the principles of sustainability and regeneration.

By advocating for slow design loops and regenerative practices, this research underscores the potential of design to reshape our relationships with resources, systems, and each other in service of a more sustainable and equitable world. Through this, design emerges not only as a tool for innovation but as a practice of care and stewardship, capable of creating conditions for a low-carbon future.