

Towards Technical Standards for circular economy: a comparative analysis and sustainability implications

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Introduction

The transition to a circular economy represents a paradigm shift from the traditional linear production-consumption model, characterized by the “take, produce, dispose” approach (Ellen MacArthur Foundation, 2012). By emphasizing resource efficiency, waste minimization, and product longevity, circularity fosters the process of economic and environmental regeneration, laying the foundation for a more sustainable future. One of the most frequently cited definitions that incorporate elements from various disciplines has been provided by the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2013) which describes the circular economy as “an industrial system that is restorative or regenerative by intention and design” emphasizing the need to create long-term value.

The effective implementation of this transition relies on robust regulatory and technical frameworks that transform circular principles into tangible and measurable strategies. Standardization efforts offer structured methodologies, providing guidelines, performance metrics, and best practices for organizations seeking to enhance circularity (Geissdoerfer, 2017). Notably, technical standards such as UNI/TS 11820, Afnor XP X 30-90, ISO 59020, and BSI 8001:2017 have emerged, each reflecting distinct cultural, economic, and regulatory perspectives.

This paper examines and compares these standards, analysing their objectives, methodologies, and scope. It investigates their approach to circularity, from strategic guidance (BSI 8001:2017) to performance measurement (UNI/TS 11820 and ISO 59020). Furthermore, it explores their practical applications, highlighting both synergies and limitations. By aligning with the principles of the United Nations' 2030 Agenda for Sustainable Development (United Nations, 2015), this study seeks to provide valuable insights for organizations looking to integrate circular economy standards to foster innovation, compliance, and resilience.

Material and Methods

This research adopts a comparative approach to evaluate four key technical standards for circular economy implementation: UNI/TS 11820, Afnor XP X 30-90, ISO 59020, and BSI 8001:2017. These standards were selected for their relevance in defining and measuring circularity, as well as their representation of diverse regulatory and economic frameworks.

The analysis focuses on three key dimensions: objectives, methodologies, and prescriptiveness, with particular attention to measurement tools and performance indicators. Clear metrics are essential for tracking progress, as highlighted in the Global Circularity Protocol for Business (World Business Council for Sustainable Development, 2024) and supported by Chatham House research (Schröder & Barrie, 2024), which emphasize the need for standardized metrics to avoid policy fragmentation. To support this evaluation, official documentation from standardization bodies and regulatory frameworks were reviewed.

By identifying strengths and gaps in existing frameworks, this study not only clarifies their impact on circularity but also suggests pathways for improving standardization efforts. It highlights opportunities for aligning technical standards with broader sustainability goals, ensuring that organizations can effectively navigate the transition towards a more circular economy.

Results

The comparative analysis of the four technical standards revealed significant differences in their scope, methodologies, and applicability as shown in Table 1 below.

A key finding is that standards with a strong quantitative approach, such as UNI/TS 11820 and ISO 59020, provide precise tools for regulatory compliance and progress tracking through well-defined indicators. Conversely, Afnor XP X 30-90 and BSI 8001:2017 focus on promoting circular economy principles through qualitative guidelines and systemic changes, yet they do not establish specific benchmarks for measuring performance.

The comparative analysis highlights both synergies and limitations among these standards. While ISO 59020 enables international benchmarking, UNI/TS 11820 is more based to Italian regulations. Afnor XP X 30-90 and BSI 8001:2017 prioritize adaptability, making them valuable for transition strategies but less effective in standardized performance measurement. Ultimately, no single standard fully addresses all circular economy aspects, suggesting that a hybrid approach could provide a more comprehensive framework.

Table 1. comparative analysis of the four technical standards.

Aspect Analysed	UNI 11820	Afnor XP X 30-90	ISO 59020	BSI 8001:2017
Geographical Specificity	Italy-focused, aligned with the EU Green Deal.	Contextualized for France, less applicable elsewhere.	Global relevance.	Universal principles, adaptable worldwide.
Main Purpose	Measures circularity through indicators	Provides project-specific guidelines	Measures circularity through standardized metrics	Offers a flexible framework for circular economy transition
Level of Detail	High.	Moderate.	Medium-high	Moderate
Circularity Indicators	detailed set of indicators	No indicators.	Standardized indicators for circular input/output.	No indicators
Measurability & Monitoring	100-point scale, precise measurement.	qualitative approach.	High, standardized monitoring metrics	qualitative approach.
Application Scope	Applicable by organizations	Applicable by organizations	Applicable by organizations	Applicable by organizations

Discussion

The results highlight the complementary strengths and limitations of the four standards analysed. UNI/TS 11820 and ISO 59020 offer structured quantitative frameworks suitable for performance measurement, while Afnor XP X 30-90 and BSI 8001:2017 emphasize strategic and systemic integration, favouring flexibility over rigid parameters.

A major challenge remains the balance between standardisation and adaptability. ISO 59020 provides global comparability but may lack regional specificity, while UNI/TS 11820 is closely aligned with the Italian regulatory environment but is less internationally applicable. In contrast, Afnor XP X 30-90 and BSI 8001:2017 provide valuable strategic direction but lack detailed performance parameters, making their implementation more flexible but less measurable.

Future research should focus on a case study to apply the different circularity standards. This will initially define a hybrid approach, combining quantitative assessment with strategic guidance, to provide the most effective framework for organizations seeking to integrate the principles of the circular economy.

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