BUILDING CAPACITY FOR CIRCULAR ECONOMY: CROSS-REGIONAL INSIGHTS ON WASTE MANAGEMENT, RESOURCE EFFICIENCY, AND ECODESIGN FROM THE BALTIC SEA AND KAZAKHSTAN

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Abstract – This paper explores innovative approaches to waste management capacity building aimed at advancing the principles of circular economy, resource efficiency, and eco-design. The study presents insights derived from collaborative research conducted across six institutions: three research institutes situated along the Baltic Sea and three counterparts based in Kazakhstan. By leveraging case studies and comparative analyses, the research examines the dynamics of knowledge exchange and cross-sectoral integration within the context of energy management and modelling. A key objective of the study is to identify and disseminate best practices in waste valorisation and resource optimization. The research highlights how diverse regional contexts – characterized by differing socio-economic, regulatory, and environmental challenges – can serve as complementary learning environments for fostering innovation. Using a multidisciplinary approach, the participating institutes developed and tested models for sustainable waste management systems that prioritize lifecycle thinking, material reuse, and reduced environmental footprints. Central to the study is the integration of energy management techniques into waste management practices, addressing the complex interdependencies between material flows and energy systems. Modelling tools were employed to simulate scenarios that optimize resource recovery and energy efficiency, demonstrating their applicability in both Baltic and Central Asian contexts. These scenarios reveal opportunities for reducing greenhouse gas emissions, lowering operational costs, and enhancing system resilience. The findings emphasize the importance of cross-border and cross-sectoral collaboration in building adaptive capacities for a circular economy. Knowledge transfer between regions enabled the co-creation of tailored strategies that consider local policy frameworks, technological readiness, and stakeholder engagement. Additionally, the study underscores the role of eco-design in bridging gaps between waste generation and resource recovery, encouraging systemic changes that align with sustainable development goals. This research contributes to the growing body of literature on circular economy practices by providing actionable insights into the implementation of integrated waste and energy management systems. It also offers a framework for replicating similar capacity-building initiatives in other regions facing comparable challenges. The paper concludes by outlining policy recommendations and avenues for future research, with a focus on scaling successful interventions and fostering long-term partnerships. By synthesizing lessons from both European and Central Asian contexts, this study advocates for a globalized yet locally adaptable approach to sustainable waste management and resource efficiency.

Keywords – Circular economy; eco-design; energy management; knowledge exchange; resource efficiency; waste management