

CBL PROJECT AND SUSTAINABILITY – SARRIKO SUSTAINABLE: THE CHALLENGE TO REDUCE, REUSE AND RECYCLE

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Abstract

Waste generation and inadequate management represent one of the most pressing environmental challenges of contemporary societies due to their direct contribution to climate change, biodiversity loss, and resource depletion. Higher Education Institutions (HEIs), as complex socio-technical systems characterized by high population density and turnover—including students, faculty, researchers, and administrative and service staff—generate a significant material footprint associated with their academic, research, and operational activities. Within this framework, the University of the Basque Country (EHU) has positioned the 2030 Agenda as a cross-cutting strategic axis, embedding sustainability principles into governance, teaching, research, and knowledge transfer through initiatives such as *EHUagenda2030 for Sustainable Development*. Aligned with this institutional strategy, the Faculty of Economics and Business promotes the collective initiative “SARRIKO SUSTAINABLE: The Challenge to Reduce, Reuse, and Recycle.” The project aims to foster a structural transformation in consumption patterns and waste management practices on campus, advancing beyond recycling performance toward waste prevention at source and measurable reductions in overall waste generation, consistent with circular economy and zero-waste frameworks. The overarching objective is to empower students as active change agents through the implementation of the Challenge-Based Learning (CBL) methodology. By integrating experiential learning, systems thinking, and collaborative problem-solving, the initiative seeks to generate feasible, scalable, and impact-oriented solutions. The project incorporates environmental performance indicators and impact assessment mechanisms to support evidence-based decision-making and facilitate the campus transition toward a more sustainable and resource-efficient model.

Keywords: CBL, EHU, sustainability, climate change, zero-waste.

1. Introduction and institutional framework

Recycling behavior in university settings has been widely studied as part of broader sustainability efforts in higher education. Universities function not only as educational institutions but also as micro-societies where environmental culture, infrastructure and behavioral norms interact. Research consistently highlights that pro-environmental behavior emerges from a combination of **individual attitudes and institutional context** (Kollmuss & Agyeman, 2002; Vicente-Molina et al., 2013).

One of the most influential frameworks explaining environmental behavior is the **Attitude–Behavior Gap**, which states that high concern for the environment does not necessarily translate into concrete, consistent action (Kollmuss & Agyeman, 2002). This gap appears clearly in recycling behavior, where intention often exceeds actual practice, particularly in campus environments where situational barriers can be substantial.

Several studies emphasize that **environmental knowledge**—particularly knowledge about what can be recycled and how—is positively associated with recycling rates (Saphores et al., 2012; Vicente-Molina et al., 2013). While general awareness tends to be high among university students, detailed knowledge about specific waste streams (e.g., batteries, electronic waste, hazardous residues) remains low, creating inconsistencies in recycling behavior.

Infrastructure availability and accessibility are among the most powerful predictors of recycling behavior on campus (Davis et al., 2006; Menegaki et al., 2009). The presence, proximity, visibility and clarity of recycling containers greatly influence whether individuals engage in pro-environmental acts. Poor signage or bin contamination, frequently reported issues in higher education institutions, reduce the effectiveness of recycling systems and discourage participation.

Gender differences in environmental attitudes have been consistently documented. Women generally show greater pro-environmental concern and are more likely to adopt sustainable habits (Vicente-Molina et al., 2013). However, the interaction between gender and commitment does not always translate into stronger recycling behavior in multivariate analyses, particularly when contextual barriers are strong.

Research also emphasizes the role of **habit formation**. Students who recycle regularly at home are significantly more likely to do so on campus (Barr, 2007; Schultz et al., 1995). Habitual recycling reduces the cognitive burden associated with sorting waste and increases the likelihood of consistent pro-environmental behavior across settings.

In line with these studies, the findings from the Faculty of Economics and Business also confirm that household recycling habits—especially paper and cardboard separation—are strongly associated with campus recycling behavior. Likewise, infrastructural barriers (lack of bins, confusing signage) appear as the main explanations for the attitude–behavior gap observed.

Overall, the literature suggests that effective campus recycling programs must combine **structural improvements, behavioral nudges, and educational communication strategies**, since interventions focusing solely on attitudes are insufficient when the physical recycling environment is inadequate.

Waste generation and management constitute a critical environmental challenge due to their contribution to greenhouse gas emissions, ecosystem degradation, and resource depletion. Within this context, Higher Education Institutions (HEIs) operate as complex socio-technical systems with significant material throughput derived from teaching, research, administrative, and service activities. As knowledge-producing and norm-setting organizations, universities are uniquely positioned not only to reduce their environmental footprint but also to catalyze behavioral and systemic change.

The University of the Basque Country (EHU) has integrated the 2030 Agenda for Sustainable Development as a cross-cutting strategic axis in its institutional policy framework. Through initiatives such as *EHUagenda2030 for Sustainable Development*, sustainability principles are embedded across governance structures, curricula, research agendas, and community engagement strategies. This alignment reflects an understanding of universities as transformative agents capable of advancing Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

In alignment with this institutional commitment, the Faculty of Economics and Business launched the collective initiative “**SARRIKO SUSTAINABLE: The Challenge to Reduce, Reuse, and Recycle.**” The project responds to the need for a structural transformation in campus waste management practices, moving beyond isolated recycling actions toward a comprehensive zero-waste and circular economy framework.

The initiative is grounded in three core premises:

1. Waste reduction must prioritize prevention at source rather than downstream recycling alone.
2. Behavioral change is as important as infrastructural improvement.
3. Students must be positioned as active agents of institutional transformation.

Thus, the project combines operational sustainability goals with pedagogical innovation, integrating environmental performance improvement with competence-based education.

2. Methodological design: Challenge-based learning as a transformative tool

The project adopts the Challenge-Based Learning (CBL) methodology as its pedagogical backbone. CBL is an experiential, student-centered approach that engages learners in solving real-world challenges through inquiry, collaboration, and iterative solution design. Unlike traditional project-based models, CBL emphasizes systemic analysis, stakeholder engagement, and measurable impact.

2.1. Research-action framework

The initiative follows a research-action model structured in four phases:

Phase I: Diagnosis and baseline assessment

The first phase focused on constructing a comprehensive diagnosis of waste generation and management within the faculty building. Rather than limiting the analysis to quantitative waste volumes, the diagnostic process aimed to understand the campus as an interconnected system of material flows, behaviors, infrastructures, and institutional norms.

A waste audit was conducted to quantify the main waste streams generated in academic and administrative activities. Particular attention was paid to packaging consumption, single-use packaging, organic waste from common areas, and electronic waste associated with technological equipment. In parallel, spatial mapping of waste collection points was undertaken to evaluate accessibility, visibility, and functional design.

Complementing the material analysis, a behavioral assessment was carried out through surveys and structured observations. This allowed the identification of discrepancies between declared environmental awareness and actual disposal practices. The diagnostic phase revealed that although recycling infrastructure was present, inefficiencies were generated by inadequate signage, contamination of separated fractions, and limited understanding of the environmental consequences of improper disposal.

The outcome of this phase would be the establishment of a baseline dataset including per capita waste generation, separation efficiency rates, and contamination levels. These indicators would provide an empirical foundation for subsequent interventions and enabled the formulation of measurable objectives.

Phase II: Challenge definition and problem framing

Building upon the diagnostic findings, the second phase consisted of reframing waste management from an operational issue into a strategic challenge requiring systemic solutions. Students were invited to analyze the collected data and identify leverage points capable of producing structural change.

Rather than prescribing predefined problems, the methodology encouraged students to construct the challenge through guided inquiry. This process led to the identification of several interconnected issues: excessive reliance on recycling rather than prevention, normalization of single-use consumption practices, and limited feedback mechanisms regarding environmental performance.

Through facilitated workshops, students reformulated these issues into actionable challenges articulated around measurable impact goals. The reframing process shifted the focus from “improving recycling rates” to “reducing waste generation at source” and from “providing information” to “modifying behavioral incentives.” This conceptual shift was critical in aligning the project with circular economy principles and zero-waste strategies.

The challenge-definition phase thus functioned as a cognitive transformation process, enabling participants to move from fragmented observations toward systemic understanding.

Phase III: Solution co-design and prototyping

The third phase involved the collaborative design of interventions capable of addressing the identified leverage points. Interdisciplinary student teams developed proposals integrating behavioral, infrastructural, technological, and governance dimensions.

Some teams focus on behavioral economics strategies, designing nudging interventions aimed at improving separation accuracy and reducing contamination rates. Others propose redesigns of bin placement and signage to enhance visibility and intuitive use. Additional initiatives include awareness campaigns grounded in data visualization, as well as digital dashboards to communicate real-time environmental performance indicators to the university community.

The co-design process emphasizes feasibility, scalability, and impact measurability. Each proposal requires to define specific Key Performance Indicators (KPIs) and an evaluation plan. This requirement reinforces evidence-based reasoning and strengthened analytical competencies.

Prototyping are conducted at a small scale within selected areas of the Faculty. The iterative nature of the methodology allowed teams to refine interventions based on feedback and preliminary results, fostering adaptive learning and continuous improvement.

Phase IV: Implementation and impact evaluation

The final phase will focus on pilot implementation and systematic impact assessment. Selected interventions will deploy in real campus settings over a defined evaluation period. Quantitative indicators—such as reductions in total waste volume, improvements in separation rates, and decreases in contamination—will be measured against the baseline established in Phase I.

Simultaneously, qualitative data were collected through follow-up surveys and focus groups to assess shifts in environmental awareness, perceived responsibility, and sense of agency among participants. The integration of quantitative and qualitative evidence enabled a multidimensional evaluation of outcomes.

Preliminary results indicate measurable improvements in separation efficiency and a moderate reduction in mixed waste generation in pilot areas. More significantly, the process contributed to a cultural shift in which sustainability was increasingly perceived as a shared institutional responsibility rather than an external administrative mandate.

The evaluation phase also will generate strategic recommendations for scaling the initiative across other faculties, demonstrating the model's transferability.

3. Discussion: Educational and institutional implications

The SARRIKO SUSTAINABLE initiative illustrates the potential of integrating sustainability governance with pedagogical innovation. By embedding environmental challenges within curricular activities, the project transforms the campus into a living laboratory for sustainable transition.

From an educational perspective, the CBL methodology enhances systems thinking, collaborative problem-solving, and data-driven decision-making. Students engage with real institutional constraints, negotiate stakeholder interests, and confront the complexity inherent in sustainability transitions. This experiential dimension strengthens both cognitive and ethical competencies.

From an institutional perspective, the initiative contributes to operational sustainability while fostering participatory governance. The incorporation of measurable environmental indicators supports accountability and evidence-based management. Furthermore, the project reduces the gap between institutional sustainability discourse and daily practices.

Importantly, the initiative reveals that infrastructural improvements alone are insufficient. Behavioral and cultural dimensions are central to achieving durable change. Universities must therefore design sustainability strategies that integrate structural redesign with participatory engagement mechanisms.

4. Conclusions

The transition toward sustainable and circular waste systems in Higher Education Institutions requires systemic, participatory, and evidence-based approaches. The SARRIKO SUSTAINABLE initiative demonstrates that Challenge-Based Learning provides a robust framework for aligning environmental performance improvement with transformative education.

First, the project confirms that universities can function as experimental ecosystems where sustainability challenges are addressed through collaborative innovation. By positioning students as co-creators of solutions, the initiative strengthens institutional ownership and long-term commitment.

Second, the findings underscore the importance of prioritizing waste prevention and behavioral change over downstream recycling strategies. Structural redesign must be accompanied by cognitive and cultural transformation.

Third, the integration of environmental KPIs and impact assessment mechanisms enhances governance quality and supports informed decision-making. Sustainability becomes measurable, monitorable, and strategically embedded.

Fourth, the initiative offers a scalable and replicable model adaptable to other faculties and institutions. Its modular design and evidence-based methodology facilitate transferability across contexts.

Ultimately, the project moves beyond symbolic adherence to the 2030 Agenda and demonstrates how sustainability can be operationalized through the convergence of pedagogy, governance, and community engagement. By transforming the campus into a living laboratory for circular economy practices, SARRIKO SUSTAINABLE contributes to redefining the role of higher education in addressing global environmental challenges.

There is still a long way to go in this project that grows in numbers and interest every day.

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