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on Resilience and Sustainable Regions

BOOK OF ABSTRACTS

2-4 July 2025

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Editorial Note

The Book of Abstracts of the 2nd International Conference on Resilience and Sustainable Regions (ICRSR 2025) bring together a diverse collection of extended abstracts presented at the Polytechnic Institute of Setúbal (Portugal), held from 2 to 4 July 2025. This second edition further consolidates the conference as an annual forum for interdisciplinary dialogue on how territories (urban, peri-urban, coastal, and rural) can strengthen their adaptive capacity and pursue sustainable development pathways in a context of increasing uncertainty and systemic risk.

ICRSR 2025 was organised by the Polytechnic Institute of Setúbal, with the participation of national and international institutions and contributions from partner networks, including the E³UDRES² Alliance, Businet, and the International Business Week Network. The conference was designed to foster exchange between research and practice, encouraging cross-fertilisation of ideas, methods, and evidence across scientific domains that shape regional resilience and long-term sustainability.

Why resilience and sustainability matter for regions and stakeholders

Regions face interconnected pressures: climate risks, demographic change, disruptions in value chains, technological transitions, and widening social inequalities. In this landscape, resilience should be understood not merely as recovery, but as the capacity to anticipate, adapt, transform, and learn, while safeguarding social cohesion and ecological systems. Sustainability, in turn, requires that economic development respects environmental limits and embraces responsibility towards both present and future generations.

The Setúbal region and its wider metropolitan and coastal context provide a particularly pertinent setting for these discussions. The coexistence of industry, services, tourism, agriculture, mobility corridors, and environmentally sensitive areas underscores the need to integrate management decisions with technological, engineering, and environmental solutions: an orientation that lay at the heart of this edition of the conference.

Programme structure and thematic organisation

The programme combined plenary moments with thematic sessions, creating space for shared reflection and specialised discussion. Two keynote addresses served as conceptual anchors:

- “Climate Modelling and AI for a Resilient Earth in the Context of Climate Change” (Pedro Matos Soares), highlighting the growing role of modelling and artificial intelligence in supporting resilience-oriented decision-making;
- “Resilience as Relationship: Rethinking Sustainability in Times of Systemic Change” (Antje Disterheft), proposing a relational and transformative approach to resilience, centred on care, learning, mutuality, and alignment between policy and lived realities.

The conference featured five parallel-session slots, with three sessions running concurrently in each slot, totalling 15 thematic sessions hosted across multiple rooms. These sessions covered a multidisciplinary agenda connecting management, technology, engineering, environmental approaches, and the social dimensions of sustainable development.

The 15 sessions were organised around the following themes (as per the official programme):

1. Collaborative Strategies for Regional Sustainability
2. Artificial Intelligence and Sustainable Innovation
3. Organizational Well-being and Leadership
4. Infrastructure and Logistics for Resilient Territories
5. Educational Innovation and Digital Tools for Sustainability
6. Branding and Organizational Innovation
7. Innovation in Agri-Food Sustainability
8. Youth, Emotions and Innovation
9. Inclusion, Gender and Social Equity
10. Biotechnologies for Environmental Remediation
11. Teaching and Participatory Innovation
12. Smart Technologies for Environmental Resilience
13. Circularity, Waste and Water Strategies
14. Health, Environment and Lifestyle
15. Sustainable Innovation in Food and Beverage Systems

About this volume

This volume compiles the 50 extended abstracts presented across the parallel sessions, reflecting a wide range of approaches: conceptual frameworks, qualitative and quantitative analyses, methodological developments, and applied case studies. Collectively, the contributions converge on a central message: regional resilience and sustainability do not result from isolated interventions, but from coordinated strategies that link governance, innovation, technological capacity, social inclusion, and environmental stewardship.

We hope this book of abstracts serve not only as a record of the conference, but also as a resource for researchers, students, decision-makers, and practitioners, supporting continued collaboration across disciplines and sectors, and strengthening our collective capacity to build more resilient, sustainable, and socially just regions.

Teresa Costa
Conference Chair, ICRSR 2025

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SPECIAL SESSION 1

COLLABORATIVE INNOVATION AND DIGITAL CO-CREATION FOR SUSTAINABLE TOURISM FUTURES

Relevance of the topic

The transformation of the tourism industry in the face of climate change, digitalization, and shifting societal values requires new paradigms of governance, strategic thinking, and stakeholder coordination. At the core of these challenges lies the imperative for more effective and forward-looking tourism management. This special session, anchored in the SHIFT research project (Sustainability-oriented, Highly interactive, and Innovation-based Framework for Tourism Marketing) highlights how management practices can integrate collaboration, technology, and co-creation to foster sustainable and resilient tourism ecosystems.

Tourism management must evolve from traditional models towards approaches that embrace systemic complexity, participatory governance, and cross-sector innovation. The papers included in this session address precisely this need by examining the design and implementation of collaborative marketing strategies, stakeholder engagement through co-creation platforms, and scenario planning as a strategic management tool. In doing so, they provide critical insights into how destination management organizations, policy makers, and tourism enterprises can anticipate global trends and co-develop inclusive and adaptive responses.

In a context marked by environmental, technological, and social transitions, this session, composed of five presentations (the first introducing the project and the remaining four presenting its core results), is highly relevant for scholars and practitioners seeking to reimagine tourism management as a discipline that not only responds to change but actively shapes sustainable futures through innovation, interactivity, and stakeholder synergy.

Theoretical framework of the topic

This session is supported by a multidisciplinary theoretical foundation that connects strategic tourism management, collaborative marketing, and technology-enabled co-creation as key pillars of sustainable tourism transformation.

In the field of strategic management, recent literature highlights the importance of foresight and systems thinking to address global disruptions. Studies by Duan et al. (2021), Postma and Yeoman (2021), and Seyitoğlu and Costa (2022) emphasize the value of scenario planning in building adaptive and resilient tourism strategies.

Research on collaborative destination marketing draws on the framework proposed by Wang and Xiang (2007), which identifies trust and strategic alignment as core drivers of cooperation. This perspective is expanded by authors such as Ngo et al. (2018) and Wilke et al. (2019), who highlight the increasing importance of sustainability and innovation as key motivations for collaborative marketing practices in tourism.

The literature on digital co-creation explores how interactive platforms enable tourists, residents, and providers to co-produce value. Binkhorst and Dekker (2009) define co-creation as central to contemporary tourism experiences, while studies such as Chen et al. (2020) and Lin et al. (2017) show how digital tools foster engagement and shared innovation. Usability and persuasive design are further supported by Nielsen (1994) and Fogg (2009), whose models guide the development of effective and sustainability-oriented technologies.

Together, these theoretical perspectives offer an integrated framework for rethinking tourism management through collaboration, innovation, and long-term sustainability.

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Special Session

Collaborative Innovation and Digital Co-creation for Sustainable Tourism Futures

ADDRESSING MACRO IMPACTS AND SCENARIO-BASED STRATEGIES FOR TOURISM INDUSTRY RESILIENCE

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Extended Abstract

Purpose– This study examines future tourism scenarios over the next five years, focusing on climate change and digital transformation. It assesses key challenges and opportunities, offering strategic insights to help industry stakeholders adapt to an evolving landscape.

Theoretical framework – The study is grounded in scenario planning and the CATWOE framework, which are widely used in strategic management to analyse complex systems and anticipate future uncertainties. The research builds on existing literature to offer a robust theoretical lens for assessing long-term trends.

Design/methodology/approach – This study follows a three-phase qualitative approach:

Systematic Literature Review (PRISMA) – Identifies key macro factors affecting tourism.

Expert Interviews (Non-Tourism) – Engages 13 specialists to highlight climate change and digital transformation as key trends.

Tourism Expert Interviews (CATWOE Framework) – Examines industry adaptation strategies through semi-structured interviews and content analysis (NVivo software).

Findings – The study reveals two primary scenarios:

Climate Change Scenario – Tourism will adapt to shifting seasons and weather changes, increasing demand for eco-friendly travel and “last chance” destinations. The industry will invest in renewable energy, sustainability, and contingency planning.

Digital Transformation Scenario – AI, VR, and digital platforms will enhance customisation, automation, and efficiency in tourism. While virtual tourism will expand, in-person experiences will still dominate. Business travel will decline due to remote collaboration technologies.

Research, practical & social implications –

Theoretical: Enhances scenario planning in tourism by incorporating non-tourism expert insights and the CATWOE framework.

Practical: Helps policymakers and tourism operators create adaptive strategies for sustainable tourism and digital innovation.

Social: Highlights the impact of climate-driven migration and digital nomadism on global tourism, emphasising the need for inclusive and sustainable policies.

Originality/value - This study integrates macro-trend analysis, expert insights, and scenario planning to forecast tourism’s future amid climate and technological changes. It provides actionable insights for industry stakeholders, contributing to academic research and practical strategy development.

Keywords - Tourism scenarios, climate change, digital transformation, sustainability, CATWOE framework.

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Special Session

Collaborative Innovation and Digital Co-creation for Sustainable Tourism Futures

MOTIVATIONS FOR MARKETING COLLABORATION IN SUSTAINABLE TOURISM

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Extended Abstract

Purpose - Interorganizational collaboration is vital for sustainable and resilient destinations. This study explores key motivations for tourism agents to collaborate. By addressing collaboration in the context of sustainable tourism marketing, this study contributes to a better understanding of collaboration in dynamic and complex tourism environments.

Theoretical framework - This study builds on inter-organizational collaboration and destination marketing theories, including Wang and Xiang's (2007) framework and recent marketing collaboration approaches. While literature links collaboration to strategic, learning, cost, and market factors, this study adds entrepreneurial and sustainable orientation as key drivers for collaboration in the context of resilient tourism destinations.

Design/methodology/approach - This study adopts an abductive approach, combining a literature review with qualitative data from interviews with European tourism policy representatives and focus groups with industry professionals. NVivo-assisted analysis identified key collaboration motivations.

Findings - The findings reveal five key motivations for collaboration in tourism marketing: sustainability-, market-, learning-, cost-, and entrepreneurial orientation. Sustainability is increasingly relevant due to environmental and social challenges. Market orientation enhances competitiveness while learning fosters knowledge exchange. Cost reduction is crucial for SMEs, and entrepreneurial orientation influences managers' willingness to accept risk and collaborate.

Research, practical & social implications - This study expands collaboration models in tourism by introducing new motivations. Understanding these drivers enables more effective collaboration.

Findings offer insights for tourism agents on how to enhance collaborative marketing. Public policies have a relevant role in supporting collaboration. Tourism agents must foster dialogue, drawing on their motives, to facilitate partnerships. Socially, collaboration improves tourism experiences, inclusivity, and destination identity.

Originality/value - This study builds on existing research by adding new empirical data to highlight the key motivations for collaboration in sustainable tourism marketing. While previous studies emphasised strategic and economic factors, this research highlights other motives. Linking theory with empirical findings offers actionable recommendations for stakeholders, promoting collaboration as a tool for long-term resilience and sustainable destination management.

Keywords - Tourism; collaboration; collaborative marketing; sustainability; resilience

Funding and Acknowledgements

This research is supported by the “Fundação para a Ciência e Tecnologia” (FCT), from Portugal, through the SHIFT project (Sustainability-oriented, Highly interactive, and Innovation-based Framework for Tourism marketing), with the reference PTDC/EDE-OGE/2146/2021.

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Special Session

Collaborative Innovation and Digital Co-creation for Sustainable Tourism Futures

**SUSTAINABILITY, TECHNOLOGY, AND CO-CREATION:
SHAPING THE FUTURE OF SUSTAINABLE TOURISM**

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Extended Abstract

Purpose - This study examines the interplay between sustainability values, technology importance, and co-creation in the tourism context. The aim is to understand how sustainability-driven attitudes influence tourists' adoption of technology and, through this mechanism, foster more engaging and responsible co-creation practices that shape the future of sustainable tourism.

Theoretical framework - Building upon extensions of the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Theory of Planned Behavior (TPB), this research integrates sustainability concerns into established frameworks. In addition, it draws on Service-Dominant Logic (SDL) and Value Co-Creation Theory to conceptualize how digital tools can mediate the relationship between sustainability values and tourist behavior.

Design/methodology/approach - A conceptual model was developed and empirically tested using Partial Least Squares Structural Equation Modeling (PLS) with data gathered from 401 tourists in the Lisbon region. Validated scales measured sustainability values, the perceived importance of technology, co-creation value, and co-creation intention. The model assessed both direct and mediated relationships among the constructs to identify the pivotal role of technology in enhancing co-creation practices in sustainable tourism.

Findings - Results indicate that while sustainability values alone do not directly drive the perceived value of co-creation or the intention to co-create, they significantly influence tourists' perception of importance of technology. In turn, the importance of technology fully mediates the relationship between sustainability values and both the co-creation value and co-creation intention. These findings emphasize that technology acts as an essential enabler, transforming sustainability attitudes into tangible co-creation behaviors.

Research, practical & social implications - Theoretically, the study extends traditional models by incorporating sustainability into technology adoption frameworks, highlighting the mediating role of digital tools in promoting co-creation. Practically, the findings offer actionable insights for tourism stakeholders, suggesting that investments in user-friendly, responsive technology can enhance tourists' experiences and satisfaction. Socially, integrating technology with sustainability efforts can drive ethical tourism practices that benefit local communities and the environment, fostering a more inclusive and responsible tourism industry.

Originality/value - This research uniquely bridges sustainability values and technology-enabled co-creation, challenging the notion that sustainability alone motivates active participation in tourism experiences. It provides novel insights into how digital innovation can transform sustainable tourism practices, offering a fresh perspective for both academia and industry on designing strategies that meet evolving tourist expectations in a digital age.

Keywords – Sustainability, technology, co-creation, tourists, tourism, destination management.

Funding and Acknowledgements

This research is supported by the “Fundação para a Ciência e Tecnologia” (FCT), from Portugal, through the SHIFT project (Sustainability-oriented, Highly interactive, and Innovation-based Framework for Tourism marketing), with the reference PTDC/EDE-OGE/2146/2021.

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Special Session

Collaborative Innovation and Digital Co-creation for Sustainable Tourism Futures

SHIFT PLATFORM: INVESTIGATING USER INTERACTION DESIGN FOR THE CO-CREATION OF TOURISM PRODUCTS

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Extended Abstract

Purpose – This research introduces the SHIFT platform, a ubiquitous system designed to promote sustainable tourism by enabling the co-creation of tourism products with tourists, residents, and tourism agents. It aims to investigate user interaction and demonstrate how tech-supported collaboration fosters inclusive, localized tourism solutions aligned with sustainability goals.

Theoretical framework – The research is grounded in co-creation theory (Binkhorst & Dekker, 2009), HCI principles (Nielsen, 1994), and persuasive system design, specifically the Fogg Behavior Model (Fogg, 2009), while aligning with the UN Sustainable Development Goals to encourage responsible innovation.

Design/methodology/approach – A design science approach guides this research, combining iterative design with expert focus groups. Qualitative thematic analysis of recorded sessions and structured questions captured key feedback from tourism professionals to improve platform usability and strategy (Chen et al., 2020).

Findings – Preliminary evaluations highlight the SHIFT platform's potential to support engagement and sustainable tourism. Experts valued its co-creation approach and praised the gamification features, monitoring tools, and SDG alignment for fostering participation (Lin et al., 2017).

Research, practical & social implications – SHIFT bridges theory and application in sustainable tourism and co-creation. Practically, it supports localized tourism development, while socially it promotes community involvement and stakeholder equity. Future tests will explore broader engagement scenarios (Chen et al., 2020).

Originality/value – SHIFT platform uniquely merges gamification, SDG metrics, and real-time feedback into a collaborative system. This integration expands research on HCI and sustainable tourism by offering a digital-first, stakeholder-inclusive innovation model.

Keywords - Co-creation, tourism, HCI, gamification, sustainability.

Funding and Acknowledgements

This research is supported by the “Fundação para a Ciência e Tecnologia” (FCT), from Portugal, through the SHIFT project (Sustainability-oriented, Highly interactive, and Innovation-based Framework for Tourism marketing), with the reference PTDC/EDE-OGE/2146/2021.

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SPECIAL SESSION 2

VALUE CREATION IN THE SOCIO-BIOECONOMY IN THE AMAZON REGION: INTEGRATING TRADITION, INNOVATION AND ENVIRONMENTAL SERVICES

Prof. Dr. Simone Galina - FEARP/USP

Relevance of the topic

This session aims to provide experiences and knowledge exchange on value creation for businesses of traditional peoples and communities (TPCs) (usually cooperatives) through the sustainable exploration of the socio-bioeconomy in the Amazon region. TPCs are keepers of traditional knowledge and practices and should be valued not only as guardians of the forest but also as disseminators of knowledge that can help mitigate climate change and environmental destruction. In this context, we propose to discuss factors that not only add value to their community businesses but also ensure that this value remains within the territory. To achieve this, we will address three key issues: alliances for innovation, payment for environmental services, and sustainable productive chains.

Theoretical framework of the topic

The Amazon region is made up of a unique biodiversity, which has been shaped for millennia by human action (Levis et al. 2018; Maezumi et al. 2018), making biological diversity inseparable from social, cultural and economic dimensions (sociobiodiversity). In the Brazilian Amazon economic exploitation of sociobiodiversity has been characterized by the commercialization of native products) through traditional (and sustainable) agro-extractive activities. These activities are based on traditional knowledge passed down through generations (Garnett et al., 2018), and are carried out by traditional peoples and communities (TCP), mainly represented by indigenous peoples, quilombolas, riverside communities and those who reside in the forests (Nhemb et al., 2017).

Although the Amazon's natural resources have been consistently exploited as raw materials for the manufacturing, food, pharmaceutical, and cosmetics industries (De Souza et al., 2022), the perpetuation of poverty among traditional communities remains persistent (Santana, 2022). It caused by factors as the lack of collective organization, informality in the production chain, low level of innovation and inadequate public policies (Bachi & Ribeiro, 2023).

It is therefore necessary to promote productive inclusion of local people that respect their social organization systems and, at the same time, value local natural resources, practices, knowledge and traditional technologies to obtain social gains. At the same time, it is necessary to discuss (or implement) strategies to stimulate markets that value sociobiodiversity products (socio-bioeconomy) through sustainable and inclusive value chains (Costa et al., 2022). With this, PCTs are expected to produce based on low-impact techniques and committed to maintaining or recovering control of the territory they explore, providing an environmental service to the ecosystem (Cunha & Almeida, 2000). Sustainable production practices for income generation are associated with the management of natural resources and agro-extractive production, enabling the commercialization of raw materials derived from the forest (Morsello, 2006). To this end, businesses are created in the community (and by the community) and generally have social and environmental purposes simultaneously, with initiatives that aim to generate income. To achieve these objectives, it is common for them to organize themselves into cooperatives, in which internal relationships (between producers,

communities and cooperatives/associations) and external partnerships can promote community businesses. Furthermore, they are inserted in economically competitive environments and establish strategic partnerships with various purposes, including innovating and complementing their organizational capabilities.

Thus, we propose a discussion on the challenges and opportunities of this business model, created and led by TPCs, addressing value creation through socio-bioeconomy: partnerships for innovation and differentiation; payment for environmental services; participation in productive chain. These topics will be further explored through the presentation of a real case from the CoFruta Cooperative, located in the Northeast region of Pará (Danylla Silva).

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Parallel Session

Session 1 – Collaborative Strategies for Regional Sustainability

**SOCIAL ENTREPRENEURSHIP IN A RURAL CONTEXT:
CHALLENGES AND OPPORTUNITIES FOR SUSTAINABLE
DEVELOPMENT IN CANHA AND PEGÕES**

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Extended Abstract

Purpose – This study analyzes the role of social entrepreneurship (SE) in the development of rural areas in the parishes of Canha and Pegões, in the municipality of Montijo, in Portugal, territories characterized by social vulnerabilities and structural challenges. The objective is to highlight how SE can contribute to social inclusion and community cohesion, while boosting the economic revitalization of these territories. In addition, the main obstacles to the effective implementation of SE initiatives are identified. The study dialogues with the existing literature on rural entrepreneurial ecosystems and the relationship between social entrepreneurship and socioeconomic development (van Twuijver et al., 2020; Aguilar, 2021; Tabares et al. 2022; Ricket et al., 2023).

Theoretical framework – The study is based on the approach of entrepreneurial ecosystems and highlights the interaction between institutional factors, local resources and social dynamics for the development of SE. In addition, it is based on the theory of social entrepreneurship as a mechanism for socio-economic transformation, capable of addressing structural challenges and promoting sustainable solutions for communities in vulnerable situations, especially in rural contexts.

Design/methodology/approach – A qualitative approach was adopted, with focus groups involving local social entrepreneurs, institutional representatives and community members. The data analysis followed an interpretative perspective to map social vulnerabilities, identify opportunities and understand the main challenges for the implementation of SE initiatives in rural territories with low population density.

Findings – The study indicates that the success of SE in rural areas depends on factors such as the existence of collaborative networks, access to financing and the adequacy of the legislative framework. However, difficulties such as the scarcity of financial resources, deficient infrastructure, inclusion problems, and distrust in institutions emerge as significant barriers to the implementation and expansion of these initiatives. In addition, the ability to mobilize local resources and the creation of community networks are crucial for the sustainability of SE.

Research, practical & social implications – The study reinforces the relevance of entrepreneurial ecosystems as support for SE and sustainable development in rural territories. In practical terms, it highlights the need for adjusted public policies and collaborative strategies across sectors to mitigate the challenges identified. Socially, it highlights the potential of SE to promote community cohesion and create innovative solutions to persistent problems, boosting equity and resilience in rural communities.

Originality/value – This study contributes to research on SE in rural contexts by bringing together two perspectives: entrepreneurial ecosystems as facilitators of innovation and socio-economic development and the importance of community networks and local resource mobilization for the sustainability of SE initiatives. By focusing on a specific territory (Canha and Pegões), the study offers a contextualized analysis that can serve as a reference for public policies and development strategies in other areas of low population density.

Keywords - Social entrepreneurship, social entrepreneurship ecosystems, rural development, community networks.

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Parallel Session

Parallel Session

Session 1 – Collaborative Strategies for Regional Sustainability

WECONOMY TRANSITION CANVAS: A THEORETICAL PERSPECTIVE

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Extended Abstract

Purpose – The WEconomy Transition Canvas (WETC) is a practical approach to organizing collaboration among various stakeholders (such as citizens, businesses, and governments) with the aim of achieving collective impact on sustainability, circularity, livability, and biodiversity.

Theoretical framework – Organizations nowadays face many wicked problems related to sustainable development (Weber & Khademian, 2008). These wicked problems must be addressed collectively and from the perspective of multiple value creation (Jonker & Faber, 2021). Consequently, new forms of collaboration between organizations are emerging, focusing on creating sustainable impact (Jonker, 2025). This development gives rise to new organizational challenges and innovative business models based on collaboration (Kamm, 2022).

Design/methodology/approach – The WETC is grounded in practice. We have examined how organizations initiate and structure collaboration aiming for sustainable impact. This research has resulted in the dynamic WEconomy Transition Model, a flexible framework consisting of three phases. Each phase comprises multiple building blocks that contribute to shaping the collaboration. For practical use we have translated the WEconomy Transition Model into a practical canvas that organizations can use to structure and organize collaboration. This canvas is supported online by a workbook, interactive landing page, whitepaper and an (online) tool. The WETC is designed to break down the complexity of collaboration into manageable components. To help organize and connect these components, suggestions and tools are provided.

Findings – The WETC was launched (as open access) in March 2025. Currently collaborations are starting to use it and provide feedback. Reactions are positive and we feel WETC could be used in an international context.

Research, practical & social implications – Within the workshop the theory and methodology is explained. Elaboration will be provided to the process of the currently available resulting materials (such as the workbook, whitepaper, interactive landing page, tool and workshop format). After the workshop, participants have gotten a small taste of what the WETC has to offer.

Originality/value – The WETC can play an important role in strengthening and speeding up the organization of collaboration and increasing the speed of transitions that aim to have an impact on sustainability, circularity, livability, and biodiversity. Considering these developments often involve different stakeholders in an international context, we find it important to further develop (and use) the WETC-approach with international partners. After all, collaboration does not stop at the border of a country or continent, yet the context changes in different cultures.

Keywords – Organization, collaboration, transition, impact, sustainability, tooling.

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Parallel Session

Session 1 – Collaborative Strategies for Regional Sustainability

WECONOMY TRANSITION CANVAS: TOWARDS A PRACTICAL APPLICATION

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Extended Abstract

Purpose – The WEconomy Transition Canvas (WETC) is a practical approach to organizing collaboration among various stakeholders (such as citizens, businesses, and governments) with the aim of achieving collective impact on sustainability, circularity, livability, and biodiversity.

Theoretical framework – Organizations nowadays face many wicked problems related to sustainable development (Weber & Khademian, 2008). These wicked problems must be addressed collectively and from the perspective of multiple value creation (Jonker & Faber, 2021). Consequently, new forms of collaboration between organizations are emerging, focusing on creating sustainable impact (Jonker, 2025). This development gives rise to new organizational challenges and innovative business models based on collaboration (Kamm, 2022).

Design/methodology/approach – The WETC is grounded in practice. We have examined how organizations initiate and structure collaboration aiming for sustainable impact. This research has resulted in the dynamic WEconomy Transition Model, a flexible framework consisting of three phases. Each phase comprises multiple building blocks that contribute to shaping the collaboration. For practical use we have translated the WEconomy Transition Model into a practical canvas that organizations can use to structure and organize collaboration. This canvas is supported online by a workbook, interactive landing page, whitepaper and an (online) tool. The WETC is designed to break down the complexity of collaboration into manageable components. To help organize and connect these components, suggestions and tools are provided.

Findings – The WETC was launched (as open access) in March 2025. Currently collaborations are starting to use it and provide feedback. Reactions are positive and we feel WETC could be used in an international context.

Research, practical & social implications – Within the first presentation, the participants have gathered insight into how the results were created. During the workshop the application of the theory and methodology in different contexts (such as citizens, students, businesses and governments) is explained. The different materials connected to the WETC (such as the workbook, whitepaper, interactive landing page, tool and workshop format) and their expected roles in the process are elaborated upon.

Originality/value – The WETC can play an important role in strengthening and speeding up the organization of collaboration and increasing the speed of transitions that aim to have an impact on sustainability, circularity, livability, and biodiversity. The second presentation adds an extra dimension through showing different methods of application in practice in different contextual landscapes. Considering these developments often involve different stakeholders in an international context, we find it important to further develop (and use) the WETC-approach with international partners. After all, collaboration does not stop at the border of a country or continent.

Keywords – Organization, collaboration, transition, impact, sustainability, tooling.

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Parallel Session

Session 2 – Artificial Intelligence and Sustainable Innovation

MACHINE LEARNING REGRESSION MODELS TO FORECAST SERVICE REQUEST PATTERNS

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Extended Abstract

Purpose – The primary purpose of this study is to develop a predictive model that can forecast demand from different clients to correctly schedule the company's service capacity and minimize the costs of the used infrastructure. The research will explore various machine learning algorithms, particularly for regression, to develop an effective predictive framework. In this stage, a representative client data was used to evaluate the accuracy of the regression models to forecast the service demand.

Theoretical framework – Machine learning regression models are powerful tools for forecasting across diverse domains, offering the ability to capture complex, non-linear relationships within data (Bishop, 2006; James et al., 2023). These models include techniques like linear regression, polynomial regression, support vector regression, and neural networks, capable of learning from vast datasets and adapt to evolving patterns (Makridakis et al., 2018). This adaptability is crucial for accurate forecasting, as it allows for the incorporation of numerous influencing factors and the identification of subtle trends that might otherwise be overlooked.

Design/methodology/approach – The CRISP-DM (Cross-Industry Standard Process for Data Mining) methodology was used in the project (Wirth & Hipp, 2000)). Historical data from the service usage was collected from a large client to develop the model. The data was explored to improve its quality and select and/or generate new variables useful for the model. Multiple configurations were tested, with distinct variables and algorithms, and evaluated using traditional performance measures (Botchkarev, 2018) to compare and identify the best models in an iterative improvement cycle.

Findings – This study was able to develop models with good R^2 score (>90%). The transformations on the original data, with a small number of variables, was effective to obtain new variables that were used to train the models.

Research, practical & social implications – With the predictive model obtained in this study, the company can predict the service demand trough each day, in slots of one hour, allowing it to efficiently define the active resources to assume the quality of service. In future developments, this model can be combined with other variables to define a new model capable to predict the demand from multiple clients, considering their characteristics as input.

Originality/value – The predictive model is an essential component for the company to forecast the service availability offered for its clients without incurring unnecessary costs resulting from the overallocation of resources, given the real need in each period of the day. In addition to reducing costs, energy waste is indirectly decreased, making the service more sustainable.

Keywords – Machine learning, regression, demand forecast.

Funding And Acknowledgements

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Parallel Session

Session 2 – Artificial Intelligence and Sustainable Innovation

INTEGRATING INDUSTRY 4.0 IN CIRCULAR ECONOMY

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Extended Abstract

Purpose — The transformation of CE by Industry 4.0 technology brings hope to sustainable development. The latest literature review material focuses on Industry 4.0 and CE (Awan et al., 2021). This paper considers how new technology such as the Internet of Things, Artificial Intelligence, and Big Data could enhance established practices in CE—but only from an industry perspective that cannot provide a human-based or ecological economy (Bag et al., 2021; Enyoghasi & Badurdeen, 2020).

It aims to analyze the literature and raise hope for the future by recognizing critical gaps and opportunities at the interface of Ind. 4.0 and CE indicate emerging changes and direct future scientific and practical endeavors.

Theoretical framework – This research focuses on shifting from a linear economic model to a circular and regenerative system enabled by Industry 4.0 technologies. While CE focuses on reducing waste and optimizing resource usage through strategies like reuse, recycling, and remanufacturing (Geissdoerfer et al., 2017; Kirchherr et al., 2017), Industry 4.0 introduces intelligent systems that enhance data-driven decision-making, real-time monitoring, and closed-loop supply chains (Bag et al., 2021; Enyoghasi & Badurdeen, 2020). The integration of these paradigms represents a new frontier in sustainable innovation (Stock et al., 2018).

Design/methodology/approach — A systematic literature review was conducted using the Web of Science (WoS), combining bibliometric and science mapping techniques. The study was nearly one month long but also saw evolving methodologies. More than 180 peer-reviewed articles made a deeper understanding of research themes possible. The PRISMA guidelines were followed to ensure the rigor of the results. Keyword co-occurrence networks, author contributions, institutional affiliations, and thematic development were used to determine the significant scientific networks.

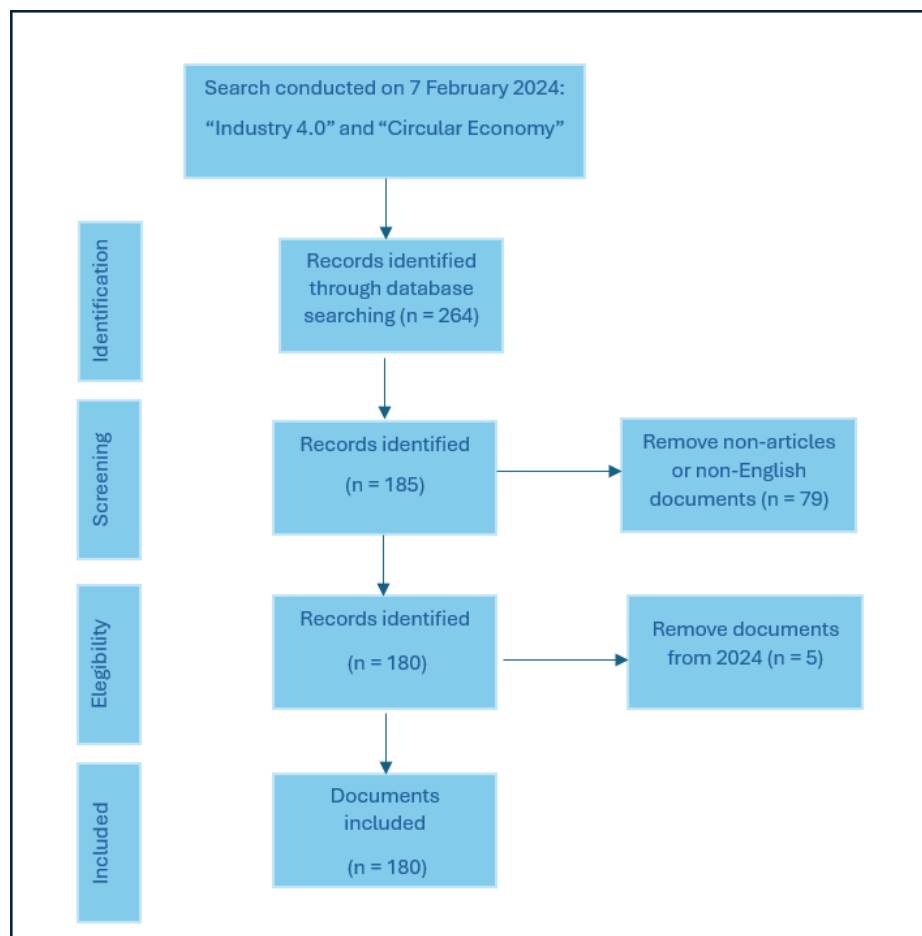


Figure 1 - PRISMA Statement

Findings — Three core clusters emerged: (1) Technological interactions between Industry 4.0 and CE (e.g., IoT, AI, Big Data); (2) Sectoral collaboration across academia, industry, and government; and (3) Circular supply chain transformation. These findings underscore the potential of innovative technologies to support sustainable and circular industrial ecosystems (Jabbour et al., 2020; Stock et al., 2018).

Research, practical & social implications — Beyond an information-gathering exercise, this review is a helpful guide for decision-makers and researchers. It also provides insights into leveraging Industry 4.0 technologies to enable a circular economy. It recommends clear and practicable actions for change, allowing organizations to work together in resource acquisition, value creation, and around the circular economy. It is also essential for stakeholders to know about sustainability and for sustainable practices to be advanced; all good sequences in following that code of environmental ethics will lead people to their immediate sustainable development goals (SDGs) (Geissdoerfer et al., 2017).

Originality/value — This research article brings Industry 4.0 and CE a little closer with a draught of wisdom from bibliometrics. In contrast to the prior fragmented studies, this paper provides an integrated look at integration from technical, organizational, and strategic viewpoints. These findings of importance and novelty are worthy to guide future research and national policies, and they help businesses move gradually into ecologically supportive cyclical operations.

Keywords — Circular economy, Industry 4.0, sustainability, supply chains, digital transformation, bibliometric analysis.

Acknowledgements

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Parallel Session

Session 2 – Artificial Intelligence and Sustainable Innovation

ARTIFICIAL INTELLIGENCE IN SOFTWARE ENGINEERING - A STUDY CASE ON DATA STRUCTURES, ALGORITHMS AND UNIT TESTING

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Extended Abstract

Purpose – Artificial Intelligence (AI) has significantly transformed numerous industries, with its disruptive potential continuing to unfold. Among its diverse applications, the realm of software development stands as a key arena poised for profound change. While the potential impact of AI on software development is widely acknowledged, empirical research in this area remains nascent. The aim of this study is to enrich the research on how generative AI is transforming the Software Engineering process.

Theoretical framework – With its appearance in 2022, ChatGpt and tools alike showed they have the capacity to challenge the software engineering world, assisting software engineers in writing code and testing an application.

Design/methodology/approach – This study addresses the current research gap on the topic by undertaking an experimental investigation aimed at exploring the capacity of ChatGPT and Claude.ai in problem-solving scenarios involving various algorithms & data structures and testing the application. In the study case, data from the Leetcode platform was used to test the capacity of ChatGpt to offer solutions to coding problems. For testing the capacity of Claude.ai, a parking application was used. The code of the application is not available in the paper due to security reasons, but the study does contain screenshots for the UI part which is tested. To deepen the understanding of the current impact of GenerativeAI tools, an interview was conducted with a specialist.

Findings – GenerativeAI based tools such as ChatGpt and Claude.ai are here to stay and are changing the way software engineers work. They can be used as assistants and will determine the software engineers to adopt new skills and delegate repetitive tasks, but not only.

Research, practical & social implications – This study case is limited to the specific data, but it can and should be extended to a larger dataset and different scenarios to test the theory that the Generative Ai tools will assist software engineers in their work. It also raises some questions such as how would companies support their employees in developing their critical thinking if they keep getting their solutions from tools such as ChatGpt. Another question for future research is whether using such tools in Software Engineering it is sustainable considering the number of resources these tools need.

Originality/value – By shedding light on the efficacy of AI in addressing complex software development challenges, this research contributes to a deeper understanding of AI's role in shaping the future of software engineering.

Keywords - Generativeai, innovation, ai, technology, sustainability.

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Parallel Session

Session 2 – Artificial Intelligence and Sustainable Innovation

**THE RELATIONSHIP BETWEEN GREEN INNOVATION AND THE
SIZE AND TURNOVER OF PORTUGUESE COMPANIES:
EVIDENCE FROM CIS 2018 – 2020**

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Extended Abstract

This study aims to investigate the relationship between green innovation and the size and turnover of Portuguese companies, based on data from the Community Innovation Survey (CIS) from 2018 to 2020. The research is based on recent literature regarding green innovation and sustainable development, considering concepts such as environmental innovation, eco-innovation, and the circular economy. The theoretical analysis is anchored in the works of Juntunen et al. (2019), Kraus et al. (2020), Hao et al. (2022), and Rahman (2023), which discuss the relationship between green innovation, business strategy, and financial performance. This study employs a quantitative methodology, analysing a sample of 13,509 Portuguese companies with 10 or more employees. Two main hypotheses were formulated: (1) green innovation has a positive relationship with company size; (2) green innovation is correlated with turnover. To test these hypotheses, statistical techniques such as non-parametric hypothesis testing and Spearman's correlation coefficient were applied. The results indicate that larger companies tend to invest more in green innovation, with this trend being positively correlated with the adoption of sustainable practices. Furthermore, it was found that there is a moderate relationship between green innovation and turnover, suggesting that sustainable initiatives can bring competitive and economic advantages to companies. This study contributes to the literature on green innovation and sustainability, offering valuable insights for academics, business managers, and policymakers. From a practical perspective, the results suggest that companies should consider investing in green innovation to improve their operational efficiency and corporate image. In social terms, the adoption of these innovations can result in positive impacts on the environment and society. Therefore, the research advances knowledge on the relationship between green innovation and business

performance, providing empirical evidence based on CIS 2018-2020. The study also highlights the importance of public policies aimed at encouraging sustainable practices in companies.

Keywords - Green innovation, Business size, Turnover, Sustainability, Eco-innovation.

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Parallel Session

Session 3 – Organizational Well-being and Leadership

DEVELOPMENT AND VALIDATION OF A MULTIDIMENSIONAL SCALE OF ORGANIZATIONAL WELL-BEING

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Extended Abstract

Purpose – This study aims to develop and validate an Organizational Well-Being Scale (OWBS) that holistically assesses workers' well-being in organizations. The scale is structured into four essential dimensions: Mental, Physical, Social, and Financial Well-Being, filling a gap in the literature by providing a multidimensional and empirically validated measure of organizational well-being.

Theoretical framework – Organizational well-being (OWB) refers to employees' collective psychological, physical, social, and financial health within the workplace, significantly influencing both individual satisfaction and organizational performance. It is a multidimensional concept integrating occupational health, workplace culture, and management practices to create a positive work environment (Molnár et al., 2024). OWB goes beyond traditional employee benefits by emphasizing holistic well-being strategies that boost productivity, engagement, and job satisfaction while minimizing burnout and absenteeism (Alipio et al., 2024). Furthermore, employee well-being is crucial to organizational success, affecting retention, performance, and overall business sustainability (Anand et al., 2024). The need to systematically conceptualize and measure well-being has created multidimensional frameworks that comprehensively assess well-being rather than relying on isolated indicators (Daniels et al., 2021). Nevertheless, despite its significance, organizational well-being is often evaluated inconsistently across various industries and research contexts (Kenttä & Virtaharju, 2023). A scientifically validated scale, such as the OWBS, is essential for providing organizations with a standardized approach to measure and enhance employee well-being effectively.

Design/methodology/approach – This is a cross-sectional quantitative study based on the positivist paradigm. This preliminary validation study of the scale was conducted with a sample of 300 active professionals, aged between 22 and 63 years, from different labor market sectors. Exploratory and confirmatory factor analysis was used to evaluate the psychometric properties of the scale, including factorial validity and the internal consistency of its dimensions.

Findings – The results confirm a four-factor structure of the scale, consisting of four distinct yet interrelated dimensions of organizational well-being (Mental Well-Being, Physical Well-Being, Social Well-Being, and Financial Well-Being). All subscales demonstrated high internal consistency (Cronbach's Alpha above 0.8) and a strong correlation with the overall individual well-being index, reinforcing the robustness of the instrument. Additionally, the scale allows for the calculation of a total organizational well-being index, facilitating a comprehensive assessment.

Research, practical & social implications – This study enhances the literature by providing a validated instrument for both academic research and organizational management. Practically, the scale helps organizations monitor and promote employee well-being, strengthening resilience and sustainable human resources. Socially, it underscores the importance of workplace well-being for healthier, more inclusive environments. The research aligns with the Sustainable Development Goals (SDGs), particularly SDG 3 (health and well-being), SDG 8 (decent work and economic growth), and SDG 10 (reducing inequalities).

Originality/value – This research offers an innovative contribution by proposing and validating a multidimensional organizational well-being instrument that can be applied across different sectors. The developed scale represents an advancement in assessing workplace well-being by integrating a holistic perspective that encompasses psychological, physical, social, and financial dimensions, allowing for a more comprehensive understanding of this construct and enhancing intervention strategies.

Keywords - Organizational well-being, occupational health, organizational resilience, sustainable human resources.

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Parallel Session

Session 3 – Organizational Well-being and Leadership

A COMPARATIVE ANALYSIS OF LIFE SATISFACTION, JOB SATISFACTION, AND ORGANISATIONAL JUSTICE: NON-FAMILY EMPLOYEES IN FAMILY BUSINESSES VS. EMPLOYEES IN NON-FAMILY BUSINESSES

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Extended Abstract

Purpose - This study investigates differences in life satisfaction, job satisfaction, and perceptions of organisational justice between non-family employees working in family businesses and employees working in non-family businesses. The aim is to shed light on how organisational context influences employee experiences and well-being, addressing a gap in the literature concerning the perceptions of non-family members in family firms.

Theoretical framework— The research integrates concepts from the Bottom-Up theory of life satisfaction (Diener et al., 1985), Herzberg's Two-Factor Theory, and the four-factor model of organisational justice by Colquitt (2001), including distributive, procedural, interactional, and informational justice. It further draws on family business literature, emphasizing the unique characteristics of these enterprises.

Design/methodology/approach - A quantitative methodology was used, based on a structured online survey administered to 267 participants, predominantly from Germany. Job satisfaction was assessed using the Minnesota Satisfaction Questionnaire (MSQ), life satisfaction via the Satisfaction With Life Scale (SWLS), and organisational justice using Colquitt's Organisational Justice Scale. Statistical analyses included independent sample t-tests, Mann-Whitney U tests, and effect size calculations using SPSS.

Findings - Non-family employees in family businesses reported significantly higher job satisfaction than their counterparts in non-family firms. While no statistically significant differences were found in overall life satisfaction or general organisational justice, differences emerged in specific justice dimensions. Employees in family businesses perceived higher distributive and procedural justice, while those in non-family firms reported higher interactional justice. Informational justice showed no difference between the groups.

Research, practical & social implications – These findings contribute to family business studies by providing insights into the experiences of non-family employees, who often face ambiguity in such environments. Practically, the study suggests that family businesses may foster stronger employee loyalty and satisfaction through equitable resource distribution and transparent procedures. However, they must address interpersonal fairness to enhance organisational justice perceptions. Socially, the research highlights the importance of balancing familial culture with inclusive management practices.

Originality/value - This research is among the first to comprehensively compare non-family employees in family businesses with employees in non-family enterprises across multiple psychological dimensions. It advances understanding of organisational dynamics and provides actionable insights for improving employee well-being and retention in different business settings.

Keywords - Family business, job satisfaction, organisational justice, life satisfaction, employee experience.

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Parallel Session

Session 3 – Organizational Well-being and Leadership

LEADERSHIP AND SUCCESSION CHALLENGES AND STRATEGIES IN A FAMILY BUSINESS: A CASE STUDY

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Extended Abstract

Purpose – The study aims to analyze the challenges and strategies of leadership and succession in family businesses, focusing on leadership perceptions, succession processes, and human resource (HR) management practices. Family businesses, which represent a significant part of the global economy, face unique challenges arising from the interaction between family dynamics and management. This research explores how the leadership style of the current manager influences both employees and potential successors, particularly in areas such as motivation, communication, and decision-making. The study also examines the impact of succession planning on organizational stability, with the goal of providing actionable insights for ensuring the continuity and success of family businesses.

Theoretical framework – The study draws on theories of leadership, succession, and HR management, specifically within the context of family businesses. Leadership is analyzed through the lenses of Leadership Styles Theory and Situational Theory, with a focus on balancing autocratic and democratic styles. Transformational and transactional leadership frameworks are employed to assess the leader's influence on employee motivation and readiness for succession. The research also examines the role of informal HR practices and their impact on recruitment, training, and performance evaluation. Succession planning theories highlight the importance of structured processes for transferring leadership while preserving organizational values and ensuring continuity.

Design/methodology/approach – A qualitative case study methodology was employed to explore leadership and succession dynamics in a family business. Data

collection methods included document analysis, semi-structured interviews with the manager and potential successors, and employee questionnaire surveys. This triangulation approach provided rich, contextual insights. Convenience sampling was used to select participants, and the data were analyzed thematically to identify patterns and themes.

Findings – The findings highlight three critical areas: (i) Leadership Style: Employees perceive the manager's leadership as predominantly autocratic, characterized by centralized decision-making and limited employee participation. While communication is occasionally open, it often lacks follow-through, creating obstacles to collaboration and innovation; (ii) Succession Planning: Succession is seen as underdeveloped, with a lack of structured planning and limited autonomy for potential successors. Resistance to delegating responsibilities and ineffective communication were identified as key barriers to a smooth transition; (iii) HR Practices: The company's HR management is informal and unstructured, with recruitment and training processes largely dependent on the manager's discretion. Inadequate performance evaluation and feedback systems negatively affect employee motivation and long-term engagement.

Research, practical & social implications – The study advances theoretical understanding by highlighting the interconnectedness of leadership styles, succession planning, and HR practices in family businesses. Practically, it underscores the significance of participative leadership, structured succession planning, and formal HR practices in enhancing organizational sustainability. Socially, the findings emphasize the crucial role of family businesses in promoting job stability and community development, advocating for inclusive and collaborative management practices to ensure long-term success.

Originality/value – This research contributes to the literature by providing a detailed exploration of leadership and succession dynamics in family businesses. It highlights the coexistence of autocratic and democratic leadership styles and their impact on HR practices. Additionally, the study emphasizes the critical importance of structured succession planning, addressing gaps in current practices and proposing strategies to balance both family and organizational objectives.

Keywords - Family businesses, challenges, leadership, succession.

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Parallel Session

Session 4 – Infrastructure and Logistics for Resilient Territories

SOLVING A SCHOOL BUS ROUTING PROBLEM FOR A LOCAL COLLEGE

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Extended Abstract

Purpose – The objective of this research was to develop a decision support system for a private school that allows optimizing bus routes in the transport services provided by the school.

Theoretical framework – The School Bus Routing Problem (SBRP) was introduced by Newton & Thomas (1969) and formulated based on a set of stops or student residences, bus fleets, schools and garages with which the aim is to optimize routes to transport all students to the school(s), reducing the operational costs of the service.

An SBRP can be considered a vehicle routing problem (VRP) that has specific assumptions and constraints and can share characteristics of the Capacitated VRP (CVRP) and the VRP with Time Windows (CRPTW). Although one or more schools can be considered, most literature focus on single-school problems, and the solution to this type of problem resembles that obtained in a VRP or CVRP.

SBRP are complex problems with several subproblems or application scenarios, and each of them can be studied individually. In the literature, several approaches and development of the problem are found.

The approach to solve an SBRP may vary depending on the environment in which the service is provided, whether urban or rural. In urban areas, students are assumed to walk from their homes to stops. In rural areas, where the number of students is smaller and more dispersed, it is common to pick them up at home, thus eliminating the need to select bus stop points.

Design/methodology/approach – Data on the current situation of the transport service of the college was collected, namely, the characterization of existing vehicles and

drivers, the locations of students to be transported (stops) and information on current routes.

A literature review was carried out on the problem and its resolution methods, namely on the existing mathematical models to represent the problems and what types of restrictions and objective functions are used.

A mathematical model was adapted to the case study and the restrictions defined by the school were included and an instance of the problem was developed for resolution.

The mathematical model was implemented in Excel, with the instance data, to be solved to optimality using Open Solver.

Findings – Routes were obtained that allow reducing the total number of kilometers traveled, as well as the number of trips made. New routes were compared to current routes to quantify the gains obtained.

Research, practical & social implications – New routes obtained by this research reduce costs associated with transportation service.

In addition to reducing costs, optimizing the use of buses and reducing kilometers traveled, could have a positive environmental impact and increase the transport service capacity offered.

Originality/value – The model developed, and its implementation in Excel, allow school staff to adjust the data and easily obtain new optimal routes. With some improvements, new objectives can be considered in the model, increasing the opportunities to explore distinct solutions.

Keywords - School Bus Routing Problem, decision support system, application case.

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Parallel Session

Session 4 – Infrastructure and Logistics for Resilient Territories

THE ROLE OF PARCEL LOCKERS IN LAST-MILE LOGISTICS: A STUDY ON SERVICE QUALITY AND CONSUMER PREFERENCES IN POLAND

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Extended Abstract

The close location of the parcel machine affects the convenience of online shopping
(Bręgiel et al., 2020).

Purpose – The logistics services market is rapidly evolving, with continuous technological advancements crucial for companies in the courier, express, and parcel industry to remain competitive. This study aims to assess the quality of parcel locker services in Poland, examine consumer preferences, and identify areas for improvement. The research investigates the significance of parcel lockers in last-mile logistics within B2C supply chains, focusing on factors influencing customer satisfaction and reluctance towards different service providers.

Theoretical framework – The study is grounded in last-mile logistics and supply chain management theories, highlighting the importance of efficient delivery systems in e-commerce. The research builds on existing literature regarding service quality assessment, consumer behavior in logistics, and the role of automation in delivery solutions.

Design/methodology/approach – A quantitative research approach was employed using a diagnostic survey method. Data was collected through an online questionnaire from 656 respondents. The survey examined key factors such as service quality perception, consumer preferences, and reasons for reluctance towards specific parcel locker providers. Statistical analysis, including correlation matrices and Pearson tests, was used to derive insights from the collected data.

Findings – The research findings indicate that the most valued aspects of parcel locker services are 24/7 accessibility and fast parcel collection. However, consumers highlighted concerns such as the limited availability of parcel machines, delivery delays, and insufficient parcel sizes. Demographic factors influence consumer preferences, with younger individuals (under 34 years) showing higher adoption rates. Geographical location also plays a role, as urban residents are more likely to use parcel lockers than those in rural areas.

Research, practical & social implications – The study offers both theoretical and practical contributions. Theoretically, it expands knowledge on last-mile logistics and consumer satisfaction regarding automated delivery systems. The close location of the parcel machine affects the convenience of online shopping (Bręgiel et al., 2020). Practically, the findings provide valuable insights for logistics companies to enhance parcel locker services by addressing identified challenges. Parcel locker as a logistics service on the market combines a low price with a quick delivery time and convenient pickup for the customer (Szeląg, 2016). Socially, the research highlights the role of parcel lockers in promoting convenience and sustainability in urban logistics by reducing congestion and emissions from failed home deliveries. The growth of e-commerce flows has led to an increase in the number of CO2 emissions (Bonomi et al., 2022). Parcel lockers offer a sustainable solution. Limitations include the study's focus on the Polish market, suggesting a need for comparative research in other regions.

Originality/value – This study contributes to the ongoing discourse on last-mile logistics by offering empirical evidence on consumer perceptions of parcel lockers. It fills a research gap by providing an updated analysis of service quality and adoption trends in Poland's rapidly evolving e-commerce sector. The findings offer strategic recommendations for logistics providers to improve service offerings and enhance customer satisfaction.

Keywords - Last-mile logistics, parcel lockers, service quality, consumer behavior, e-commerce.

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Parallel Session

Session 4 – Infrastructure and Logistics for Resilient Territories

ANALYTICS TOOL FOR DAMAGES AND LOSSES IN 3PL: A CASE STUDY IN LOGISTA PHARMA

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Extended Abstract

Purpose – This study aims to demonstrate the importance of implementing a specific Key Performance Indicator (KPI) at Logista Pharma to measure damages and losses in last-mile delivery (Durães, 2024). This KPI will provide a comprehensive view of the percentage of deliveries affected by damages or losses, enabling proactive decision-making and complaint anticipation. The study also highlights the legal landscape and trends in Portugal concerning pharmaceutical supply chain security, including serialization and counterfeit drug investigations.

Theoretical framework – This study's theoretical basis draws from literature on supply chain management and the crucial role of performance measurement through KPIs (Huan et al., 2004). Measuring damages and losses is essential for both regulatory compliance and maintaining high service levels within the pharmaceutical industry (Bapatla et al., 2024). Additionally, the study incorporates legal frameworks and trends in Portugal and Europe, highlighting the significance of serialization and investigations into counterfeit drugs (Chowdhary & Vinš, 2023).

Design/methodology/approach – This study employs a methodology that includes a literature review, the collection of data from Logista Pharma's operational activities, and the practical implementation of the KPI within Power BI. It further integrates an analysis of legal requirements and industry standards relevant to pharmaceutical supply chain security, with a specific focus on the last mile. Additionally, the study explores the influence of outsourcing, particularly Third-Party Logistics (3PL), and their associated responsibilities in handling damages and losses (Andrejić, M. & Pajić, V., 2024).

Findings – The primary results demonstrate that implementing the KPI significantly reduced response time to incidents of damages and losses. The study concludes that the KPI is an effective tool for enhancing risk management and underscores the importance of adhering to legal standards and leveraging serialization to prevent counterfeit drugs. Moreover, the findings emphasize the potential consequences for patients when medications are lost or damaged. The KPI also facilitated faster and more efficient responses when data was required for audits, potential clients, or Logista Pharma's management. While Logista Pharma previously measured damages and losses, this KPI provided distinct measurements by type and carrier, representing a significant advancement for informed decision-making.

Research, practical & social implications – This study offers theoretical implications by contributing to the body of knowledge on performance management within supply chains. Its practical implications include the capability to measure damages and losses on demand, present this data effectively in audits, and proactively address potential complaints arising from non-compliance with client service level agreements. Socially, the study underscores the importance of proactive management in safeguarding the integrity of pharmaceutical products. A limitation of this study is the presence of confidentiality constraints related to Logista Pharma and its clients.

Originality/value – This study's main contribution is demonstrating how a KPI can serve as a competitive tool in supply chain management. It advances research by providing a practical model for KPI implementation in logistics companies. Furthermore, it emphasizes the importance of legal compliance and industry standards for security in the pharmaceutical supply chain. This comprehensive document offers updated and detailed information regarding the social and legal effects of damages and losses in the pharmaceutical last-mile distribution in Portugal.

Keywords - Supply chain management, KPI, 3PL, damages and losses, Logista Pharma.

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Parallel Session

Session 5 – Educational Innovation and Digital Tools for Sustainability

**EXPLORING THE IMPERATIVE OF ENVIRONMENTAL
SUSTAINABILITY IN EDUCATION AND RESEARCH. CRAFTING
AN ENGAGING VISUAL DESIGN FOR A WASTE MANAGEMENT
MOBILE APP**

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Extended Abstract

Purpose – The research presents the architecture (with graphic design elements) for a waste management mobile app. The initial phase of graphic design focused on layout and formatting to create educational material for the higher education students. The subsequent phase aimed to present the information in a simple, accessible manner that is easier to understand. Various methods were used to combine words, symbols, and images to visually communicate ideas and messages, ultimately aimed at changing the community's perception of waste management. The article documents the design of a new mobile app to facilitate collaborative efforts in waste sorting, particularly within medical centres.

Theoretical framework – Education for environmental sustainability demands a rich interdisciplinary approach that embraces collaboration, encouraging each person to harness their unique strengths while also recognizing their limitations. It is vital to cultivate robust relationships with a diverse array of partners to create immersive and meaningful learning experiences. This collaborative environment fosters an educational environment that encompasses essential elements such as clear vision, strategic planning, proactive action, and thoughtful reflection, while tackling pressing real-world challenges. The conceptual framework for education for environmental sustainability (EES) emphasizes the importance of all stakeholders understanding the social, economic, political, cultural and ecological factors that shape sustainability. In the realm of education, sustainable development should be bearable, equitable, and viable.

Design / Methodology / Approach - Starting from the Education for Environmental Sustainability conceptual framework, integrating environmental sustainability into the core curriculum at all levels of education is essential. At the university level, the integration of the three pillars of environmental sustainability, namely operations, teaching, and research, should be presented in a more general way through independent development units or courses. In so doing, the paper provides a case study of a mobile application for waste sorting. Then the theoretical foundation for the application's architecture was built upon several key technologies, including MySQL and Tomcat, which is part of the Apache Jakarta Project. The final step was to create a graphical design for the mobile waste application. For the graphical design, the research team used Adobe Illustrator and Adobe Photoshop and for the mobile app prototype was designed using the Figma tool. Various methods are used to create and combine words, symbols, and images for a visual representation of ideas and messages to change the community's perception of waste management methods.

Findings – A mobile recycling app can only achieve success when integrated within a comprehensive waste and recycling policy that encompasses all dimensions of sustainable waste management, including social, technical, environmental, and economic aspects. This means that while mobile applications have the potential to significantly influence individual behavior toward recycling and enhance the overall efficiency of a waste management system, it is crucial to have a foundational education infrastructure established to support the effective use of these apps.

Research, practical and social implications – Furthermore, it is essential to recognize that a mobile recycling app that has demonstrated success in one community cannot be blindly implemented in another without a thorough understanding of the specific cultural, social, and historical context of the new audience. Each community has its own unique characteristics and challenges that must be respected and addressed. As widely acknowledged by professionals in the waste management sector, sustainable success depends on the ability to merge global best practices and lessons learnt with localized conditions, insights and expertise. This tailored approach ensures that the app not only meets the immediate needs of users but also fosters long-term engagement and positive environmental outcomes within the community.

Originality/value – In today's society, people are generally proficient in navigating the Internet and using mobile phone applications; however, numerous dimensions of education in the maintenance of a sustainable environment still require further exploration. The integration of mobile applications at the local level presents an opportunity for portable devices to serve as catalysts for improved waste management practices. Although a web application proposed for the private sector has undergone testing, significant efforts are still necessary to advance mobile application development in this area. The initial step towards proper disposal of biomedical waste involves understanding its classification, thereby facilitating accurate segregation. Effective waste segregation represents a fundamental component in the management of biomedical waste.

Keywords - Higher education, marketing, graphic design, sustainability, branding.

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Parallel Session

Session 5 – Educational Innovation and Digital Tools for Sustainability

A COMPARATIVE STUDY ON ENTREPRENEURIAL INTENTIONS AMONG STUDENTS OF THE POLYTECHNIC INSTITUTE OF SETUBAL

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Extended Abstract

Purpose – This paper explores and evaluates entrepreneurial intentions (EI) and their antecedents among students from the College of Business Administration, Polytechnic Institute of Setubal. The study examines the role of age, gender, work experience, and self-employment in affecting personal attitudes, subjective norms, perceived behavioral control, and entrepreneurial intentions. Additionally, this paper presents a comparative analysis of entrepreneurial intentions between students who attended the entrepreneurship course in the academic years 2023/24 and 2024/25, offering insights into potential changes in attitudes and perceptions over time.

Theoretical framework – It is recognized that an entrepreneurial career offers significant opportunities for individuals to achieve financial independence and benefit the economy by contributing to job creation, innovation, competitiveness, and economic growth. Today's students are tomorrow's potential entrepreneurs, which may explain why a growing number of universities worldwide offer entrepreneurship courses and programs. Numerous studies have identified entrepreneurial intention (EI) as a highly influential predictor of entrepreneurial activities and behaviors (Arasti, Zandi & Talebi, 2012). Consequently, contemporary research has increasingly emphasized EI over the broader field of entrepreneurship (Yu, Khalid & Ahmed, 2021). Indeed, the utilization of EI as a foundational framework for research has increased since the early 90s, underscoring the pivotal role of EI in various contexts (Liñán & Fayolle, 2015).

Design/methodology/approach – The empirical analysis has been carried out on a sample of final-year students from the College of Business Administration, Polytechnic Institute of Setúbal, who attended the entrepreneurship course in the academic years 2023/24 and 2024/25. Data were collected using a structured questionnaire based on the Entrepreneurial Intentions Questionnaire (EIQ) developed by Liñán and Chen (2009), which measures entrepreneurial intentions (EI) alongside variables such as personal attitude (PA), subjective norm (SN), and perceived behavioral control (PBC). The questionnaire also included demographic questions related to age, gender, academic background, work experience, and self-employment experience. The comparative approach enables an analysis of changes in students' EI across two consecutive academic years.

Findings – This study presents a model that identifies the variables influencing entrepreneurial intentions among students from the Polytechnic Institute of Setúbal (Portugal). The comparative analysis of students from the 2023/24 and 2024/25 cohorts highlights trends and possible shifts in entrepreneurial attitudes, providing valuable insights into the impact of educational experiences and external factors on students' intentions to engage in entrepreneurship.

Research, practical & social implications – Future research should extend the sample to a greater number of higher education institutions to cover students from diverse academic disciplines. Additionally, further studies could explore other factors influencing students' entrepreneurial intentions, such as family background, exposure to entrepreneurial role models, and macroeconomic conditions. Understanding how entrepreneurial intentions evolve over time can help educators and policymakers design more effective entrepreneurship programs tailored to students' needs.

Originality/value – Our study builds upon the work previously conducted by Liñán and Chen (2009), which explored similar variables in different cultural contexts, namely Spain and Taiwan. By introducing a longitudinal comparative analysis between two consecutive academic years in Portugal, this research provides unique insights into the dynamics of entrepreneurial intentions among university students, contributing to the ongoing discourse on entrepreneurship education and its effectiveness.

Keywords – Entrepreneurial Intentions, higher education, entrepreneurship education.

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Parallel Session

Session 5 – Educational Innovation and Digital Tools for Sustainability

**DEVELOPING EDUCATIONAL LIVING LABS TO FOSTER
STRONG SUSTAINABILITY PRACTICES**

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Extended Abstract

Purpose – Living Labs function as user-centered, open innovation ecosystems that embed research and innovation within real-world communities and settings. Their goal is to foster collaboration among diverse stakeholders—including academia, industry, government, and citizens—to co-create, prototype, and test innovations in real-world contexts, addressing challenges in sustainability, technology adoption, and social innovation. This initiative aims to establish multidisciplinary "Living Labs (LL) for Strong Sustainability" to tackle ecological, social, and economic challenges through co-creation

and systemic approaches. Led by faculty members from the Polytechnic Institute of Setúbal (IPS), these Labs aim to enhance literacy in sustainability and raise awareness within the institution and the broader community. The Labs will focus on ecosystem resilience, circular economy, doughnut economics, innovative education, One Health and sustainable energy systems. The objective is to enhance collaboration among students and faculty from diverse disciplines, drawing on interdisciplinary expertise to develop innovative, holistic and impactful solutions.

Theoretical framework – This initiative is underpinned by the concept of strong sustainability, which emphasises the preservation of natural capital as the basis for long-term well-being, focusing on qualitative development measured by quality-of-life indicators, social well-being and environmental integrity. By integrating systems thinking and collaborative innovation, the LL employs frameworks such as circular economy principles, doughnut economics, and socio-ecological resilience to align human activities with planetary boundaries. The inclusion of academic expertise from IPS reinforces the initiative's educational and research dimensions.

Design/methodology/approach – The methodology of the LL is rooted in user-centred design, participatory design and open innovation theories. It highlights active user engagement, co-creation and iterative development in real-world settings. This approach helps to bridge the gap between theoretical research and practical application, boosting the creation of innovative and user-validated solutions. The LL will promote sustainability literacy through targeted activities, including open classes, workshops and the use of the Design Thinking method. Additionally, the Problem-Based Learning (PBL) methodology will be employed to encourage active learning, real-world problem-solving and the development of interdisciplinary knowledge through collaborative efforts.

Findings – Preliminary findings suggest that Living Labs can effectively bridge the gap between theoretical frameworks and practical applications encouraging collaboration and participation in the development and implementation of innovations. By engaging users and stakeholders throughout the innovation process, LL increase the relevance and acceptance of new solutions, leading to more successful implementation outcomes.

Research, practical & social implications – The LL is expected to offer practical insights to help educators and practitioners to adopt more sustainable practices. Socially, the initiative aims to congregate communities and IPS students, raising awareness and encouraging behavioural changes. Practical outcomes include also exploring opportunities to incorporate biodiversity, circular economy principles, and renewable energy practices into local initiatives.

Originality/value – This initiative stands out by embedding strong sustainability principles into a multidisciplinary and collaborative Living Lab’s framework. Its originality lies in engaging participants as co-creators in the innovation process, rather than as passive participants. Led by IPS faculty, the initiative highlights the critical role academic institutions play in advancing sustainability literacy and systemic change, while also contributing to research, innovation, and sustainable development.

Keywords - Strong sustainability, living lab, circular economy, doughnut economics, innovative education.

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Parallel Session

Session 5 – Educational Innovation and Digital Tools for Sustainability

**DIGITAL AND SUSTAINABILITY SOLUTIONS IN HIGHER
EDUCATION TO AWARENESS OF THE CIRCULAR ECONOMY**

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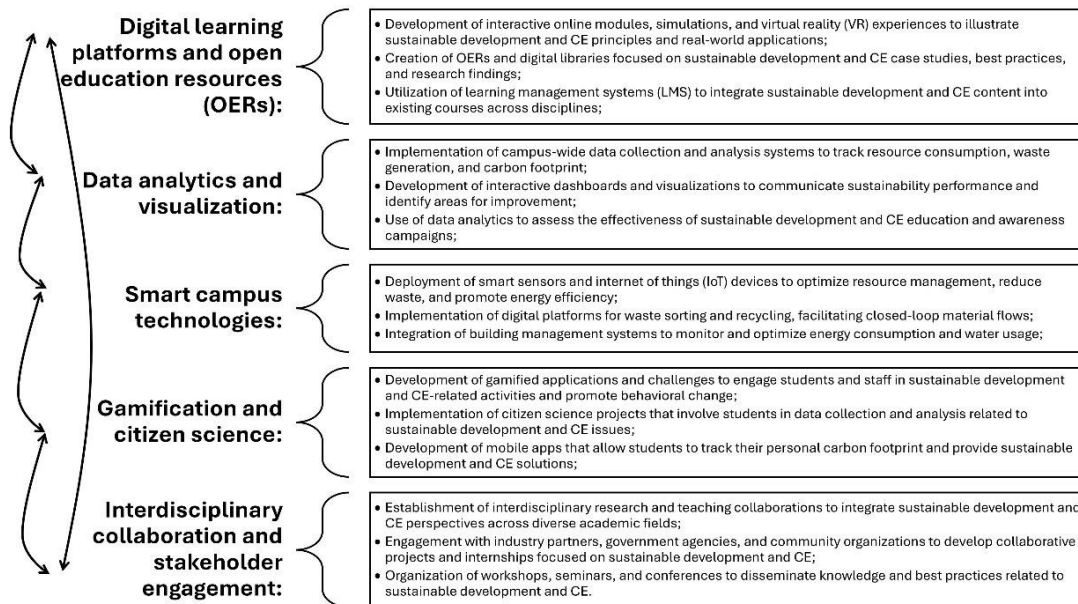
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Extended Abstract

Purpose – The imperative for a transition from a linear "take-make-dispose" economy to a circular economy (CE) to support sustainable development management (with low carbon-emission) is increasingly urgent. Higher education institutions (HEIs) play a pivotal role in fostering this transition by educating future leaders and promoting sustainable practices (Vargas-Merino et al., 2024). This research explores how digital and sustainability solutions within HEIs can effectively raise awareness and facilitate the adoption of sustainable development and CE principles. By leveraging technology and integrating sustainability into curricula and campus operations, HEIs can create a powerful ecosystem for sustainable development, CE education and implementation.

Theoretical framework – Despite growing recognition of sustainable development and the CE's importance, awareness among students and staff in HEIs remains limited. Traditional educational approaches often struggle to convey the complexities and practical applications of sustainable management and CE and the presentation of classical existed frameworks in the literature or sharing local best cases and experiences developed with local stakeholders (Kopnina, 2020; Anthony Jnr, 2021; Figueiró et al., 2022; Acosta Castellanos & Queiruga-Dios, 2022). Furthermore, the integration of sustainability into campus operations and decision-making processes is often fragmented and lacks a holistic approach. This necessitates innovative solutions that effectively combine digital tools and sustainability practices to enhance sustainability and CE awareness and drive behavioral change. The original framework is introduced and explained.

Design/methodology/approach – The research approach proposes a multi-faceted approach (associate with a strategic framework at HEIs level) that integrates five dimensions as presented in the below strategic framework.



Findings – By strategically integrating digital technologies and sustainability principles, HEIs can effectively cultivate a culture of circularity and empower future generations to drive the transition towards a sustainable and regenerative economy. This extended abstract provides a framework for developing and implementing innovative solutions that enhance sustainable development and CE awareness and promote the adoption of green practices within the higher education sector. Future research should focus on evaluating the effectiveness of these solutions and identifying best practices for scaling up sustainable development and CE education and implementation. The applicative research will present the efforts of Politehnica University of Timisoara (UPT), Romania to define and support “Sustainability@UPT” via different projects implementation.

Research, practical & social implications – The implementation of these digital and sustainability solutions provided by different projects implemented at Politehnica University of Timisoara, Romania demonstrating the following implications (supported by qualitative and quantitative results):

- Enhance awareness and understanding of sustainable development and CE principles among students and staff;
- Promote the adoption of sustainable behaviors and practices within the campus community and demonstrating the idea of Creative Campus of UPT;
- Integrate and transfer knowledge and wisdom (generated from the Erasmus+ projects implementation and other type of projects of Politehnica University of Timisoara, Romania) into curriculum development and research activities;
- Improve the efficiency and sustainability of campus operations;

- Foster interdisciplinary collaboration and stakeholder engagement;
- Generate data-driven insights to inform CE policy and decision-making;
- Increase the number of graduates (from Bachelor, master and PhD study programs) having a strong understanding of sustainability management and how to implement CE principles in their future professional life.

Originality/value – The added value of research focusing on digital and sustainability solutions in higher education for circular economy awareness is multifaceted, contributing to both academic advancement and real-world impact. Here's a breakdown of key areas: (1) Enhanced educational practices (innovative pedagogy; syllabus, and curriculum development); (2) Improved sustainability performance: (data-driven decision-making; smart campus innovation); (3) Societal and economic impact: (behavioral change; knowledge dissemination; advancing in sustainable development and CE research). This research bridges the gap between theory and practice, providing valuable insights and tools for HEIs to become catalysts for the sustainable development and CE transition.

Keywords – Sustainable development, circular economy, education, higher education, strategic framework, projects.

Acknowledgements

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Parallel Session

Session 6 – Branding and Organizational Innovation

EMPLOYER BRANDING AND EMPLOYEE VALUE PROPOSITION: IMPACT ON ATTRACTING WORKERS TO THE PUBLIC SECTOR

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Extended Abstract

Purpose - This study explores the impact of Employer Branding and the Employee Value Proposition (EVP) on the attractiveness of the Public Administration as an employer, with a specific focus on generational differences. The goal is to identify the factors influencing potential candidates' perceptions and understand how these perceptions affect their intention to apply for public sector jobs.

Theoretical framework – The research is grounded in Employer Branding theory (Ambler & Barrow, 1996; Backhaus & Tikoo, 2004), Employer Attractiveness (Berthon et al., 2005), Employee Value Proposition (Minchington, 2006), and Public Service Motivation (Perry & Wise, 1990). Additionally, it draws on generational theory (Bejtkovsky, 2016; Twenge, 2010) to analyze value differences across age groups.

Design/methodology/approach - A quantitative approach was adopted, using a survey based on the EmpAt scale (Berthon et al., 2005) and items from Perry's (1996) Public Service Motivation construct. The sample (n = 235) included participants from different generations and professional sectors. Statistical analyses included Kruskal-Wallis tests, Spearman correlations, and Dunn/Bonferroni post-hoc tests, conducted using SPSS.

Findings - Results show that organizational attractiveness varies significantly across generations. Baby Boomers place more value on social, interest, and application-based attributes, while Generation Y (Millennials) shows less affinity with public sector values, favoring private sector employment even when aware of the benefits of public service. Job stability was the most valued factor overall, while Public Service Motivation was higher among older generations.

Research, practical & social implications - This study offers practical guidance for public institutions to tailor their Employer Branding strategies according to generational preferences, aiming to attract and retain qualified talent. From a social standpoint, it highlights the urgency of rejuvenating the public workforce in the face of demographic aging and the importance of strategic communication in reshaping the image of the public sector as an attractive employer.

Originality/value - This research fills a gap in the literature by applying concepts widely explored in the private sector to the context of Public Administration. It presents an integrated view of public employer attractiveness, considering both extrinsic and motivational factors, and offers relevant insights for public human resources policy and talent management.

Keywords - Public sector, employer branding, employer attractiveness, employee value proposition, generations.

Funding And Acknowledgements

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Parallel Session

Session 6 – Branding and Organizational Innovation

**IMPACTS AND CHALLENGES OF DIGITALIZATION IN A
PORTUGUESE IPSS: CASE STUDY**

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Extended Abstract

Purpose – To analyze the results of implementing the digitalization process in the administrative services of a Private Social Solidarity Institution (IPSS). Specifically, the aim of this study is to: (i) analyze the difficulties and barriers perceived by Parents and Guardians during the digital Kindergarten application process (2024/2025 school year) and their effects on registration and satisfaction; (ii) analyze the degree of operational commitment of human resources and the financial impacts resulting from the implementation of the digitization process for digital Kindergarten applications for the 2024/2025 school year; (iii) find a set of solutions to the problems faced, with a view to promoting improvements in the quality of the services provided.

Theoretical framework – The study was based on the Digital Transformation Theory, which addresses the processes of integrating digital technologies into organizations beyond the simple adoption of technological tools, highlighting the importance of cultural and organizational changes and new business models as a strategic differentiating factor for competitiveness.

Design/methodology/approach – The research method used was a case study, based on a mixed methodology, semi-structured interviews with the employees responsible for customer service, and a questionnaire survey aimed at service users.

Findings – The study revealed that although the respondents belonged to low-income households, this did not affect their accessibility to Information and Communication Technologies (ICT), since 99.1% said they had a computer, tablet or cell phone, and

96.6% said they had internet access in their homes or workplaces. It was also noted that although more than half of the parents (53.4%) reported significant difficulties, the digitization did not have a significant impact on the completion of applications, since a high percentage of candidates (80.2%) managed to register. It was found that digitization led to a substantial reduction in face-to-face customer service, making it possible to manage administrative routines in a more systematized way, allowing applications to be processed more quickly and efficiently, and promoting improvements in communication and the flow of information, which consequently ended up raising the level of satisfaction among users of the service. However, although some authors have asserted that digitalization fosters a closer relationship with customers by facilitating the fulfilment of their needs more swiftly and effectively, the results obtained during the inquiry revealed a moderate level of dissatisfaction regarding the factors of speed and transparency. This finding ultimately supports the assertion that digital technologies, in isolation, do not influence organizational performance, as human factors have a direct impact on this process.

Research, practical & social implications – The challenges observed that proved to be some of the main limitations of this study were: the lack of digital literacy among respondents, the need to conduct the survey by telephone, the partial sample (65.91%), and the impossibility of measuring financial impacts. The study will promote a series of positive social implications, such as digital inclusion, the promotion of accessibility and sustainability.

Originality/value – The study took the form of exploratory research given the lack of specific literature on the subject. The results obtained could minimize the impacts caused by social inequalities.

Keywords - Digitalization, customer satisfaction, operational efficiency, IPSS.

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Parallel Session

Session 6 – Branding and Organizational Innovation

TOURISTS' SUSTAINABILITY VALUES AND THEIR ROLE IN CO- CREATION PROCESSES

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Extended Abstract

Purpose – This study examines whether tourists' sustainability values influence their perceived value of co-creation and their intention to participate in co-creation activities. While sustainability is an increasing priority in tourism, the extent to which sustainability-conscious tourists actively engage in co-creation remains unclear. Understanding this relationship is crucial for developing tourism strategies that effectively engage tourists in co-creation while promoting sustainability-driven experiences.

Theoretical framework – Co-creation in tourism highlights tourists as active participants in shaping their experiences rather than passive consumers of pre-defined

services (Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004). This collaborative process enhances the psychological, functional, and social value of tourism experiences, fostering engagement and satisfaction (Prebensen et al., 2013). As sustainability gains prominence, it is often assumed that environmentally and socially conscious tourists engage more in co-creation, aligning their travel experiences with ethical values (Adongo et al., 2018; Polat, 2022). However, while sustainability values influence travel preferences, their direct impact on co-creation remains uncertain, as other factors may play a more significant role. To address this gap, this study examines whether tourists' sustainability values influence their perceived value of co-creation and their intention to engage in co-creation activities, providing theoretical and practical insights for sustainability-driven tourism experiences.

Design/methodology/approach – The study employs a quantitative research design, using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the hypothesized relationships. Data were collected from 401 tourists visiting Lisbon, assessing their sustainability values, perceived value of co-creation, and intention to engage in co-creation activities.

Findings – The results indicate that sustainability values do not directly influence the perceived value of co-creation or the intention to engage in co-creation activities. While sustainability-oriented tourists recognize the importance of responsible tourism, this does not necessarily translate into greater perceived value of co-creation or increased engagement in co-creative tourism experiences.

These findings challenge the assumption that sustainability-conscious tourists inherently value or actively seek co-creation opportunities. Instead, other factors, such as personalization, interaction quality, and perceived benefits, may play more significant roles in shaping co-creation perceptions and intentions. This suggests that simply appealing to sustainability values may not be sufficient to foster co-creation engagement among tourists.

Research, practical & social implications – The study challenges the notion that sustainability values directly drive co-creation engagement. This highlights the need for tourism stakeholders to go beyond sustainability messaging and focus on designing personalized and interactive co-creation experiences that offer clear benefits to tourists. On a broader level, findings suggest that fostering engagement in sustainable tourism requires mechanisms beyond awareness-raising, ensuring tourists perceive meaningful opportunities to co-create value and actively participate in sustainability-driven tourism experiences.

Originality/value – This research contributes to the discussion on sustainability-driven tourist behavior by empirically examining the assumed link between sustainability values and co-creation engagement. By demonstrating that sustainability values alone do not

directly enhance co-creation, it provides new insights into the factors shaping co-creative tourism experiences and offers valuable implications for sustainable tourism strategies.

Keywords – Sustainability, co-creation, tourist behavior, tourism, destination management.

Funding And Acknowledgements

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Parallel Session

Session 6 – Branding and Organizational Innovation

**ANALYSING THE CUSTOMER JOURNEY AT A LEADING BEAUTY
RETAILER: A PRACTICAL APPROACH USING THE MYSTERY
SHOPPER METHODOLOGY AND NON-PARTICIPANT
OBSERVATION**

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Extended Abstract

Purpose –This paper examines whether the customer journey in a leading beauty retailer aligns with the expectations set by the brand.

Theoretical framework – The research is based on consumer behaviour, customer experience and mystery shopper methodology studies. It also draws on the literature on the customer journey and incorporates the concept of the messy middle, which explores the complexity of consumer decision-making throughout the purchasing process.

Design/methodology/approach – The study used a qualitative and quantitative approach, using the mystery shopper methodology and non-participant observation. Three mystery shoppers and three observers participated in the research, totalling nine hours of non-participant observation.

Findings – Findings indicate that customer experience is generally positive, with well-organised, clean and attractive stores. However, personalised customer service was inconsistent at peak times. The large number of displays affected the flow of customers through the store.

Research, practical & social implications – The study provides practical insights for store owners to improve the customer experience by suggesting adjustments to space and services. On a theoretical level, it contributes to the understanding of the consumer journey in high-demand retail environments. From a social perspective, the analysis reinforces the importance of consistent service for customer loyalty.

Originality/value – The research adds value by linking the customer journey to the practical evaluation methods of mystery shopping and non-participant observation. Having been carried out in the festive season, it highlights the impact of seasonality on the consumer experience. Further observations should be carried out at different times of the year to remove bias and suggest concrete improvements to align the practical experience with the brand proposition.

Keywords – Mystery shopping, customer satisfaction, consumer journey, non-participant observation.

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Parallel Session

Session 7 – Innovation in Agri-Food Sustainability

UNLOCKING THE POTENTIAL OF AGRO-INDUSTRIAL RESIDUES FOR LIGNOCELLULOSIC BIOMASS VALORIZATION

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Extended Abstract

Purpose – This study evaluates pre-treatment methods for processing agro-industrial residues, specifically from tomato, grape, and coffee production, to enhance their value. The aim is to transform these byproducts into valuable resources that contribute to a circular bioeconomy, reducing environmental impact while unlocking their potential for biotechnological applications, such as incorporation into microalgae culture media.

Theoretical framework – Agro-industrial residues, such as tomato pomace, grape pomace, and spent coffee grounds, are abundant and rich in macromolecules like polysaccharides, proteins, and polyphenols (Tudella et al., 2023; Aghamirzaei et al., 2015). These components, however, are often locked within complex lignocellulosic structures, making them difficult to access without proper treatment. Pre-treatment methods play a crucial role in breaking down these structures, facilitating the recovery of high-value compounds for applications in food, pharmaceuticals, and other

biotechnological purposes (Kumar et al., 2022).

Design/methodology/approach – A variety of pre-treatment methods were applied to the residues, including mechanical disruption, thermal treatment, and chemical hydrolysis (acidic and alkaline) (Carvalho et al., 2008). The effectiveness of these treatments was evaluated based on the release of reducing sugars, proteins, and bioactive compounds. Analytical methods, such as the Dinitrosalicylic acid (DNS) method and Lowry assays, were used to quantify the extracted macromolecules. Polyphenol extraction was optimized using ethanol-water mixtures to maximize recovery.

Findings – Among the tested methods, chemical hydrolysis demonstrated the highest efficiency, with acid hydrolysis yielding increased sugar content and alkaline hydrolysis enhancing protein availability. For instance, grape pomace hydrolysates showed a glucose concentration of 51.45 g L^{-1} , suitable for biotechnological applications. Polyphenol extractions using ethanol-water solvents were highly effective, particularly for grape stalks, resulting in significant recovery of bioactive compounds. Additionally, the treated residues were successfully tested as nutrient media for microalgae cultivation, showing promising results in biomass productivity and protein content.

Research, practical & social implications – This study highlights the potential of agro-industrial residues as sustainable resources for high-value applications. By transforming these wastes into valuable products, such as alternative nutrient sources for microalgae or polyphenol-rich extracts, the environmental footprint of agro-industrial activities can be significantly reduced. These applications contribute to the development of innovative bioprocesses that valorize waste streams, offering cost-effective solutions for industries and supporting the production of bioactive compounds or biomass with commercial and environmental relevance.

Originality/value – This research highlights the importance of effective pre-treatment methods in the valorization of agro-industrial residues, as polyphenol concentrates and alternative nutrient sources for microalgae cultivation. The innovative use of these residues not only addresses waste management challenges but also contributes to the development of bio-based products, such as natural antioxidants or microalgal biomass for feed and biofertilizers, thereby enhancing the economic and environmental sustainability of agro-industrial sectors.

Keywords - Agro-industrial residues, pre-treatment, circular bioeconomy, polyphenols, sustainability, resource recovery.

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Parallel Session

Session 7 – Innovation in Agri-Food Sustainability

TRACEABILITY AND ECONOMIC IMPACT OF BLOCKCHAIN IN THE AGRIFOOD SECTOR: A CASE STUDY OF THE GARGANO REGION

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Extended Abstract

Purpose – This study investigates the potential of blockchain technology for enhancing traceability in the agrifood sector, with a focus on local food products from the Gargano region. It aims to demonstrate how blockchain can strengthen product authenticity, build consumer trust, and foster economic development in a rural and touristic context.

Theoretical framework – The research is grounded in supply chain management theories and the emerging literature on digital innovation in rural economies. Blockchain's decentralized nature is analyzed as a tool for increasing transparency and fostering trust among stakeholders.

Design/methodology/approach – The study adopts a mixed-methods approach. A literature review provides a foundation for understanding blockchain applications in the agrifood sector. Primary data is collected through a questionnaire targeting local producers to gauge their awareness, sentiment, and willingness to adopt blockchain. Finally, a pilot project demonstrates the practical application of a blockchain-based traceability system for selected Gargano products.

Findings – Preliminary results indicate that blockchain can effectively enhance traceability, increase consumer confidence, and improve the market positioning of local products. Producer surveys reveal a growing interest in adopting blockchain but highlight barriers such as cost and technical knowledge.

The pilot project provides actionable insights into the implementation process and its scalability potential.

Research, practical & social implications – The research emphasizes the theoretical contributions of blockchain to supply chain management and highlights practical solutions for local economies. Socially, the adoption of blockchain could empower small producers, preserve regional traditions, and support sustainable practices in the agrifood sector.

Originality/value – This study contributes to the limited body of research on blockchain in rural and touristic contexts, offering a replicable model for integrating blockchain in similar regions. It bridges the gap between theory and practice, showcasing blockchain's transformative potential for rural economic development.

Keywords – Blockchain, agrifood, traceability, Gargano, rural economy.

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Parallel Session

Session 7 – Innovation in Agri-Food Sustainability

UNLOCKING MICROALGAE'S POTENTIAL FOR FOOD, COSMETICS, AND AGRICULTURE

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Extended Abstract

Microalgae are a sustainable and nutrient-rich protein source with immense potential in various industry sectors. With high protein content, essential fatty acids, and antioxidants, they provide an eco-friendly solution to meet rising global consumer demands for safer, natural and sustainable solutions. However, challenges such as poor functionality, bad palatability, and high production costs have limited their widespread adoption. To address these challenges, under the framework of the European REDWine project (BBI-JU Horizon 2020), this study develops a biorefinery cascade extraction process, unlocking microalgae's full potential by enabling the production of diverse microalgae-based ingredients with enhanced purity, improved sensory properties, and tailored functionalities for specific applications.

By employing these novel solvent-free extraction processes, involving sequential ultrafiltration, enzymatic hydrolysis, in combination with disruptive technologies, several protein ingredients (whole biomass, extracts, concentrates and hydrolysates) are produced for food, cosmetic and agricultural applications. Each extract are rigorously characterized, and specific criteria are established in close collaboration with industry experts to ensure that the produced ingredients meet the desired quality standards. As a result, the developed process—achieving over 80% protein recovery—has been proven to produce ingredients with more than 70% protein purity (dw), free from undesirable compounds such as chlorophylls, oils, and volatile compounds, making them highly suitable for food and cosmetic applications. Additionally, whole biomass (59% protein dw), along with selected extracts and microalgae hydrolysates (65% protein dw), exhibit high-quality compositions, positioning them as promising biostimulants for sustainable agriculture.

As a conclusion, the study provides an efficient, eco-friendly method for extracting high-quality compounds from microalgae, offering viable solutions to industry challenges. The use of microalgae as natural ingredients sources as well as alternative protein, reducing the dependence on traditional animal-based sources, contributing to a more sustainable

industrial systems with a lower environmental footprint. It demonstrates that the use of microalgae and its derivatives can contribute to implement a valuable and innovative model within food, cosmetics, and agriculture industries, fostering innovation and sustainability in these sectors.

Keywords – *Chlorella vulgaris*, hydrolysates, biorefinery, sustainability, alternative protein.

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Parallel Session
Session 8 – Youth, Emotions and Innovation

MINDFUL INNOVATIONS IN PUBLIC MARKETING THROUGH THE INTEGRATION OF CULTURAL EVENTS IN THE HIGHER EDUCATION ENVIRONMENT

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Extended Abstract

Purpose – The paper investigates innovative public marketing strategies by analyzing how the integration of cultural events within higher education institutions fosters active student and community engagement in cultural heritage. It explores the methods and tools that universities can employ to enhance participation, influencing students' behavioral patterns and decision-making processes regarding cultural involvement and appreciation.

Theoretical framework – This paper aims to emphasize the importance of cultural marketing and how it can be implemented in the public sector to promote cultural services. Various marketing tools used in the cultural sector, the ethical aspects of cultural marketing and the benefits of implementing a well-structured marketing plan are presented.

Design/methodology/approach – This paper adopts a multidisciplinary approach to examine the intersection of culture and innovation within the public sector, with a particular focus on higher education institutions. The research is structured into four main sections, each addressing a distinct aspect of this interaction. The first section provides a conceptual analysis of the cultural and creative sectors within the broader social context, exploring their contributions to social and economic development. This includes an examination of the underlying factors that drive cultural and social innovation, as well as the role of public policies in fostering a creative and sustainable cultural environment. The methodological framework integrates qualitative research methods, including case study analysis, to investigate the practical applications of cultural marketing strategies within university settings. Specifically, the study presents an in-depth analysis of the UPT CREATIVE CAMPUS initiative, with a focus on the PoLItivity project, as a model for promoting cultural engagement and innovation within

the academic community. The research evaluates the strategies and tools employed in this initiative to enhance institutional visibility, student participation, and interdisciplinary collaboration. The study synthesises theoretical perspectives with empirical insights to provide a comprehensive understanding of how cultural marketing can be effectively leveraged to strengthen the role of universities as cultural and social innovation hubs.

Findings – The final section presents a case study on the applicability of cultural marketing within the UPT CREATIVE CAMPUS, focusing on the PoLIivity proposed project, and highlighting the strategies and methods used to promote innovation and culture within the university community.

Research, practical & social implications – This study offers significant theoretical and practical contributions to the domain of cultural marketing within the public sector, particularly in the context of higher education institutions. From a theoretical standpoint, it makes a substantial contribution to the extant literature by offering a comprehensive understanding of the manner in which cultural marketing can be integrated into public institutions to foster social engagement, innovation, and economic development. Moreover, it highlights the pivotal role of public policies in facilitating a creative cultural environment, thus providing valuable insights for policymakers and educational administrators. From a practical standpoint, the study provides a framework for universities to implement cultural marketing strategies effectively, demonstrating how cultural events can enhance institutional branding, student engagement, and collaboration between academia and the creative sector.

The case study on UPT CREATIVE CAMPUS offers actionable insights into the methods and tools that can be used to promote culture and innovation within university settings. This study highlights the importance of citizen participation in cultural initiatives and its role in developing a dynamic, inclusive, and innovative higher education environment. The incorporation of cultural events within academic institutions has been shown to foster community building, encourage interdisciplinary collaboration, and play a crucial part in the preservation and dissemination of cultural heritage. Moreover, the study emphasises the potential of universities to function as cultural hubs, thereby actively driving social transformation and extending their influence beyond the academic domain.

Originality/value – This study makes a significant contribution to the advancement of research in the field of cultural marketing by establishing a link between the promotion of cultural heritage and public sector marketing strategies, particularly within the context of higher education institutions. In contrast to conventional research in the area of cultural marketing, which predominantly focuses on museums, galleries and the arts sector, this paper extends the discussion to universities as active participants in cultural and social innovation.

The paper's originality lies in its interdisciplinary approach, combining cultural studies, marketing strategies and public policy analysis to propose a structured framework for integrating cultural events in university environments. The case study on UPT CREATIVE

CAMPUS and the PoLitivity project serves as an innovative example of how institutions can leverage cultural marketing to foster creativity, collaboration and social impact. The practical application of cultural marketing principles elucidates valuable insights for educators, policymakers, and cultural organisations seeking to enhance public engagement with culture, and it also highlights the transformative potential of cultural initiatives in shaping the identity and competitiveness of higher education institutions in an increasingly knowledge-based society.

Keywords - Culture, higher education, marketing, social innovation, mindful innovations.

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Parallel Session
Session 8 – Youth, Emotions and Innovation

ENHANCING RESILIENCE IN YOUTH WITH EMOTIONAL INTELLIGENCE AND GREEN AWARENESS

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Extended Abstract

Purpose – This study aims to strengthen the connection between emotional intelligence, green awareness, and green perspectives among youth. It addresses the need to equip young people with the emotional resilience and environmental consciousness necessary to confront climate-related challenges while fostering sustainable, empathetic, and responsible behaviors.

Theoretical framework – The theoretical foundation integrates concepts from emotional intelligence and environmental psychology, emphasizing their interplay in shaping attitudes and behaviors toward sustainability. Emotional intelligence is essential in managing climate anxiety and fostering empathy, while green awareness promotes informed, sustainable decision-making. Together, they form a comprehensive framework for empowering youth to address global environmental challenges.

Design/methodology/approach – The study adopted a multi-phase approach, beginning with a needs assessment conducted through questionnaires and open-ended consultations to identify specific requirements and to design tailored tools and strategies for the target group. The "Be the Other and Be Green" storytelling methodology was employed as a path to facilitate sharing experiences, cultivating empathy, and promoting positive environmental actions. Furthermore, a virtual platform enabled community-driven storytelling and collaborative learning, emphasizing shared values and fostering proactive, solution-oriented engagement.

Findings – Preliminary results indicate that integrating emotional intelligence with green awareness significantly enhances youths' capacity to adapt to climate challenges without resorting to extremist behaviors. The storytelling approach has proven effective in building resilience, fostering community engagement, and encouraging practical,

sustainable actions. These outcomes underline the importance of combining emotional well-being with environmental education.

Research, practical & social implications – The study contributes to research by exploring the intersection of emotional intelligence and environmental awareness in youth education. It offers innovative tools and methodologies that can be adapted across different educational and cultural contexts. Socially, it fosters a sense of global responsibility among youth, empowering them to influence policy and advocate for sustainable practices on local, national, and international levels.

Originality/value – This study stands out by addressing climate-related anxiety through the lens of emotional intelligence and its integration with green awareness. Using storytelling as a methodological tool adds a unique dimension to environmental education, enabling youths to connect emotionally with sustainability issues.

Keywords - Emotional intelligence, green awareness, youth resilience, sustainability, climate anxiety, storytelling, environmental education.

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Parallel Session
Session 8 – Youth, Emotions and Innovation

DEVELOPING INTERCULTURAL INTELLIGENCE: THE ROLE OF EMOTIONAL INTELLIGENCE IN ADAPTIVE STRATEGIES IN FOREIGN ENVIRONMENTS

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Extended Abstract

Purpose - This study investigates how Emotional Intelligence (EI) influences the strategies individuals use to adapt to foreign environments. In the context of increasing globalization and intercultural interactions, understanding the impact of EI on adaptation processes is crucial for improving cross-cultural adjustment and reducing misunderstandings in multicultural settings.

Theoretical framework – The research is grounded in the Ability Model of Emotional Intelligence (Mayer, Salovey, & Caruso, 2002), which includes four components: self-awareness, self-management, social awareness, and social skills. The framework is complemented by theories of Cultural Intelligence and intercultural communication to explore the interplay between emotional capacities and cultural adaptation.

Design/methodology/approach – A quantitative methodology was employed, using a survey distributed to 192 participants from 31 nationalities. Emotional intelligence was measured using the MSCEIT scale, and adaptation strategies were assessed via self-reported frequency on a 7-point Likert scale. Statistical analyses included correlation, simple and multiple linear regressions, and ANOVA, conducted through SPSS.

Findings - Results demonstrate a significant positive relationship between overall EI and the use of adaptive strategies. Among EI dimensions, social skills showed the strongest correlation, followed by self-management and social awareness. Younger participants and those with greater international experience or multilingual backgrounds reported higher

use of adaptive strategies. These findings validate the hypothesis that EI, particularly in its interpersonal dimensions, facilitates successful adaptation in foreign environments.

Research, practical & social implications – The study emphasizes the importance of developing EI as a lifelong skill to enhance intercultural adaptability. Practically, the findings support the integration of EI training in higher education and global workforce preparation. Socially, this contributes to more inclusive, empathetic, and resilient communities by promoting better communication and cooperation across cultures.

Originality/value - This research advances the understanding of the emotional dimensions of intercultural adaptation. It offers a novel empirical contribution by detailing how specific EI components predict adaptive behaviors in multicultural contexts, providing actionable insights for educators, HR professionals, and policy makers aiming to foster global competence.

Keywords - Emotional intelligence, cultural adaptation, intercultural communication, self-awareness, social skills.

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Parallel Session
Session 9 – Inclusion, Gender and Social Equity

CHALLENGES AND OPPORTUNITIES FOR MANAGEMENT IN A GLOBALIZED WORLD

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Extended Abstract

Purpose – This study explores the intersection of migration, sustainability, and management in a globalized context. It investigates how management practices can address the challenges and leverage the opportunities posed by migration to foster sustainable development, focusing on economic, social, and organizational dimensions.

Theoretical framework – The research is grounded in the United Nations' Agenda 2030 for Sustainable Development, particularly the Goals related to reduced inequalities (SDG 10), decent work and economic growth (SDG 8), and sustainable cities and communities (SDG 11). It also draws on theories of global citizenship and cultural diversity to emphasize the role of management in integrating migration into sustainability strategies.

Design/methodology/approach – The study employs a qualitative methodology, combining a comprehensive review of academic literature with an analysis of recent reports from organizations such as the European Commission, OECD, and IOM. It examines how management practices can address migration-related challenges, such as workforce integration and cultural resistance, while capitalizing on opportunities to enhance organizational sustainability.

Findings – The research reveals that migration plays a critical role in sustainable development by addressing labor shortages, mitigating demographic challenges, and contributing to economic growth. However, barriers such as economic disparities and cultural resistance persist, requiring proactive management strategies. Inclusive recruitment practices, intercultural training, and diversity management are identified as essential tools for organizations to promote innovation, social cohesion, and long-term sustainability.

Research, practical & social implications – The findings highlight the necessity for organizations to integrate migration into their sustainability frameworks. Practically, this includes adopting inclusive policies, fostering diverse workplaces, and aligning management practices with the Sustainable Development Goals. Socially, the study advocates for initiatives to combat xenophobia and promote global citizenship, enhancing societal cohesion and equity.

Originality/value – This study contributes to the literature by emphasizing the role of management in addressing migration-related challenges within the broader context of sustainability. It offers actionable insights for organizations and policymakers to align migration management with sustainable development goals, reinforcing their contribution to a more inclusive and resilient global society.

Keywords - Migration, sustainability, management, globalization, sustainable development goals (SDG).

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Parallel Session
Session 9 – Inclusion, Gender and Social Equity

INCLUSIVE ACCESSIBILITY FOR PEOPLE WITH REDUCED MOBILITY IN THE HOTEL INDUSTRY: SESIMBRA CASE STUDY

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Extended Abstract

Purpose – In recent years, there has been a significant increase in global tourism flows, driven by travelers from various countries worldwide. This phenomenon has posed challenges to the procedures and management strategies of tourist destinations. In a highly competitive scenario where destinations strive to attract tourists, a study was conducted to identify the key elements that visitors easily perceive when exploring the town of Sesimbra, with a direct focus on tourism competitiveness. Thus, this study aims to highlight the importance of investing in this area and raising awareness about the topic of accessible tourism.

Theoretical framework – This criterion implies that a tourist destination must ensure that people with reduced mobility (or other disabilities) have equal access to information, transportation, accommodation options, facilities, activities, communications, products, and services available to the general public. Through this study, we sought to develop insights into what makes a tourist destination accessible to all.

Design/methodology/approach – In the first phase, we aimed to understand how the topic is perceived and the needs of people with reduced mobility, followed by an analysis of conditions in Sesimbra's main attractions. In the second phase, interviews were conducted with decision-makers from the Sesimbra City Council, alongside a survey assessing tourists' perceptions of accessibility in the town. Two research approaches were employed throughout this study: a literature review and empirical research. The literature review involved a document analysis based on secondary sources, including publications

from entities such as Turismo de Portugal, the National Institute of Statistics, national and international organizations, as well as academic studies on the topic, national accessibility legislation, scientific articles, and other publications related to accessible tourism.

Findings – This study focused on the needs of individuals with reduced mobility, including people with disabilities and the elderly, aiming to obtain precise responses regarding their perception of accessibility in the hospitality and wellness sector. Surveys targeting the tourism supply in Sesimbra were conducted, with special emphasis on the specific needs of this group. The questionnaire was structured into three dimensions: travel profile, visiting profile in Sesimbra, and accessibility within the town. After analyzing the data, the main findings were: the available information on accessibility in Sesimbra is inadequate for welcoming visitors and tourists with special needs; there is a significant gap between central management/administration and the flow of tourists with special needs regarding the services provided in this area; and training and information-sharing have a positive impact on service quality and visitor satisfaction.

Research, practical & social implications – It is therefore essential to develop best practices and implement measures to overcome existing barriers, both from the perspective of tourism business owners and political authorities.

Originality/value – This study highlights the importance of accessible tourism and provides concrete insights into the perception of accessibility in Sesimbra, contributing to the improvement of conditions and management strategies for the tourist destination.

Keywords – Sesimbra, strategic planning, tourist destinations, accessibility.

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Parallel Session
Session 9 – Inclusion, Gender and Social Equity

**PROMOTING SUSTAINABILITY THROUGH GENDER EQUALITY
IN AN INTERDISCIPLINARY PROGRAM IN HIGHER
EDUCATION**

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Extended Abstract

Purpose – This study explores the interconnections between sustainability, gender equality, and interdisciplinary living labs as participatory innovation methodologies. Within the Sustainable Development Goals (SDGs) framework, gender equality is represented by SDG 5, which aims to achieve gender equality and empower all women and girls. While sustainability often emphasizes environmental and economic dimensions, this work highlights the social dimension, with gender equality playing a pivotal role.

Gender equality is critical for developing skills needed to address real-world issues, such as opportunity gaps and discrimination. Interdisciplinary living labs in higher education serve as collaborative spaces for testing, implementing, and evaluating initiatives that simultaneously promote sustainability and gender equity. By integrating gender equality into higher education practices, institutions contribute to global sustainability goals while fostering inclusive and diverse learning environments.

Theoretical framework – Literature highlights the relationship between gender equality and sustainability, emphasizing equal access to resources, participation in decision-making, and contributions to sustainability. Research indicates that institutions with greater gender diversity achieve higher innovation and better governance. Gender diversity fosters innovative and sustainable decision-making, underscoring the importance of embedding gender equity into educational frameworks to advance global sustainability goals.

Design/methodology/approach – A program addressing gender equality was designed to support interdisciplinary activities within curricular units or other institutional offerings. Guided by professors trained in gender equality and participatory methodologies like Analytical Dashboards, Project-Based Learning, and Design Thinking, the program leverages data-driven insights to address gender equity challenges. Students in multidisciplinary, gender-diverse groups co-create solutions and foster behavioral change through immersion in real-world problems, shared experiences, and simulated scenarios. Local and regional partners bring concrete issues related to inequality of opportunities and rights, ensuring that the program addresses real-world challenges. This collaborative model strengthens partnerships between academia, local communities, and industry.

Findings – Students develop skills in teamwork, critical thinking, and technology use while working in gender-diverse teams. The program also deepens their understanding of systemic inequality and sustainability challenges, enabling a holistic approach to problem-solving.

Research, practical & social implications – The program promotes a culture of gender equality within the institution and contributes to building a digital society focused on sustainable and accountable citizenship. It equips participants with the competencies needed to advance gender equity and sustainability agendas in professional and social contexts.

Originality/value – This initiative uniquely integrates sustainability and gender equality with innovative interdisciplinary pedagogical practices. By addressing global challenges, it provides a replicable model for other institutions aiming to enhance their contributions to the SDGs. The combination of interdisciplinary methodologies and a focus on gender equity distinguishes the program as a forward-thinking educational initiative.

Keywords - Sustainability, gender equality, living lab, innovative education, higher education.

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Parallel Session
Session 9 – Inclusion, Gender and Social Equity

AGENDA 2030 AND SUSTAINABLE CITIES

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Extended Abstract

Purpose – The purpose of this extended abstract is to analyze the role of cities in achieving the Sustainable Development Goals (SDGs) set by the United Nations' 2030 Agenda, with a particular focus on Goal 11: "Make cities and human settlements inclusive, safe, resilient, and sustainable." This study explores key strategies, challenges, and best practices for promoting sustainable urban development, while emphasizing the importance of local governance, innovation, and community participation in transforming urban areas into engines of sustainability.

Theoretical framework – From a theoretical perspective, sustainable urban development involves the balanced integration of environmental, social, and economic dimensions, as well as the promotion of equity, resilience, and inclusion. Various theoretical approaches—such as ecological urbanism, participatory planning, and local governance—provide conceptual frameworks for understanding how cities can evolve into spaces that not only minimize environmental impact but also enhance the quality of life for all residents. Additionally, theories of urban transitions and resilience offer insights into how urban environments can proactively adapt to challenges such as climate change, rapid urbanization, and social inequalities.

Design/methodology/approach – This study adopts a qualitative, descriptive methodology based on a comprehensive bibliographic review. The research is grounded in secondary sources, including academic articles, institutional reports, policy documents, and publications from international organizations such as the United Nations and UN-Habitat. The review aims to identify key theoretical frameworks, best practices, and recurring challenges related to the implementation of Sustainable Development Goal 11 within the broader context of the 2030 Agenda. The selection of literature follows a thematic approach, focusing on core dimensions such as urban governance, sustainability indicators, participatory planning, and resilience strategies. This method allows for the synthesis of existing knowledge, providing a structured understanding of how sustainable urban development is conceptualized and applied across different contexts.

Findings – The literature review reveals a growing global consensus on the importance of integrating sustainability into urban planning, with particular emphasis on inclusivity, resilience, and environmental responsibility. Key findings indicate that while many cities have adopted strategic plans aligned with SDG 11, there is often a gap between policy design and practical implementation. Successful case studies highlight the role of strong local governance, cross-sectoral collaboration, and citizen participation as critical factors for advancing sustainable urban agendas. However, challenges such as limited funding, institutional fragmentation, and lack of reliable data remain persistent barriers. Furthermore, the review identifies a need for more localized indicators and context-sensitive approaches to better assess progress towards sustainable cities in diverse socio-economic settings.

Research, practical & social implications – This study contributes to the academic discourse by synthesizing current theoretical and practical perspectives on sustainable urban development within the framework of the 2030 Agenda. From a research standpoint, it highlights key areas where further empirical investigation is needed, particularly regarding the localized implementation of SDG 11 and the development of measurable sustainability indicators. Practically, the findings may inform urban policymakers, planners, and local authorities by providing a clearer understanding of effective strategies and common pitfalls in the pursuit of sustainable cities. Socially, the study underscores the importance of inclusive governance and community engagement, suggesting that long-term urban sustainability depends not only on technical solutions but also on active citizen participation and social equity.

Originality/value – This study offers original value by providing an integrated and up-to-date synthesis of the theoretical and practical dimensions of sustainable urban development as framed by the 2030 Agenda, with a specific focus on SDG 11. Unlike empirical case studies that are limited to specific contexts, this bibliographic review draws from a wide range of sources to identify cross-cutting themes, recurring challenges, and innovative approaches applicable to diverse urban settings. The work contributes to a deeper understanding of the systemic changes required for sustainable cities and highlights the significance of interdisciplinary thinking in addressing complex urban issues. It also serves as a useful reference for scholars, policymakers, and practitioners seeking a holistic overview of sustainability frameworks in urban contexts.

Keywords - Sustainable development, agenda 2030, SDG 11, urban sustainability, sustainable cities.

Funding And Acknowledgements

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Parallel Session

Session 10 – Biotechnologies for Environmental Remediation

**DEVELOPMENT OF A BIOREMEDIATION PROCESS FOR
HEXAVALENT CHROMIUM REDUCTION USING ENDEMIC
BACTERIA**

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Extended Abstract

Purpose – The purpose of this study is to develop a bioremediation process to reduce hexavalent chromium and address the problem of contaminated soils and water.

Theoretical framework – The industrial development that the state of Sonora has witnessed in recent decades has led to an increase in the concentration of heavy metals in the environment, mainly due to the large number of industrial processes that use metals as raw materials, as well as mining activities and their related industries (Gobierno del Estado, 2019).

Among these pollutants, hexavalent chromium (Chromium VI) stands out due to its high oxidation potential, high solubility in water, rapid permeability through biological membranes, and its classification as a carcinogenic agent and a mandatory reportable contaminant under Mexican regulations (NOM-147-SEMARNAT/SSA1-2004). For this reason, the study of techniques to reduce contamination caused by hexavalent chromium is a highly relevant and important topic.

Currently, the treatment of environments contaminated with metal ions—such as industrial effluents, sludge, sediments, and soils—can be carried out using various techniques, including precipitation, ion exchange, membrane filtration, and electrochemical methods. However, these treatments are limited by technical and economic constraints, creating the need to develop remediation methodologies that are renewable, highly effective, and low-cost (Qian, 2017).

Bioremediation, which involves the use of microorganisms to remove or reduce metal ions, emerges as one of the best options to meet these requirements (Lin, 2020). The objective of this project is to develop a bioprocess for the reduction of Chromium (VI) to Chromium (III) for the treatment of industrial wastewater contaminated with Chromium (VI). Chromium (III) is less bioavailable and significantly less toxic than Chromium (VI) (Lin, 2020). To achieve this objective, bacteria isolated from soils in the industrial areas of Hermosillo, Sonora, are used.

Methodology – Four industrial zones in Hermosillo, located in the north, south, east, and west of the city, were selected, and soil samples were collected from drainage points. The samples were prepared for total chromium determination using graphite furnace atomic absorption spectrophotometry.

Bacteria were isolated from the soil samples by diluting 1 gram of the sample in 10 mL of distilled water, followed by plating 20 μ L onto Petri dishes with LB agar. The colonies were allowed to grow and were then streaked onto culture medium containing 5 μ g/L of Chromium (VI). This process was repeated, gradually increasing the Chromium (VI) concentration until the bacteria could no longer form colonies.

The streaking process was repeated several times to ensure culture purity and eliminate any contamination from other bacterial strains. Finally, pure cultures of chromium-resistant bacteria with different phenotypic characteristics were obtained.

Findings – We isolated four bacterial strains, and the fact that they were able to survive at high concentrations of Chromium (VI) indicates that they can effectively reduce extracellular chromium and are ideal candidates for the development of bioremediation strategies. What are the main results? What are the conclusions from the results?

Research, practical & social implications – A bioprocess capable of remediating contaminated soils and water is being developed to address the contamination problem our state faces.

Originality/value – The identification of endemic bacterial strains will help reduce time and costs in bioremediation processes aimed at desert areas, such as Sonora

Keywords - Bioremediation, hexavalent chromium, bioreduction.

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Parallel Session

Session 10 – Biotechnologies for Environmental Remediation

**MICROALGAE CELL CULTURE CONCENTRATION:
MEASUREMENT SYSTEM ANALYSIS**

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Extended Abstract

Purpose – Equipment and human resources are two key elements in any (non)industrial organization. While equipment is a permanent asset, employee turnover is a growing concern for business improvement and sustainability. In this dynamic setting, organizations need to ensure the technical competency of their human resources. To assess the measurement performance of those who collect data from processes and products is of paramount relevance. Therefore, this paper shows how a measurement system in an academic laboratory can be assessed and presents guidelines for acquiring high quality data.

Theoretical framework – Many organizations are already using data to fuel innovation, drive economic growth, and shape its and society future. Valid, accurate and reliable data are crucial for that purpose. Therefore, continuous attention is due to measurement systems analysis (Hamada, 2025). This paper focuses on the measurement system quality of optical density in microalgae cultures. These measurements are made in a research laboratory of IPS – ESTBarreiro and contribute to developing innovative technologies with the potential to improve the economy and sustainability of local industries through novel applications of agro-industrial wastes and effluents (Sousa et al., 2024).

Methodology – Widely accepted techniques to assess the Repeatability, Reproducibility, and Discrimination/Resolution of measurement systems are used in this study (AIAG, 2010). The data were obtained from the measurement of cell culture concentration during microbial growth by two technicians using a spectrophotometer (Multisky) at 590 nm with an optical 96 plate reader under appropriate environmental conditions and randomly. The cell culture was the microalgae *Chlorella* sp. at different growth stages.

Findings – This study confirms that employee turnover must be a concern for managers of (non)academic organizations, namely for research laboratory managers. The

performance of new technicians may not be as good as necessary to ensure the required quality of data collected and work in the laboratory. The measurement system is not as good as expected. It is a marginal system (Contribution of $1\% < R\&R < 9\%$), though its discrimination is good ($NCD > 5$) (Costa, 2024). These results differ from those obtained by previous laboratory technicians. The discrepancy in performance must be (is) a concern for the laboratory managers. These findings suggest that new technicians should undergo a training program before undertaking measurement activities.

Data analysis reveals that the measurement system's reproducibility requires improvement. The two technicians have clearly a different performance. Technician 1 presents smaller average and range values in each measurement than technician 2. An investigation into causes of technician 2's lower performance is necessary, and a training program should be developed to cancel this issue. Technician 2 participation in the training program must be ensured as soon as possible.

Research, practical & social implications – This study confirms that measurement systems analysis cannot be ignored by managers of (non)academic organizations. This analysis should be conducted before any new technician begins measurement activities, namely in academic research laboratories. This practice will ensure the required confidence in the work performed and maintain the relevant role of the laboratory in academy-industry collaborations. The development of innovative technology that can leverage the economy and sustainability of local industries is relevant enough to justify a statistical analysis of measurement systems.

Originality/value – This study is another contribution to disseminate the need and the relevance of measurement systems analysis in (non)academic settings, particularly where dynamic organizational environments are a reality. In addition, it contributes to strengthen university-industry collaboration by demonstrating the usefulness of statistical techniques and the need of organizational managers ensure their implementation, namely within academic research laboratories.

Keywords – Repeatability, reproducibility, knowledge transfer, cell culture, algae.

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Parallel Session

Session 10 – Biotechnologies for Environmental Remediation

IMPACT OF NANOPLASTICS AND TOXIC METALS ON *LACTUCA SATIVA*: A PHENOLIC AND ANTIOXIDANTS COMPOSITION ASSESSMENT

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Extended Abstract

In recent years, there has been a growing interest in the antioxidant properties of phenolic compounds present in plants, since they benefit human nutrition. These antioxidants are notable as they have numerous anti-inflammatory and anti-cancer

properties, helping prevent cardiovascular and neurodegenerative diseases, diabetes, obesity and other conditions (Brazaitytė et al., 2022).

The bioproduction of these compounds is favored when the plant is suffering stress (e.g.: ultraviolet radiation, pathogenic attacks, low temperatures, etc.), leading to an accumulation of reactive oxidative species (ROS). This causes a homeostatic imbalance in the plant, as ROS react with organic constituents, damaging cell organelles, and eventually causing the death of the vegetation (Michalak, 2006).

In response, the plant activates its defense mechanism and biosynthesizes antioxidant metabolites and enzymes, including phenolic components such as polyphenols and flavonoids (Brazaitytė et al., 2022).

Considering another aspect, natural freshwater resources are scarce and increasingly under pressure. The reuse of wastewater can promote water resources management and the sustainability of agriculture. However, since they may contain pollutants such as toxic metals and/or nanoplastics (Nps), they also have the potential to cause negative effects on soil and plants (Gaylarde, Baptista Neto & Monteiro da Fonseca, 2020).

Different studies have shown that the contamination of Np and heavy metals can induce oxidative stress in plants (Roy, Dey, & Jamal, 2022; Michalak, 2006).

The main objective of this study is to analyze the phenolic compounds in lettuce watered with treated wastewater containing nanoplastics and toxic metals (Cd, Cr, Pb and Ni).

For the procedure, spheric nanoparticles of poly(methylmethacrylate) labeled with Fluorescein were produced and characterized by Light Diffraction (Mastersizer-Malvern) and ATR-FTIR (Thermo Nicolet5700).

Lettuces were planted in boxes in a greenhouse on the ISEL campus. The boxes containing lettuces were watered with different types of water over a period of 45 days: tap water (TW), treated wastewater (TWW), TWW contaminated with NP (TWW+Np), TWW contaminated with toxic metal (TM), Cd, Cr, Pb, and Ni at maximum legal concentrations (DL238/96) (TWW+TM) and (TWW+Np+TM). TWW was collected at the outlet of an urban wastewater treatment plant with secondary treatment, filtration in sand filters and disinfection. At the end of the 45 days the lettuces were harvested, washed, dried and shredded.

The determinations were carried out in a 96-well microplate, using a Folin-Ciocalteu reagent method with the absorbance measured at 765 nm for polyphenols, compared with gallic acid standards. And an aluminum chloride method, with the absorbance measured at 415 nm, for Flavonoid, compared with Catechin standards.

In a general approach, the results indicate that there is a variation in the production of polyphenols and flavonoid content in the samples when treated with Nps and toxic metals. In order to better understand the tolerance and adaptation mechanisms used by *Lactuca sativa*, a more in-depth analysis will be necessary.

Keywords – Phenolic compounds, treated wastewater, nanoplastics, toxic metals, lettuce grown.

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Parallel Session

Session 11 – Teaching and Participatory Innovation

**BUSISKILLS: WELLBEING@WORK: EXAMPLES LEARNED
FROM A COIL AND A BIP FROM *BUSINET***

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Extended Abstract

Purpose - This study describes the international organization of a Collaborative Online International Learning (COIL) and a Blended Intensive Programme (BIP) focused on "*Busiskills: Wellbeing @work*" among *Businet* partners.

Theoretical framework – COIL is an online learning approach that facilitates international and intercultural collaboration among students and Faculties, fostering curriculum internationalization and intercultural learning (Leask, 2020; Hackett et al., 2023). A BIP combines short-term physical mobility abroad with a mandatory virtual component, enabling online collaboration and teamwork, supported by ERASMUS+ project (EC, 2025). Both pedagogical innovations involve international, interdisciplinary, and intensive learning activities for students and staff, supported by the *Businet* network (www.busetnet.org.uk/).

Design/methodology/approach – COIL is a 3 ECTS online course, and BIP is a hybrid course with 4 ECTS. Both employ a co-creation model integrating social and communication skills, based on the ICOMs framework developed by UCLL, which categorizes international competencies into five domains: personal growth, language skills, international involvement, international expertise, and intercultural competencies. These courses use a multidisciplinary to interdisciplinary approach, with international student teams exploring topics such as health, social work, human resources, and

business. Starting from research in their professional contexts, teams collaboratively develop best practices, share insights, and compare information across countries and professions. Learning activities include lectures, workshops, and socialization, either virtual or face-to-face. Assessment is based on final team presentations, project work, and vocabulary sheets, with facilitators/coaches guiding students throughout the entire process process.

Findings - Over the past five years, data from COIL and BIP *Busiskills: Wellbeing @work* show diverse student participation in terms of background, study year, and nationality. Students researched various topics, participated in activities, and provided feedback highlighting the programs' effectiveness. The project evaluation is done by the project staff and students on a scale from insufficient to excellent and rates these pedagogical approaches as excellent or very good, citing improvements in competencies and validating these methods as innovative learning pathways.

Research, practical & social implications – Practical implications include the value of multidisciplinary collaboration, inclusivity through internationalization, wide geographical participation, social bonding, and co-creation based on real-time needs. These factors enhance motivation, engagement, and skill development, fostering rich learning experiences.

Originality/value – This study's originality lies in its co-creation approach, integrating real-time topics and needs with innovative learning methods to enhance student engagement and competency development.

Keywords – COIL, BIP, Wellbeing@work, education, innovation.

Funding And Acknowledgements

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Parallel Session

Session 11 – Teaching and Participatory Innovation

SONIFICATION OF SITE-SPECIFIC GROUND PENETRATING RADAR DATA TO CONNECT CITIZENS AND LOCATIONS

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Extended Abstract

Purpose — This study aims to explore the use of sonification technology to create musical soundscapes that represent subsurface geophysical data from various sites in Portugal and Spain. This way, we seek to engage the public by connecting them to specific locations through sound.

Theoretical Framework — In this study we apply sonification technology to geophysical datasets, building on available sonification methodologies from seismic (Dell'Aversana et al., 2016; Hayward, 1994) and ground-penetrating radar (GPR) (Kaplanvural & Livaoğlu, 2021; Sgambati et al., 2011) geophysical techniques where timeseries data are converted into auditory representations to improve data analysis.

Design/Methodology/Approach — GPR traces were chosen from published and unpublished GPR datasets located in Portugal and Spain. Our processing flow consisted of the following: 1) Fourier transforms of GPR traces, obtaining amplitudes maps; 2) conversion of amplitudes maps into MIDI maps through attribution of MIDI notes to frequency bins; 3) selection of the MIDI note corresponding to the highest amplitude per time step. Steps 1 and 2 followed the methodology described in (Dell'Aversana et al., 2017). This process was implemented in R language (R Core Team, 2020), using R core functions and pyramidi package to create the MIDI maps. After that, the final MIDI maps, with one note per time step, were taken to a digital audio workstation, Waveform 13, where a specific sound was chosen to play the notes and to create the final mp3 files.

Findings — Our main outcome is the creation of musical soundscapes based on geophysical data. The methodology applied successfully transforms subsurface characteristics into sound, allowing for an innovative and artistic interpretation of the data. The soundscapes created serve as a tool for public engagement, offering a novel way to experience and connect with the geophysical properties of different regions.

Research, Practical & Social Implications – This research broadens the scope of sonification of geophysical data by moving beyond its use for subsurface analysis to its application in artistic and cultural contexts. Practically, it can be used for public engagement and education, offering a new medium for communicating complex scientific data. Socially, it could foster a deeper connection between communities and their surrounding environments, enhancing regional identity and cultural engagement through sound.

Originality/Value – This study's primary contribution is its novel application of geophysical sonification for artistic purposes, using geophysical data of the subsurface to create immersive soundscapes that engage the public in a multisensory experience. It extends the scope of sonification from a technical tool for data analysis to a medium for artistic and cultural expression, contributing to both the fields of geophysics and sound art.

Keywords – Sonification, geophysical data, ground-penetrating radar (GPR), musical soundscapes, public engagement.

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Parallel Session

Session 12 – Smart Technologies for Environmental Resilience

**SUSTAINABLE TOURISM CAPACITY IN MARINE RESERVES:
THE CASE OF THE TREMITI ISLANDS, ITALY**

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Extended Abstract

Purpose – The Marine Reserve of the Tremiti Islands - Southern Italy, Apulia - covers 1466 hectares and is managed by the Gargano National Park Authority. The Reserve is characterized by natural features such as *Posidonia oceanica* meadows. During the summer months, particularly in August, the flow of tourists increases exponentially. This study describes an evolution of the method to determine the Tourist Carrying Capacity (TCC) of the Tremiti Islands to ensure the sustainability of the marine reserve. The approach is an extension of the carrying capacity model used by Pazienza (2001) for three important municipalities in the Gargano National Park. Among other strategies to ensure the sustainability of the Tremiti Islands, Ranieri et al. determined an environmental contribution for each activity authorized in the MPA: 0.70 €/capita for bathing; 0.27€/capita for diving; 1.34 €/capita for boat rental; 1.10 €/capita for boating.

Theoretical framework – The TCC is 'the maximum number of people who can visit a tourist destination at one time without destroying the physical, economic and socio-cultural environment and without an unacceptable decrease in the quality of visitor satisfaction'. This issue can be addressed by modelling the optimal number of visitors, rather than the maximum number that can be accommodated in a tourist destination. Canestrelli and Costa (1991), building on the pioneering work of Fisher and Krutilla (1972), propose a measure of carrying capacity, which translates into a financial flow generated by the maximum number of tourists that can be accommodated in a particular destination. This depends on several constraints on each resource serving the local tourism sector.

Design/methodology/approach – The TCC of the Tremiti Islands has been calculated using a function based on socio- economic and environmental variables in August 2022. The TCC was subsequently determined using the MATLAB optimization toolbox to find the number of tourists accommodated in the hotel (HT) and non-hotel (NHT) sector and the number of excursionists by maximizing the objective function. In particular, a non-linear optimization model has been used to calculate the optimal number of visitors to the Tremiti Islands, considering the variables and constraints in the equation.

Findings – The net benefit of the tourism sector is 3,478,373.37 €/August. The analysis shows that the Tremiti Islands can accommodate an optimal number of 32,887.14 tourists in August in hotel and non-hotel facilities compared to 22,743 tourists in August 2022 and an optimal number of 51,088 excursionists compared to 58,089 excursionists in August 2022 to ensure the sustainability of the Tremiti Islands (Ranieri, 2024).

Research, practical & social implications – The number of excursionists in the Tremiti Islands Marine Reserve should decrease and tourists should be encouraged to stay overnight on the Tremiti Islands to reduce the CO₂ emissions produced by the ferries, passing from an environmental cost of 2.92 €/capita for an excursionist to 1.05 €/capita for an overnight tourist.

Originality/value – The research may provide useful insights to support policy makers in promoting sustainable tourism policies in the Tremiti Islands. These policies can be replicated in similar marine reserves.

Keywords – Sustainable tourism, carrying Capacity, marine reserve, non-linear optimization model, environmental protection.

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Parallel Session

Session 12 – Smart Technologies for Environmental Resilience

SMART TWIN HOUSE: A BIDIRECTIONAL DIGITAL TWIN FRAMEWORK FOR XR-BASED SMART HOME VISUALIZATION AND CONTROL

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Extended Abstract

Purpose – This research presents a bidirectional digital twin framework that enables both visualization and control of smart home environments through Extended Reality (XR) interfaces. The framework allows redefining the interaction between users and smart home systems, creating intuitive spatial visualizations of environmental data and providing real-time control capabilities (Morris et al., 2021). This bidirectional digital twin bridges physical and virtual spaces, allowing users to visualize and control smart home systems via immersive interfaces. Through this enhanced interaction model, the framework advances both the technical state of smart home interfaces and contributes to broader goals of improved home management and sustainability.

Theoretical framework – The research builds upon three key theoretical foundations: digital twin theory for smart environments (Bolognesi & Signorini, 2021), XR interaction paradigms (Besan et al., 2021), and sustainable smart home management. Drawing from recent advances in digital twin implementations (Bouchabou et al., 2023), this work extends existing approaches by implementing bidirectional control capabilities within immersive virtual environments. The theoretical framework emphasizes the importance of spatial awareness and intuitive interaction in smart home interfaces, while aligning with Sustainable Development Goals (SDGs) 9 and 11, which focus on resilient infrastructure and sustainable urbanization.

Design/methodology/approach – The study employs Design Science Research methodology to develop and validate the framework through iterative implementation and evaluation. The core implementation integrates a visualization system based on the Unity engine, using particle systems for intuitive temperature distribution representation and based on an MQTT-based real-time communication infrastructure for IoT device

integration. The framework employs inverse distance weighted interpolation algorithms to create smooth and spatially accurate environmental data visualizations, while the integration with Home Assistant and its add-ons provides robust device management and control capabilities (Barricelli et al., 2024).

Findings – The framework successfully implements real-time visualization of environmental data through an innovative particle system approach, with the system providing smooth visualization of temperature gradients across different rooms. The architecture's modular design establishes a foundation for integrating diverse IoT devices. The implementation of temperature visualization through particle systems proves the viability of extending this approach to other environmental data types.

Research, practical & social implications – The framework establishes a new paradigm for spatial visualization of environmental data in residential settings (Besan et al., 2021), while its extensible architecture enables integration of various smart home actuators. The system's bidirectional communication capabilities support effective control interfaces for managing multiple interconnected systems simultaneously. From a social perspective, the framework's ability to integrate diverse IoT devices and present their data in an intuitive spatial context advances both home management practices and energy awareness. This integration of visualization and control capabilities positions the framework as a practical tool for promoting sustainable home management practices, with potential applications in regional energy efficiency initiatives.

Originality/value – The Smart Twin House project demonstrates practical applicability through its integration with established smart home platforms. By addressing both technical innovation and sustainability goals, it makes a unique contribution to smart home technology through demonstrated improvements in spatial understanding and control of home environments (Bouchabou et al., 2023). Finally, this combination of technical innovation and practical application provides contributions to the theoretical understanding and implementation of digital twins in residential environments.

Keywords - Smart home, extended reality, internet of things, digital twins, sustainable buildings.

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Parallel Session

Session 12 – Smart Technologies for Environmental Resilience

SOURCE OF STONES ON WALLS OF SANTIAGO FORTRESS IN SESIMBRA: PART 2

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Extended Abstract

Purpose – In this study we continue the work already started in Ludovico-Marques and Paz (2024), which intends to identify the coeval quarries or the sites that can be used as source of stone materials similar to those found on Santiago fortress, Sesimbra, Portugal, built in XVII Century on the construction site of Ancua Fort of XVI century (Ferreira, 2015; Pedrosa, 2020). The knowledge of a natural process of extraction of rock material, as the fall of unstable blocks of the rock massif in a surrounding area over California beach, and its ancient probable use for building stones of Santiago fortress, contributes to ensure the sustainability of future conservation works as it provides a source of sound similar materials for replacement.

Theoretical framework – Consolidating existing stone blocks is preferable to using newly extracted materials, which often lack the original quality. The best materials were typically used in past constructions, and finding identical ones today is rare. However, using similar, weathering-resistant stones from extractable sites is an acceptable alternative (Soares, 2001).

Design/methodology/approach – Having previously established that the most probable location of the quarries that produced the stone materials for the fortresses of St. Teodósio and Santiago, were the Ribeira de Cavalos area at west, and the area close to the California beach, towards Serra da Achada, at the east (Ludovico-Marques and Paz, 2024), we focused the present study on the stability analysis of the rock mass found over California beach and the result of slipping of the unstable blocks from the mountain. For this, we used Google Earth for a remote detection inspection, analyzed the geological map of Manuppela et al. (1999), visited the site, and carried out a field survey.

Findings – The process of the natural movement of unstable blocks of dolomitic limestones of the rock mass that fell and slipped through smooth to steep slopes, downwards the shoreline around California Beach, was a probable main procedure for

“quarrying” rock materials that were later cut into dimension stones used to build the Santiago fortress.

The orientations of the three most representative families of fractures are responsible for the blocky massif according to the classification considered by ISRM (1978). The results of the field survey comprised the detection of fractures with strikes of N30°-35° W, N30°-35° W, N75°-85°E and with dips to, respectively: NE, SW and NW, ranging to sub-vertical. Visible natural “production lines” of blocks are located on the slopes of the rock mass. Sliding of blocks occurred when their own weight prevailed over the resistance forces of the rock mass and then fell and slipped downwards to the beach.

Research, practical & social implications – Nowadays the more similar blocks to those found in Santiago fortress to be used in future conservation works should be removed from the beach and stored under adequate conditions to ensure their availability.

Originality/value – The obtained knowledge will contribute to the sustainable conservation improvement of cultural heritage and preservation of historical values in the Sesimbra area, especially Santiago fortress.

Keywords – Santiago fortress, Sesimbra, nature “quarrying”, stones conservation.

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Parallel Session
Session 13 – Circularity, Waste and Water Strategies

ASSESSMENT OF THE PLASTIC WASTE CYCLE IN PORTUGAL

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Extended Abstract

Purpose – This article addresses the pressing issue of plastic and microplastic pollution in Portugal, focusing on identifying inefficiencies in waste management systems and mapping critical pollution hotspots. By tackling these challenges, the research aims to contribute to developing more effective strategies for combating regional plastic pollution.

Theoretical framework – This study is based in established theories related to the plastic life cycle, sustainable waste management, and the environmental impact of microplastics. Key concepts from the circular economy are employed to understand the flow of plastic materials within Portugal, and principles of ecotoxicology are integrated to evaluate the effects of microplastics on marine and terrestrial ecosystems. A systems analysis approach is employed to assess the efficiency and challenges of waste management systems, providing a comprehensive perspective on the issue.

Design/methodology/approach – An integrated methodology was applied, starting with a bibliometric analysis conducted using Biblioshiny in R Studio to identify trends in scientific research on plastic pollution. A mass balance analysis was then performed on Municipal Waste Management Systems data to evaluate the efficiency of recycling and waste treatment processes. To complement these findings, detailed spatial maps were

developed in R Studio, illustrating the distribution of microplastics in sediments and marine organisms and identifying research gaps in inland and protected natural areas.

Findings – The findings of this research reveal a significant increase in scientific publications on plastic pollution following the onset of the global Covid-19 pandemic. This increase indicates a raising global and national concern about this issue. The mass balance analysis identified considerable inefficiencies in the current waste management systems, which hinder progress toward achieving European Union recycling targets. Additionally, spatial mapping highlighted critical contamination areas, mainly coastal marine ecosystems, and exposed notable research gaps in inland regions. These results emphasize the need for targeted interventions in public policy and future scientific investigations.

Research, practical & social implications – This work has substantial practical implications, emphasizing the importance of developing more efficient recycling infrastructures, implementing educational campaigns to enhance public engagement in waste management practices, and developing effective public policies. Furthermore, the study highlights the need for prioritizing research in underexplored regions and sensitive ecosystems to address current knowledge gaps effectively.

Originality/value – The present article makes an original and significant contribution by offering a detailed mapping of microplastic pollution hotspots in Portugal and identifying key deficiencies in waste management systems. These findings provide a robust foundation for advancing research and formulating more effective public policies to combat plastic pollution, ensuring a more sustainable future for Portugal.

Keywords - Plastic pollution, microplastics, waste management, recycling, Portugal.

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Parallel Session
Session 13 – Circularity, Waste and Water Strategies

**THE FRONTSH1P PROJECT: DEVELOPING CIRCULAR
SYSTEMIC SOLUTIONS BASED ON WATER AND NUTRIENTS
WITH MICROALGAE TOWARDS A GREENER AND MORE
RESILIENT CIRCULAR ECONOMY, ACCELERATING
TERRITORIAL REGENERATION**

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Extended Abstract

FRONTSH1P aims to ensure a green and just transition of the Polish region of Łódzkie towards decarbonization and territorial regeneration by demonstrating highly replicable circular systemic solutions (CSSs) at TRL7 and creating a territorial cluster of circular initiatives. Accelerating the transition to a greener and more resilient economy will provide sustainable responses to the needs of the regions involved. The proposed CSSs were implemented and demonstrated in the Łódzkie region, where key territorial partners, including regional institutions, scientific partners, representatives of civil society, and industry groups, played a relevant role in promoting, facilitating, and enabling systemic and circular economy at the regional scale.

LNEG is leading the CSS Water and Nutrients, initially collecting data and characterizing the available wastewaters and anthropogenic CO₂-rich gases, which were evaluated as feedstocks with potential for treatment by microalgae, with particular emphasis on direct use by partners within the consortium. An inventory of known physical and (bio)chemical data was compiled. The exploitable wastewaters were identified based on chemical and physical characteristics, periodicity of production and treatment in dedicated wastewater treatment plants, environmentally critical issues, geo-location, and any relevant information on the discarded residues. Conventional treatment processes currently in use and associated costs were used as a base scenario for comparison with the microalgae-based treatment process proposed in this work.

Domestic wastewaters from the multinational company K-FLEX, which specializes in the production of plastics, rubbers, and coatings, and from the municipality of Parzęczew, Poland, were successfully used as culture medium for *Chlorella vulgaris* with an adequate carbon/nitrogen/phosphorus (C/N/P) balance, which significantly promoted cell growth.

The microalgae effectively assimilated the nutrients, resulting in biomass accumulation and concomitant bioremediation. To facilitate the cultivation of the microalgae on in situ generated wastewater, a mobile 1m³ tubular photobioreactor (FBR) prototype with an integrated LED lighting system was designed and fabricated by the Italian company STAM and operated at the K-FLEX industrial plant in Poland. This system controls algal growth and optimizes environmental conditions to increase biomass productivity. Mobile FBRs offer significant advantages by providing flexibility of use and reducing the need for extensive infrastructure investments. Moreover, the ability to maintain stable growth conditions, regardless of external climatic variations, makes this system a valuable tool in the advancement of wastewater bioremediation strategies. The results of the first experiments carried out in the mobile FBR are presented and critically discussed here. In addition to biomass productivity, LNEG also investigated the agronomic efficacy of the produced biomass as a biofertilizer or biostimulant through various bioassays. The integration of waste valorization and resource recovery principles within the FRONTSH1P project aligns with broader sustainability goals and contributes to the development of circular bioeconomy models.

Keywords – microalgae, bioremediation, photobioreactors, circular economy.

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Parallel Session
Session 13 – Circularity, Waste and Water Strategies

TRENDS IN SUSTAINABLE OIL SPILL REMEDIATION TECHNIQUES

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Extended Abstract

Purpose – This study aims to explore the trends in oil spill remediation techniques, emphasizing the shift towards sustainable methods. While oil exploration occurring with significant economic and energy benefits, its widespread extraction, use, and the resulting spills pose severe environmental threats. The purpose is to analyze the development of effective remediation strategies and highlight emerging innovations in addressing the ecological impact of oil spills.

Theoretical framework – Oil has been central to the global economy for over a century. It is essential for energy production, transportation, and manufacturing. However, the extensive extraction and use of oil have raised concerns due to the environmental consequences, particularly oil spills. These spills pose significant risks to marine ecosystems, wildlife, and human communities. Therefore, remediation of oil spills is crucial in mitigating the damage caused by these events. This study's theoretical framework is grounded in classifying oil spill remediation methods into physical, chemical, and biological approaches, with an increasing focus on sustainable solutions such as bioremediation

Design/methodology/approach – This study utilizes a bibliometric analysis to evaluate oil spill remediation research trends. It categorizes remediation techniques into physical, chemical, and biological methods and examines the growing interest in sustainable approaches. The study focuses on the shift towards bioremediation, which uses microorganisms to degrade pollutants, and nanotechnology, which offers innovative solutions for more effective remediation. The analysis also highlights the role of international collaboration in addressing the global challenges of oil spill management.

Findings – The bibliometric analysis indicates a steady increase in research publications on oil spill remediation, especially following major oil spills like the Exxon Valdez and Deepwater Horizon disasters. The findings suggest that while traditional methods such as physical containment and chemical dispersants continue to be used, there is a clear trend towards more sustainable and eco-friendly approaches. Bioremediation, which leverages naturally occurring microorganisms, has shown promising results, as it is cost-effective and environmentally friendly. Additionally, nanotechnology, which can enhance oil removal from contaminated environments, is gaining attention as an innovative and potentially transformative tool in oil spill remediation. Furthermore, the analysis reveals a growing network of global collaborations among institutions, underlining the need for international cooperation in combating oil spill disasters.

Research, practical & social implications – The research underscores the importance of developing more sustainable and cost-effective oil spill remediation techniques. From a practical perspective, bioremediation and nanotechnology hold promise for reducing the long-term environmental impacts of oil spills. Socially, the study emphasizes the need for global collaboration to address the widespread ecological damage caused by oil spills, particularly in vulnerable coastal and marine ecosystems. The ability to quickly and effectively mitigate the impacts of oil spills is critical for protecting biodiversity, local communities, and industries dependent on these ecosystems.

Originality/value – This study contributes to the literature by providing a comprehensive bibliometric analysis of oil spill remediation, focusing on sustainable methods. It highlights the growing importance of bioremediation and nanotechnology in improving the efficiency and environmental sustainability of oil spill response efforts. The study also emphasizes the role of international collaboration in addressing the global scale of oil spill challenges.

Keywords - Oil spill remediation, bioremediation, sustainable techniques, environmental impact, global collaboration, marine ecosystems.

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Parallel Session
Session 13 – Circularity, Waste and Water Strategies

THE INTERNATIONAL STANDARDS OF SUSTAINABLE ENVIRONMENTAL-ECONOMIC ACCOUNTING IN THE CONTEXT OF WATER RESOURCE ACCOUNTING

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Extended Abstract

Purpose - In focus of this study is an analysis of international standards and agreements pertaining to the accounting of water resources to ensure their sustainable development, and a discussion of the issue related with adaptation of the international sustainable development policy in the context of use of water resources. One of the gravest problems in water resource management stems from the lack of sustainable development standards, resulting in numerous adverse effects.

Theoretical framework - The framework international standards and agreements regulating the sustainable development of water resources include several important documents. A central one is Sustainable Development Goals (SDGs), SDG 6 in particular, aimed to ensure access to clean water and sanitation for everybody. This standard underscores the need for rational use of water resources and protection of ecosystems. Another important document is the EU Water Framework Directive setting a holistic approach to the protection of all the water objects in the European Union. The Directive is designed to achieve good environmental conditions of waters and an integrated management of water resources.

Design/methodology/approach - The study involves a review of the existing international standards and recommendations on the environmental-economic accounting, with emphasis on water resources. This allows for identifying mainstream conceptions and approaches already used in various countries. Also, the comparative approach is used: a comparison of methods for accounting water resources in various jurisdictions, to reveal most effective practices and their compliance with the international standards.

Findings - Integrating water resources in national and international policies is critically important. Collaborative efforts of government and non-government organizations, businesses and communities can promote the development of innovative approaches to

water resource management, including the implementation of nature-based solutions and advanced technologies

Research, practical & social implications - Preservation and rational use of water resources is a strategic objective for each country. The important components of this process, apart from technical activities, include raising public awareness and introducing best international practices. Only a holistic approach to water resource management can help preserve water resources for future generations and achieve the sustainable development in a country.

Originality/value - The sustainable development of water resources is a key component in implementing SDG 6. As shown by the analysis, effective methods of water resource management and investment in their development will ensure the accessibility of clean water and advanced sanitation systems for everybody. Special emphasis is made on the indicators measuring the progress in the achievement of these goals, in particular the share of population with access to safe drinking water and centralized sanitation systems, and the volume of discharges of polluting drainage waters.

Keywords - Water resources, environmental-economic accounting, special data dissemination standard, sustainable development.

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Parallel Session
Session 14 – Health, Environment and Lifestyle

GENETIC SCREENING FOR CHANGE: TACKLING OTOTOXICITY AND HEARING LOSS TO EMPOWER COMMUNITIES

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Extended Abstract

Purpose - This project introduces an innovative approach to raising awareness about genetic mutations linked to ototoxicity and hearing loss, contributing to improved hearing health and health literacy. By collaborating with primary schools and offering micro-credential courses for parents and caregivers, it bridges the gap between scientific research and community engagement while screening for the A1555G mutation.

Theoretical Framework - Grounded in educational theories emphasizing lifelong learning and effective science communication, this initiative integrates genetic literacy with community-based strategies. This approach fosters a deeper understanding of how genetic mutations impact hearing health and highlights preventive measures.

Design/Methodology/Approach - The methodology combines genetic screening with community outreach. Partnerships with primary schools facilitated workshops and introduced a painless swabbing method as an alternative to traditional blood sampling. This protocol, designed for accessibility and minimal invasiveness, proved particularly suitable for young children. Screening was conducted on 25 children, aged 1 to 5 years, from diverse national backgrounds.

Findings - No cases of the A1555G mutation were detected in this cohort. However, results indicate a substantial increase in parental understanding of how genetic factors influence hearing health. The micro-credential courses saw high participation and completion rates, demonstrating their success in effectively sharing knowledge. While the mutation was not identified among the screened children, the findings emphasize the importance of systematic screening programs for early prevention and intervention.

Research, Practical & Social Implications - By integrating education with genetic research, this initiative demonstrates the impact of community engagement in health literacy. The successful implementation of micro-credential courses provided families with essential knowledge about hearing health, while the painless swabbing technique offers a replicable model for other community-based genetic screening programs.

Originality/Value - This work highlights the potential of combining genetic screening with educational initiatives to enhance public health literacy. By empowering families with knowledge, it promotes informed decision-making and ensures equitable access to genetic information, ultimately contributing to early prevention strategies and reducing long-term healthcare costs.

Keywords - Genetic screening, ototoxicity, A1555G mutation, community engagement, micro-credentials.

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Parallel Session

Session 14 – Health, Environment and Lifestyle

**LOW-COST SENSORS-BASED SOLUTIONS AS TOOLS TO
IMPROVE INDOOR AIR QUALITY IN CLASSROOMS:
PERCEPTION IS NOT ENOUGH**

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Extended Abstract

Purpose - This study intended to study indoor air quality (IAQ) in classrooms, in a multi-pollutant approach using low-cost sensors (LCS), to obtain real-time data that allows teachers to act to improve ventilation, when threshold values are exceeded.

Theoretical framework - Poor Indoor Air Quality in classrooms (Osborne et al., 2021) has been linked to several negative effects, including cognitive decline and reduced focus (Toyinbo, 2023). Increasing CO₂ concentrations e.g. from 900 to 2100 ppm, can reduce task performance by up to 12% (Wargocki et al., 2020). As students spend much of their day in classrooms, adequate ventilation and regular IAQ monitoring are crucial for timely interventions.

Recent advances in low-cost sensors and Internet-of-Things (IoT)-based solutions enable real-time monitoring of indoor pollutants. These strategies can support sustainable ventilation systems, improve IAQ, and contribute to healthier buildings (Demanega et al., 2021).

Methodology - This study monitored 171 classes in nine naturally ventilated classrooms, in a high school in Ponte de Sor, in May 2023 (Canha et al., 2024). Low-cost sensors measured particulate matter (PM_{2.5} and PM₁₀), CO₂, VOCs, temperature and relative humidity (RH). Data was sent in real time to an online cloud platform. Teachers completed a questionnaire after each class, to assess their IAQ perception (from 1 = "very bad" to 10 = "very good"). Data analysis was performed using IBM SPSS Statistics 27.

Findings - The overall mean PM_{2.5} and PM₁₀ concentrations in the monitored classes were 19.5 ± 6.8 and $29.7 \pm 11.1 \mu\text{g.m}^{-3}$, respectively, both below the Portuguese legislation limit values (LV 25 and $50 \mu\text{g.m}^{-3}$), but above the WHO guidelines (5 and $15 \mu\text{g.m}^{-3}$, respectively). The mean CO₂ concentration was 1042 ± 449 ppm (LV 1250 ppm) and VOCs averaged 144 ± 79 ppb (LV 262 ppb). The mean temperature was $25.5 \pm 1.8^\circ\text{C}$ (according to ISO 7730, the summer optimal range is $23\text{--}26^\circ\text{C}$). Considering the monitored classes, temperature presented the highest percentage of exceedances (46%), followed by PM₁₀ (32%), CO₂ (27%), PM_{2.5} (21%), RH (16%), and VOCs (3%). Spearman's correlations only showed a significant association between IAQ perception and temperature ($\rho = -0.225$, $p\text{-value} = 0.003$).

Research, practical & social implications - This study confirmed that classrooms are a microenvironment where CO₂, PM and temperature thresholds are often exceeded. It also found that high CO₂ levels, commonly perceived as "stuffy air," may go unnoticed, as teachers did not link elevated CO₂ concentrations with a lower IAQ perception, even when legal limits were exceeded.

Given the impact of IAQ on health and performance, real-time monitoring of pollutant concentrations should be implemented, as in this study. If teachers are aware of the declining of IAQ during classes, they can take action and improve ventilation, e.g. by opening windows or doors. Therefore, real-time IAQ monitoring with feedback for teachers, should be available in classrooms.

Originality/value - This study demonstrates that low-cost sensing technologies enable real-time, accurate air quality monitoring in classrooms and other environments, where the traditional monitoring methods are impractical due to factors like noise, portability and cost.

The use of these tools allows for informed human decision-making regarding IAQ. Furthermore, they offer the potential for automatic control systems that can actively improve IAQ, and can be integrated into management systems for healthy, sustainable buildings.

Keywords - Healthy sustainable buildings, indoor air quality, low-cost sensor, ventilation, schools.

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Parallel Session

Session 14 – Health, Environment and Lifestyle

IMPACTS OF HOLISTIC FESTIVALS ON VISITOR' WELL-BEING

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Extended Abstract

Purpose – The objective of this study is to understand the impact of a holistic festival on the health and the well-being of visitors. More specifically, it aims to understand the profile of the visitors and their lifestyle, their motivations, the benefits that this festival provides and the contribution to local economy.

Theoretical framework – Holistic tourism emerges as a new form or option for the practice of tourism, supported by ideas such as the search for well-being. The creation of related products and services related to both tourism and health has established health and wellness tourism as a unique identity, emerging innovative possibilities, such as the development of well-being festivals (Yoo et al., 2013).

Holistic tourism, namely the festival studied, by promoting the supply of services and products related to well-being, can attract tourists and boost national and local economic development.

Design/methodology/approach – The sample consists of 129 participants from the festival, and data collection was a questionnaire specifically designed for this purpose. The first part of the questionnaire aims to understand the motivations and benefits of the festival and the second the profile and lifestyle of the visitors.

Findings – Through this study, we found that visitors to this Festival value an environment conducive to relaxation and introspection, fundamental characteristics of holistic tourism. In addition to providing a space for socializing, it is a catalyst for the adoption of healthier lifestyles, benefiting both visitors and the local community. Regarding the profile of festival visitors, there is a predominance of women and people who are employed. Most participants have a high level of education, which suggests a search for socialization, self-care and personal development experiences. With a predominance of health, management and education professionals, this Festival

reflects its relevance as an inclusive space for well-being, with the possibility of international attraction.

Research, practical & social implications – This Festival demonstrates a strong potential to consolidate itself as an accessible and quality well-being event, with regional appeal and capacity for internationalization.

Furthermore, it can strengthen the local economy. By attracting people from different regions, it boosts regional commerce, benefiting restaurants, hotels and local businesses. On the other hand, the inclusion of activities focused on well-being and holistic practices expands the tourist offer, positioning the region as an interesting destination for health and well-being tourism. This dynamic not only provides a richer experience for visitors but generates also new employment opportunities and stimulates the growth of local services, contributing to a more sustainable development of economy.

Originality/value – Although the importance of holistic tourism is growing as a thriving segment in the wellness tourism sector, current knowledge on the subject is still limited. According to Dillete et al. (2020) this type of tourism is increasing substantially and many already consider health tourism as an important part of their business, making it essential to develop strategies that correspond to the growing demand for health-related products.

Keywords - Tourism, holistic tourism, well-being, health.

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Parallel Session

Session 15 – Health, Sustainable Innovation in Food and Beverage Systems

**SUSTAINABLE AND RESILIENT REFRIGERATION SYSTEMS
FOR FISHERIES: INTEGRATING CO₂ TECHNOLOGY WITH
RENEWABLE ENERGY FOR REGIONAL DEVELOPMENT**

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Extended Abstract

Ensuring sustainable and resilient food preservation systems is crucial for regional development, particularly in fisheries-dependent communities. This study evaluates innovative refrigeration solutions that integrate CO₂-based technologies with renewable energy sources, reducing environmental impact and enhancing economic sustainability. Four alternative configurations for refrigerated fish storage are analyzed, ranging from grid-dependent systems to fully autonomous renewable energy solutions. Alternative A consists of two refrigeration units using R134a, powered by the public grid, while Alternative B employs a transcritical CO₂ refrigeration system, also grid powered. Alternative C integrates a CO₂ refrigeration system with autonomous renewable energy, and Alternative D combines CO₂ refrigeration with seawater heat exchange and autonomous renewable energy sources. Results indicate that Alternative D is the most advantageous, achieving a return on investment within five years and enabling a 95% reduction in greenhouse gas emissions through autonomous electricity generation. Although Alternative C requires an initial investment of €769,172.00, it proves financially feasible, reducing CO₂ emissions by 360,697 kg compared to conventional systems and significantly improving energy resilience. Beyond environmental and economic benefits, the implementation of resilient refrigerated storage facilities strengthens regional fisheries, extending fish preservation time, reducing food waste, and increasing market flexibility for fishermen. By fostering economic resilience, food security, and local sustainability, this study underscores the role of integrated renewable energy solutions in regional development and sustainability.

Keywords - Sustainability, fish preservation, environmental impact, food security, socioeconomic development.

Parallel Session

Session 15 – Health, Sustainable Innovation in Food and Beverage Systems

SUSTAINABLE APPROACH TO REUSE OF WINERY EFFLUENTS IN MICROALGAE CULTIVATION

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Extended Abstract

Purpose – The wine industry must adapt their processes address future challenges that emerge from climate changes, such as greenhouse gas emissions and water scarcity. Microalgae cultivation offers a solution to mitigate both issues while also generating valuable products from the resulting biomass. This study intends to scale up microalgae cultivation in media containing winery effluents supplemented with essential nutrients.

Theoretical framework – Winery effluents are challenging due to their complex composition, which includes high organic load and growth-inhibiting compounds such as alcohols, organic acids, polyphenols, and a low pH (Jorge et al. 2023; Vlotman et al. 2022). Nevertheless, these effluents are still rich in nutrients to support microalgae

growth and their incorporation into cultivation media has shown to promote cell proliferation (Sousa et al. 2024).

Design/methodology/approach – The cultivation tests were conducted in tubular photobioreactors, with a 40-fold scale up from laboratory tests that identified the optimal culture medium composition for microalgae growth. Growth was monitored daily for over two weeks, with samples collected to measure cell density, pH, temperature, and light intensity. At the end of the experiment, the biomass was harvested, dried, and analyzed for its primary macro- and micronutrient composition.

Findings – The microalgae biomass productivity was enhanced by the presence of 10% effluent concentration in the tested media. Furthermore, the resulting biomass exhibited higher of lipids carbohydrates, and pigments such as chlorophylls and beta-carotene. These characteristics make this biomass particularly valuable for agricultural applications.

Research, practical & social implications – REDWine project introduces an innovative circular business model that leverages synergies across bio-based industries, enabling wine manufacturers to efficiently treat liquid and gaseous effluents while diversifying revenue streams through the valorization of *Chlorella* biomass into high-value products. By cultivating microalgae in media partially incorporating winery effluents, the process not only enhances water efficiency but also generates biomass with applications in agriculture, such as vine protection and soil enrichment. A streamlined biorefinery, designed for deployment within wineries, produces sustainable and cost-competitive ingredients for several sectors: proteins and fatty acids for food formulations, peptides, carotenoid-rich oils, and active polysaccharides for cosmetics, carbohydrates as vine biostimulants for agriculture, and proteins for wine clarification. This approach transforms winery waste into valuable resources, promoting sustainability within a circular economy scheme.

Originality/value – The possibility of using microalgal biomass cultivated in media partially incorporating winery effluents not only enhances water efficiency but also the production of valuable byproducts with potential agricultural applications, such as protecting vines and enriching soils.

Keywords – Winery effluents, microalgae, chlorella, circular business model, biorefinery.

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Parallel Session

Session 15 – Health, Sustainable Innovation in Food and Beverage Systems

**REDWINE PROJECT: INCREASING MICROALGAE BIOMASS
FEEDSTOCK BY VALORIZING WINE GASEOUS AND LIQUID
RESIDUES**

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Extended Abstract

Global warming due to greenhouse gases (GHG) has become a serious worldwide concern. The new EU Green Deal aims to achieve GHG emissions reduction by at least 55% by 2030 and a climate neutral EU economy by 2050. The deal strongly encourages GHG reducing measures at local, national and European levels. The REDWine project will demonstrate the technical, economic and environmental feasibility of reducing by, at least, 31% of the CO₂ eq. emissions produced in the winery industry value chain by utilizing biogenic fermentation CO₂ for microalgae biomass production.

REDWine concept will be realized through the establishment of an integrated Living Lab demonstrating the viability of the system at TRL 7. The Living Lab will be able to utilize 2 ton of fermentation off-gas/year (90% of total CO₂ produced in the fermenter) and 80 m³ of liquid effluent (100% of the liquid effluent generated during fermenter washing) to produce 1 ton (dry weight) of *Chlorella* biomass/year. This biomass will be processed under a downstream extraction process to obtain added-value extracts and applied in food, cosmetic and agricultural end-products and to generate a new EcoWine. REDWine will focus on the recovery of off-gas from a 20000L fermenter of red wine production existing in Adega Cooperativa de Palmela (ACP, located in Palmela, Portugal).

REDWine's microalgae were tested in 2022 and 2023 with 4 purposes in vineyard: improve flowering stages, contribute to high temperature resistance, biofungicide against downy mildew and increasing in nitrogen content in ripening to help fermentation and improve aromatic compounds. It was also used in winemaking processes as a clarificant or antioxidant agent.

It was also produced a cake using 1% of *Chlorella vulgaris* flour and a jelly food to replace tuna or salmon. It's expected to have first cosmetics prototype by March 2025.

Closing Summary

ICRSR 2025 brought together perspectives from management, engineering, environmental sciences, technology, and the social sciences to examine how regions can navigate complex transitions while safeguarding equity and ecological integrity. A recurring theme was the need to move beyond siloed solutions and toward coordinated strategies that combine governance capacity, data and digital tools, sustainable infrastructure and logistics, circular economy approaches, and social inclusion. The programme underscored that resilience is not only a matter of recovery, but also of learning, adaptation, and transformation, enabled by trust, collaboration, and institutional innovation.

In closing, participants reaffirmed the value of conferences such as ICRSR as spaces where research and practice can meet, challenge assumptions, and co-create actionable agendas. The contributions included in this book of abstracts capture both the breadth of ongoing work and the urgency of continued collaboration. We hope this volume supports further exchange among researchers, students, practitioners, and decision-makers, and serves as a stepping stone toward resilient, sustainable, and socially just regional futures.