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Table of Contents

Foreword

Assoc. Prof. **Agnese Dāvidsone**, Rector of Vidzeme University of Applied Sciences

Dear readers,

It is my honour and privilege to introduce to you this exciting and topical collection of conference abstracts from the 5^{th} International Scientific Conference *SOCIETY. TECHNOLOGY. SOLUTIONS,* held at Vidzeme University of Applied Sciences (ViA), Latvia.

With this book, we mark an important milestone in our dedicated efforts to nurture STEAM, social sciences, and the humanities in proposing scientifically grounded solutions to some of the most pressing challenges of today's world. Among these challenges, we see (too) rapid technological development, struggling economies, and the climate crisis—all of which are coupled with a growing need for increased societal resilience and stronger-than-ever democratic leadership.

The authors of these abstracts represent various universities and countries from different continents. However, they are united by a shared scientific passion for making the world a better place.

I would like to warmly thank the authors of the abstracts, the reviewers, and the members of both the Scientific and Organizing Committees of the conference. I would also like to personally thank my esteemed colleague, Ms. Zane Kudure, for leading the team that organized the conference and the dynamic and diverse program of the very first international Science Festival at ViA. This festival serves as a great example of how the vibrant community of the European University Alliance, E^{3}UDRES^2, continues to bring together academics, students, industry practitioners, and policymakers. At E^{3}UDRES^2, we lead by example.

I wish you many new insights and much inspiration as you read this volume!

Assoc. Prof. **Oskars Java**, Co-Director of Doctoral School at Vidzeme University of Applied Sciences

We started the tradition of the International Scientific Conference *SOCIETY. TECHNOLOGY. SOLUTIONS* in 2019, when I was the main organizer. I continued organizing the conference until 2022, when I changed my position at the University and no longer had the time to organize it.

I'm glad that other colleagues have taken over and that the tradition is being kept alive. This year, the Conference has grown larger than before, with more participants and a greater number of thematic sections. Among the participants are several of our doctoral students, and we hope that this conference will be an excellent soil to grow and learn from more experienced colleagues and keynote speakers.

Prof. **Agita Līviņa**, Co-Director of Doctoral School at Vidzeme University of Applied Sciences

The conference is being held during a period of significant structural changes at Vidzeme University of Applied Sciences, where a single joint scientific institute is being established to enhance interdisciplinarity in research.

The Doctoral School was established in early Spring 2025. I am co-leader of the Doctoral School on the joint PhD study programme on Economics and Business. I am proud that at our conference, 13 PhD students or candidates are presenting their research, of course, in different stages, but this is a way to grow by doing, discussing and networking. It is very gratifying that the conference includes trusted and well-known researchers from other countries affiliated with Vidzeme University of Applied Sciences. We have researchers from India, the Netherlands, the United Kingdom, Finland, Albania, Ukraine and of course from Latvia.

I would emphasize topics such as resilient & circular economy, creative industries, heritage, nature conservation, and outdoor activities as well as media, communication and technologies.

All of these areas of research revolve around people, both in terms of how they have acted in the past and what legacy they have left behind, so that we can view and evaluate it with today's eyes, and in terms of working and creating innovations to develop the region sustainably and ensure that society and entrepreneurs are responsible for their actions. So that after work, people can relax and enjoy nature, preserving it for future generations. And, of course, all of this is influenced by the technologies that researchers develop and try to apply in various industries, as well as external circumstances and communication about what is happening from different angles and at different levels.

I am always truly delighted to welcome outstanding researchers in their field to Valmiera, and sometimes I am amazed at how it works out. And I can only recommend one recipe: do it, try it, and understand why you invite excellence.

KEYNOTE

The Digital Data Divide: Using Speculative Fiction to Facilitate Public Dialogue on the Increased Use of Personal Data

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Background

In today's interconnected world, personal data generation and collection are growing exponentially. Increasingly, data from multiple sources, ranging from vital signs to environmental and lifestyle information, are combined to create detailed personal profiles (Brunning et al., 2023). While this enables more personalized care, it also raises questions about privacy, data reliability, ownership, and the desirability of collecting such data.

To foster dialogue on these issues with a broad audience in an engaging and accessible way, the festival experience *The Digital Data Divide* (www.thedigitaldatadivide.nl) was developed (Groeneveld et al., 2024). This interactive experience draws on the concept of narrative learning, an approach that uses stories and dialogue to help individuals interpret and understand the world around them (Elsden et al., 2017). When applied as speculative fiction, narrative learning is especially effective for exploring potential future scenarios. By embedding these scenarios within a story, it encourages participants to critically examine and question their present viewpoints (Haste and Abrahams, 2008). *The Digital Data Divide* premiered at the Zwarte Cross Festival in the Netherlands in 2023 and has since been featured at various festivals, events, congresses, as well as in educational and healthcare settings and won the E^{3}UDRES^2 Innovative Science Outreach Award in May 2025.

Methods

The concept was co-created with a diverse group of stakeholders, including professionals from healthcare, gaming, ethics, education, design, as well as students. This collaborative process generated two future focused storylines (one dystopian, one utopian) which were developed with a professional scriptwriter, actors, a composer, and videographers into two short films (trailer: https://youtu.be/SAZAgA2zeRM). During the experience, participants select either a red or blue pill to determine which scenario they will view. After watching their chosen film, they are matched with individuals who saw the alternative scenario and take part in a guided discussion supported by dialogue cards.

Evaluation was conducted over one year at diverse public venues. Data collection used a flyer suited to informal environments: participants provided demographics (gender, age, education level) and indicated agreement with statements on a visual analog scale. Open comment fields invited qualitative feedback.

Results

A total of 758 participants took part (47% male, 51% female, 2% other/prefer not to say), with an average age of 34 years (SD = 12). Educational backgrounds were varied: 22% vocational, 42% applied sciences, 35% academic, <1% PhD.

Awareness of the effect of personal data use on the individual increased after participation (pre: M = 48, SD = 18; post: M = 50, SD = 16; $p = 0.004$). Awareness of its effect on society also increased (pre: M = 47, SD = 19; post: M = 51, SD = 17; $p < 0.001$).

Qualitative analysis identified three main themes:

Concept – Participants valued the contrasting perspectives and the rejoining of viewpoints in dialogue; some requested clearer facilitation and more time for discussion.

Effect – Many described the tool as thought-provoking and a stimulus for reflection; some wished for more factual context about current real-world situations.

Content – Participants found the scenarios impactful and sometimes confronting; others were skeptical about their likelihood.

Conclusion

The Digital Data Divide shows that future-focused scenarios, created through narrative learning and speculative fiction, can effectively spark dialogue on emerging technological and ethical challenges. Combined with structured discussion, they promote critical reflection and multiple perspectives, offering value for a wide range of societal issues. This work highlights speculative fiction as a valuable tool for meaningful dialogue on the societal and ethical implications of new technologies.

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Keywords

data, AI, society, technology, speculative fiction, festivals

Nature and Heritage Conservation, Management and Interpretation

State of the Art of Research on Responsible Tourism Education: A Systematic Literature Review

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Responsible Tourism Education (RTE) is considered as an important tool to advance the concept of sustainable development. The components of RTE contribute significantly to the future workforce of tourism, which affects the practice of responsible tourism principles not only by self but also by insisting on their business operations and other stakeholders. Several review studies examined various aspects of responsible tourism such as attitudes, behavior, awareness, actions and so on, in the context of tourism stakeholders like tourists, hoteliers, travel agents and tour operators, destination management organizations. However, there are no studies examined in the literature in detail on RTE. In this regard, the study examines state of the research on RTE in terms of curriculum, teaching and learning, tools and technologies, methodologies, issues, challenges and advantages, and emerging trends. In doing so, the study constitutes a systematic literature review of the studies published in the Scopus-indexed outlets and adopts the PRISMA technique for search, inclusion and exclusion strategy. Total 40 studies were considered for the final review. Analysis shows that the responsible tourism education and related principles are mainly emphasized on eco-tourism and related destination planning and development. Studies examined responsible tourism principles such as local participation, economic aspects, national parks and protected areas, environmental education, conservation management, public attitude and perception. The study suggests that there is a need to advance sustainability discourses, particularly in the context of the RTE for higher tourism educational institutes, to adopt new trends and address the associated issues and challenges.

Keywords

responsible tourism, tourism education, SDG4, systematic literature review

Developing Financing Models for Public Goods Related to Nature-Based Tourism and Outdoor Recreation

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Public goods enable people to live together as a community, provide common benefits, and support available activities such as tourism. However, these public goods require investment, construction, and maintenance. Cities and natural areas affected by tourism are increasingly under pressure, notably nature-based tourism or outdoor activities, which have seen a surge in popularity during the COVID-19 pandemic. Higgins-Desbiolles describes tourism's problem as an addiction to growth, which is fundamentally incompatible with sustainability goals (Higgins-Desbiolles, 2018).

Apart from tourism's negative impact on nature and protected areas, global warming imposes additional costs to compensate for or protect natural areas that hold great potential for both outdoor tourism and nature conservation itself, emphasizing the need to avoid an anthropocentric approach.

On the flip side, tourism activities also create revenue for national and local governments to fund some expenditures. In the age of austerity, governments and local governments are looking for ways to deal with the funding issue for public goods fairly (Comerford et al., 2010; Crawford et al., 2010; Ortiz & Cummins, 2013). That brings us to our problem: How can we finance public goods related to nature-based tourism and outdoor activities in a sustainable way?

The aim of this doctoral research is to examine existing funding models and strategies in the field and develop sustainable funding models or tools suitable for the case of Latvia. This study aims to transform financing methods or tools to fund public goods related to nature-based tourism and understand spatial connection and restructure financing methods in the local context.

The objectives of the research can be seen below:

Identify and evaluate various existing financing models for common goods related to nature-based tourism and outdoor recreation, as defined in literature and strategy documents.

Examine various sources and mechanisms of financing and assess their suitability.

Evaluate the applicability of these financing models by assessing the balance between the identified economic and societal benefits and inputs/investments in nature-based tourism and outdoor recreation at the regional level.

The objectives mentioned above lead us to look for different dimensions of reality. Roy Bhaskar concluded that reality has three dimensions at various levels, such as the empirical level, the actual level, and the real level.

In the first stage, two systematic literature reviews will be conducted based on existing literature. Article 1 aims to examine various models of financing common goods related to nature-based tourism and outdoor recreation. In Article 2, we will conduct a systematic literature review with thematic analysis to develop a framework for categorizing public goods related to outdoor recreation and nature-based tourism.

In the second stage, a case study approach will be utilized to analyze the applicability and effectiveness of the combined financing model or models in Article 3. This phase combines qualitative and quantitative studies with field work. It aims to examine how the nature-based tourism industry can contribute to financing mechanisms and how it can be transformed.

In article 4, visitor data will be analyzed using geographic information systems (GIS). Visitors and financing strategies will be segmented according to their motivations, and conservation areas will be classified according to their visit density.

In the final stage, we will finalize the proposal of the financial models alongside the online Delphi tool for focus group discussions. That will provide valuable insights into developing sustainable funding models for the common goods and for understanding the transformation.

To this day, a typological framework has been developed, and financing strategies for funding nature parks have been determined. These findings will be further evaluated as part of the first stage of the thesis.

Acknowledgments

This research is funded by the Horizon Europe MSCA DN (Marie Skłodowska-Curie Actions Doctoral Networks) project “Visitor monitoring and management in protected and recreational areas: new challenges, novel solutions for the Anthropocene (VIMAS)”.

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Keywords

public goods, financing strategies, protected areas

Managing Nature and Visitors: Governance Strategies in National Parks of the Baltic States

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Natura 2000, the largest coordinated network of protected areas in the world, plays a key role in biodiversity conservation across the European Union. Beyond their ecological value, Natura 2000 sites also present socio-economic opportunities — particularly through nature-based tourism. In the Baltic States (Estonia, Latvia, and Lithuania), national parks within this network are both a core element of national conservation strategies and an underutilized driver of local and regional economic development.

Significance of the Topic lies in its focus on the governance of national parks (Natura 2000 sites) as multi-functional landscapes where nature conservation objectives intersect with community development and tourism-based economic opportunities. In many rural areas of the Baltic States, challenges such as depopulation, limited infrastructure, and lack of economic diversification hinder sustainable development. National parks hold strong potential to act as catalysts for environmentally responsible growth through nature-based tourism and related services.

There is an established body of research on governance structures, stakeholder roles, and policy instruments in protected area management. For instance, Lockwood (2010) outlined core governance principles such as legitimacy and inclusiveness, while Borrini-Feyerabend et al. (2013) categorized governance types and emphasized co-management. Studies on Natura 2000, such as Jones et al. (2017), demonstrate that inclusive, well-structured governance improves conservation outcomes. These works stress the importance of community engagement, flexible policy tools, and aligning conservation with socio-economic development.

However, despite this strong theoretical base and examples of good practice, the Baltic States remain underrepresented in the literature, especially in terms of how these governance strategies are implemented in practice. This research aims to address this gap by examining national parks in Estonia, Latvia, and Lithuania through a governance lens. It explores how these parks balance ecological protection with tourism-driven development, considering both institutional arrangements and stakeholder dynamics. Without well-designed frameworks, tourism development may lead to environmental degradation or fragmented policy application. This balance is increasingly crucial as the European Union prioritizes nature restoration, green jobs, and sustainable tourism through the European Green Deal and the EU Biodiversity Strategy for 2030.

Purpose of the Research

The primary objective of this study is to explore and evaluate governance approaches that enable national parks within the Natura 2000 network in the Baltic States to fulfill their economic potential — particularly through tourism service exports — while upholding conservation obligations. It seeks to identify the governance structures, stakeholder roles, and policy instruments that support integrated and sustainable protected area management.

According to national legislation, Estonia, Lithuania, and Latvia define national parks as protected areas established to preserve and manage natural and cultural landscapes of national significance — balancing conservation, restoration, research, heritage protection, and sustainable use, including nature tourism.

Each of the Baltic States has national parks engaged with the EUROPARC Federation's European Charter for Sustainable Tourism in Protected Areas (ECST), applying Charter principles through strategic partnerships, education, and best practices:

In Latvia: Ķemeri National Park and Gauja National Park (undergoing evaluation).

In Estonia: Lahemaa, Matsalu, and Soomaa National Parks.

In Lithuania: Žemaitija (Samogitia) National Park.

Methodology

This research uses a comparative, multi-case study approach focused on selected Natura 2000 and EUROPARC-certified national parks. Data collection includes:

Semi-structured interviews (with park authorities, local governments, tourism operators, NGOs);

Desk research and policy analysis of national management plans, EU directives, tourism strategies, and funding instruments (e.g., LIFE, LEADER);

Quantitative analysis of tourism statistics (visitor numbers, service exports), biodiversity indicators, and socio-economic data such as employment rates.

Expected Results

The study will produce a comparative overview of governance practices in Natura 2000 national parks across the Baltic States. It will map governance structures, stakeholder engagement mechanisms, and policy tools used to balance conservation and tourism. The findings will highlight both national differences and shared challenges, offering insight into how governance models shape the sustainable development of protected areas.

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Estonian Nature Conservation Act1 (21.04.2004.) § 26; Lithuanian Law No. I-301 on protected areas. 12 Section; In Latvia, each national park is governed by its own law, which seeks to achieve a balance between conservation and sustainable use. For example, aim of the Gauja National Park law (30.04.2009.), 2nd Section

Keywords

Natura 2000, governance, national parks, Baltic States, sustainable nature tourism, nature conservation, rural development, tourism export

Herbaceous ornamental garden escapers – a path from the urban environment to the forest

Inese Nāburga

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Over the past 25 years, the diversity of herbaceous perennial plants used in ornamental horticulture in Latvia has increased significantly. As a result of the direct introduction of various taxa into botanical gardens, nurseries, and through the activities of gardeners on private properties, different types of garden and park plants have begun to escape and naturalize *ex-situ* in local habitats outside their original settings.

Records of these new "escapers" are being documented in two main ways: traditionally, through herbarium collections maintained by academic institutions, and more recently, through online platforms that engage the general public in observing and recording flora and fauna. In Latvia, this platform is Dabas Dati (https://dabasdati.lv). The intensity of plant observation reporting on this platform is remarkably high — in 2024 alone, 54,706 plant observations were submitted.

I began monitoring garden escapers based on the list of escapee species included in the List of Vascular Plants of Latvia (Gavrilova & Šulcs, 1999), as well as my own experience working at the University of Latvia Botanical Garden (Nāburga-Jermakova & Strazdiņa, 2019). As a result of this ongoing and still-incomplete monitoring, several trends have emerged:

Previously identified garden escapers, which were recorded in the last century in ruderal and urban areas (based on herbarium collections from LATV, RAS, DAU, RIG I, and RIG II), are now being found in more natural habitats. These include forest edges, clearings, meadows, riverbanks, bogs and even protected areas and nature reserves. In this group included more than 20 taxa: *Asparagus officinale, Colchicum automnale, Hemerocallis sp., Hesperis matronalis, Ornithogalum umbellatum, Primula elatior, Scopolia carniolica, Sisyrinchium montanum* and others.

New garden escaper taxa have also been identified growing *ex situ* in ruderal and urban territories. More than 10 new ornamental plant taxa have been recorded in these environments: *Allium hollandicum, Clematis recta, Crocus vernus, Crocus tommasianus, Phlox divaricata, Phlox subulata, Lavandula angustifolia, Scilla lucidiae* and others.

In addition to the traditional ways garden escapers spread—such as through seeds and plant parts dispersed by animals, water, wind, transportation, or the dumping of plant residues outside populated areas — human-made plantings in natural areas, often within the boundaries of private property, have also been observed. Consequently, the spread of garden escapers has been unintentionally facilitated by the land reform of the 1990s, which restored land ownership rights and increased private land use in rural and semi-natural areas.

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Keywords

garden escapers, online platforms, protected areas

Impact of Online Reviews on Consumer Preferences for Travel Agencies in an Emerging Economy Context

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Online reviews have emerged as a critical source of information, reflecting the experiences of previous travelers. Research in the past indicates that such reviews shape tourists' perceptions of service quality, booking intentions, decision-making, and trust in travel services, ultimately influencing the evaluation of alternatives and finalizing travel arrangements. India, as a rapidly growing economy and a key player in both inbound and outbound tourism, has witnessed a significant rise in online travel agencies and widened services of existing travel agencies over recent years. Despite global interest on research in the role of online reviews, studies focusing specifically on the Indian context remain limited. This study investigates the impact of online customer reviews on travelers' decision-making when selecting travel agencies in India. An online survey was conducted with tourists who had previously used online travel agencies, employing a questionnaire that addressed perceptions, decision-making processes, and their influence on agency selection. The total sample size was 150 and in the present study authors have focused only on domestic travelers. The study conducted in the month of June 2025. Authors have adopted existing measurement scale to develop the questionnaire based on the study variables.

The results reveal that reputation is the most important factor influencing travel agency choice, with 55.3% (83 participants) indicating this. Price competitiveness follows at 12.7% (19 participants), with recommendations (16.7%, 25 participants) and travel agency specialization (9.3%, 14 participants) also playing a role. User-friendliness of the agency website was the least influential factor, with only 6.0% (9 participants) considering it most important. While online reviews are likely a factor for many choosing a travel agency, this survey suggests reputation is the key driver. The social media is a popular source for travel agency reviews, feedback, and content. The most popular platform (36.7%, 55 participants) is a combination of Instagram, Face book, Twitter, and travel bloggers. Google Workspace and web articles are used by a similar proportion of participants (36.0%, 54 participants and 23.3%, 35 participants respectively). Tripadvisor is the least popular source, with only 2.7% (4 participants) reporting using it. Therefore the results offer valuable insights for travel agencies in refining their business strategies and operations to enhance customer satisfaction and foster loyalty.

The survey also underscores the importance of convenience and personalized service in influencing customer choice of travel agencies. In conclusion, travel agencies must prioritize online reputation management. Encouraging positive reviews and effectively addressing negative feedback can significantly impact customer decisions. Understanding the growing influence of online reviews and catering services towards factors valued by customers, such as destination expertise, will be crucial for success in the travel industry. This research confirms that customer choice in travel decisions is undeniably influenced by the power of online reviews and feedback.

Keywords

travel agency, online review, decision making, emerging economies

Contrasting Perceptions of Cold War Military Legacy Sites in Latvia: Residents' Attitudes and Behaviours

Iveta Druva-Druvaskalne, Linda Veliverronena, Ilze Grīnfelde

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During the Cold War, global tensions were reflected in the everyday lives of local people, and these local dimensions in the landscape are visible reminders of the past, even today. In European countries, including Latvia, Cold War legacies are abundant, ranging from Soviet military bases of varying sizes to partisan bunkers and battlefields. Some of the sites and memorials are well-preserved and functional, while others are in a state of decay. The sites built by alien powers or created to resist the Soviets nowadays can be a source of difficulty and conflict among different community groups. Previous studies have explored how the presence of Cold War legacies influences the attitudes and opinions of local people across various groups, the discourse surrounding the legacy, interest in visiting places, and engagement in decision-making processes. Previous studies suggest that attitudes towards the Cold War legacy and behaviors are influenced by residents' age group, nationality, and personal connection to the legacy (Seljamaa et al., 2018; Paulus & Brekke, 2022). Miller (2019) states that younger residents are more eager to learn about these sites, while older ones who have experienced the occupation period still feel uncomfortable around such sites.

Considering the number of alien power sites established in the Cold War, the presence of multiple contexts (e.g., location, sensitivity, size, and type of the legacy, its physical state, as well as sociodemographic characteristics of the community), consequences for the landscape and communities, there are not enough studies exploring the complexities of the Cold War legacy. This research examines the attitudes of residents towards the Cold War legacy in two territories: Daugavpils City and Balvi County. Each features distinct historical narratives, types of sites, spatial structures, and sociodemographic patterns of the population, which add another layer that highlights dissonance. The data were collected through structured interviews with residents in Daugavpils (n = 108) and the Balvi region (n = 43), conducted in person from April to June 2025.

Daugavpils is the second-largest city in Latvia, with a predominantly Russian-speaking population. Balvi County is a rural territory where the majority of the population is Latvian. There are several ideologically controversial historical narratives related to the heritage that represent the legacy of the Cold War in both territories.

The study findings confirm previous research that ethnicity, age, Soviet-era experience, and personal affiliation have an impact on attitudes toward the Cold War legacy. For example, Dubrovins Park, where both the memorial to Soviet soldiers and the recreation area are located, is more associated with recreation by the younger generation, while the older generation has ambiguous views, as it is primarily a memorial site and a symbol of the Soviet period. It is noticeable that in predominantly Russian-speaking Daugavpils, people are less willing to express their opinions about the legacy of the Cold War period. In Balvi County, the residents have a closer personal affiliation with the legacy of the period (bunkers of the national partisans), but this does not mean they visit these sites more frequently. At the same time, for the locals, knowing the stories of the Partisans is part of their identity. Divided opinions exist on whether the Cold War sites should be presented to tourists. Slightly more than half of the participants in both destinations believe that the residents benefit from the presence of the sites, as they help preserve collective memory and history, ensure that sites are taken care of, encourage tourism and create jobs, and serve as a resource for education.

As a result, the majority of residents support the preservation and promotion of Cold War heritage.

Acknowledgements

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Keywords

local community, Soviet occupation period, dissonant military heritage

From Cold War Legacy to Future Heritage: A Value-Based Framework for Military Heritage Management

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Despite its social, educational, economic, and symbolic significance, military heritage (MH) remains an underexplored field in academic research. One important aspect of this heritage is the legacy of the Cold War, which — although often perceived as an 'imaginary' war — remains both nationally and globally relevant. Over the past decade, researchers from countries such as the United States, the United Kingdom, Germany, Taiwan, and the Nordic and Baltic States have increasingly focused their attention on the legacies of the Cold War. Their work has categorised this heritage, investigated strategies for its preservation or intentional neglect, and explored its potential for education and tourism.

In Latvia — formerly the westernmost border of the USSR — the legacy of the Cold War is particularly visible. The landscape encompasses a diverse range of sites, from popular tourist attractions to unattractive, degraded and abandoned locations. However, Latvia currently lacks clear national or local strategies to determine which of these sites should be preserved as heritage, especially given their broader transnational significance. Some sites have even undergone disinheritance during processes of national identity formation, reflecting a broader challenge of managing difficult heritage.

Globally, interest in military heritage is growing, particularly in the tourism sector, where well-preserved and well-promoted sites often serve as powerful attractions for visitors. This study proposes a conceptual framework for the identification, preservation, and management of Cold War military heritage sites, supporting effective heritage governance and decision-making.It employs the heritage values approach (Pearson & Sullivan, 1995; Sahraiyanjahromi & Olgaç Türker, 2021) alongside for assessment and management (Satterfield, 2002). Ten in-depth interviews were conducted with national-level military heritage experts to identify which values are most relevant to Cold War heritage.

The analysis revealed two categories of values: core values and transformative values, which are of key importance for decisions on future preservation or deliberate "forgetting". The core values include a unique heritage value (architectural, aesthetic, artistic, historical, technological, etc.), a unique and powerful story, a historical milestone, and authenticity. Transformative values encompass educational potential, economic self-sustainability (including tourism or other forms of income), the influence of interest groups, the presence of multiple levels of heritage, the degree of dissonance, and relevance to the dominant political ideology, among others. Based on these findings, a four-quadrant matrix was created to guide decision-making around site preservation or abandonment.

This multidimensional approach enables Cold War sites to enable evidence-based decision-making regarding preservation, safeguarding, conservation, or abandonment, as well as the development of effective management strategies.

Finally, the study emphasizes the importance of engaging a wide range of stakeholders — including local communities, site managers, tourism professionals, and visitors — to better understand diverse perspectives on the value of military heritage. Recognising differing views is essential for addressing potential conflicts and challenges in heritage site management.

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Keywords

post-war landscape, heritage sites, difficult heritage, heritage value, heritage governance Soviet legacy

Perception of Cultural Ecosystem Services for Entrepreneurship

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This paper builds upon the growing body of research exploring cultural ecosystem services (CES) and how individuals responsible for fostering the business environment in these areas perceive them. CES are non-material benefits that people obtain from nature (for example: recreation and ecotourism, aesthetic values, sense of place, spiritual and religious values, inspiration, cultural heritage). The intangible nature of CES complicates their economic valuation, yet they play a crucial role in overall economic development decision-making and investment planning. The economic valuation of CES can highlight the tangible benefits of nature for society, such as through inspirational processes, outcomes, and a sense of place. However, it is necessary to be careful to avoid ethical and practical concerns, such as the commodification of nature.

The primary objective of UNESCO's Man and the Biosphere (MAB) program for biosphere reserves is to integrate human values and activities with nature, while preserving the economic, ecological, ethical, and socio-cultural benefits associated with sustainable natural processes. These functions should serve the stakeholders involved in their production and management. Research on the economic value of CES in biosphere reserves highlights their significant contribution to human well-being and sustainable development (Bernadett & Melanie, 2021). It is recognized that ecosystem service values vary across different zones within biosphere reserves based on each zone's objectives; however, cultural and regulating services tend to be significantly higher in core zones (Cusens, Barraclough & Måren, 2022).

The aim of this study was to explore the perception of cultural ecosystem services in relation to entrepreneurship within the North Vidzeme Biosphere Reserve (NVBR). The study approached this from two perspectives: business support specialists in municipalities and entrepreneurs whose businesses are based on CES. The NVBR, located in North Latvia, is the only biosphere reserve in the country, covering an area of 457,708 hectares. It aims to promote interdisciplinary collaboration for sustainable social and economic development in the region, which encompasses three municipalities: Limbaži, Valmiera, and Valka. The reserve stretches along the 60-kilometer-long Vidzeme coastline of the Gulf of Riga and includes the Livonian Cultural Space. The study was conducted in three steps. Secondary data were sourced from the Latvian Central Statistical Office regarding entrepreneurship, as well as a survey conducted by the Latvian Society in 2021 and 2024 on nature conservation in Latvia. Primary data were gathered through interviews with experts and focus group discussions with municipal business development specialists and entrepreneurs focused on CES. Additionally, interviews were conducted with stakeholders who received small grants as part of the project "Biodiversity Protection in the North Vidzeme Biosphere Reserve" (2005-2008). Focus group participants completed a task aimed at assessing various territories within the NVBR and their potential for business development. They evaluated natural habitats on a scale of 0 to 3, with 3 indicating the highest potential for entrepreneurial activity. The results were then compared between municipal business development specialists and entrepreneurs. The results of the Latvian Society survey indicated that people frequently utilize cultural ecosystem services in diverse ways, including entrepreneurship, inspiration, and cultural activities. Latvia's natural resources offer opportunities for developing unique and niche products based on CES. The key lies in identifying opportunities and leveraging the unique vision, skills, and knowledge of each entrepreneur. Local business development grants provide vital support for developing and testing ideas, with each municipality offering its own small grant programs that entrepreneurs can apply for one or two times a year. While studies on the assessment of CES in Latvia and the NVBR exist, they primarily focus on the experiences of residents and visitors. This study provides insights into how existing CES and cultural ecosystem services are valued and utilized in entrepreneurship, as well as the benefits they offer to entrepreneurs, territorial development, and the biosphere reserve itself.

Acknowledgements

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Keywords

biosphere reserve, entrepreneurship, cultural ecosystem services

Resilient and Circular Economy

Transition Towards a Circular Economy in Small and Medium - Sized Enterprises: Methodological Approach

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Small and medium-sized enterprises (SMEs) play a crucial role in Europe's transition to sustainability, accounting for more than 50% of EU GDP and more than 63% of business are responsible for CO^2 and broader GHG emissions (European Commission, 2025).This study focuses on a synthesis of existing methodological approaches used to study the transition to a circular economy in small and medium-sized enterprises (SMEs). The aim is to analyze and summarize different research strategies, highlighting the most effective methods for the transition to a circular economy in these enterprises. The study uses a meta-analytic approach, reviewing qualitative, quantitative and mixed methods research designs used to investigate best practices. The main methodological frameworks include case studies, surveys, life cycle assessments and comparative analysis of regulatory compliance. By examining these approaches, the study identifies their strengths, limitations and applicability in assessing the circular economy performance of SMEs. A key aspect of this methodological synthesis involves the categorization of research approaches, such as resource efficiency, waste management, carbon footprint and regulatory compliance. It allows identifying best practices and gaps in current methodologies, contributing to a more comprehensive understanding of how SMEs can effectively implement the transition to a circular economy.

One of the current political and regulatory drivers catalyzing the circular economy is the European Commission’s Communication “A Green Europe” aims to protect, conserve and enhance the EU’s natural capital and to safeguard the health and well-being of citizens from environmental threats and impacts. The Commission proposes a new growth strategy and industrial policy to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy with net-zero greenhouse gas emissions by 2050 (European Commission, 2019).

The economic driver for the transition to a circular economy (CE) is the fluctuation of resource prices. Not only does recycling or refurbishment reduce production costs, but it also makes companies more resilient to market fluctuations (McKinsey & Company, 2024).

Several authors (Gennari, 2023; Cassano, 2020) acknowledge that large companies already have the necessary resources and knowledge to transition to a circular economy. The search for competitive advantages in global markets has long been a driving force behind efforts to ensure sound and sustainable governance. Conversely, SMEs struggle to address the transition to a circular economy coherently, failing to implement sustainability-oriented practices as part of a consistent strategy that considers business from a circular perspective.

To increase SME commitment to implementing sustainable and circular economy activities, it is necessary to identify activities specific to the circular economy for SMEs. These activities include supply chain transparency, transport initiatives to reduce emissions, procurement and storage optimization, waste reduction initiatives, energy efficiency and resource conservation, as well as other industry-specific activities. This allows the necessary resources and benefits of implementing these activities to be identified.

This study offers a methodological approach to the implementation of circular economy principles in SMEs.

Acknowledgements

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Keywords

circular economy, small and medium-sized enterprises, methodological approach

Green Economy and Directions of Regional Economic Transformation in the Post-War Recovery Period

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Significance of the Topic

Ukraine and its regions have endured 13 years of aggression from the Russian Federation, resulting in catastrophic consequences across all spheres of life: economic (destruction of critical infrastructure, industrial, and agricultural facilities), environmental (environmental pollution and threats to nuclear safety), social (crises in education and healthcare, increasing psychological trauma), and demographic (human losses and humanitarian crises), among others.

The recovery of Ukraine requires a comprehensive and innovative approach focused on "green" transformation. This will foster economic growth, job creation, energy efficiency, energy independence, and integration into the European and global spaces while improving the quality of life.

Purpose of the Study

The purpose of this study is to identify the main directions for the green transformation of the Ukrainian regional economies in the post-war period.

Research Methodology

The research is based on an interdisciplinary approach that combines the analysis of legal and regulatory frameworks, statistical data, strategic documents, and expert sources. In particular, it examines international practices in implementing the “green” transition (such as the European Green Deal and the UN Sustainable Development Goals), as well as key Ukrainian documents, including the “Green Deal for Ukraine,” the National Energy and Climate Plan, and the Green Transition Roadmap.

The synthesis of economic, environmental, and social data was carried out through a systematic analysis of open sources. Economic indicators covered the state of production in industry, energy, and agriculture; environmental indicators included pollution levels, waste management, protected areas, and greenhouse gas emissions; while social indicators encompassed quality of life, demographics, access to services, and environmental rights.

Research Results

The realization of long-term sustainable development goals and a green economy is outlined in the Association Agreement between Ukraine and the European Union. The European Green Deal represents a comprehensive transformation of the EU economy. Key areas include achieving climate neutrality by reducing greenhouse gas emissions, promoting renewable energy, and modernizing energy systems. Particular attention is given to the circular economy: decarbonization of industries, waste reduction, and the development of markets for sustainable products. The Green Deal also addresses sustainable mobility: reducing transport emissions, supporting electric vehicles, and advancing multimodal transportation.

In food production, the goal is to minimize its ecological impact, reduce pesticide use, and encourage the production of environmentally friendly goods. Biodiversity preservation is another important area: protecting ecosystems, expanding nature reserves, and greening cities. The success of this transformation relies on investments in green technologies and innovations across all sectors.

To outline pathways for achieving Ukraine's green transformation and its regions, the study analyzed the Green Future Index from MIT Technology Review Insights.

In the context of post-war recovery, the integration of green technologies into reconstruction processes becomes a key task, enhancing energy efficiency, preserving natural resources, and reducing environmental impacts.

Concrete models of green recovery have already been developed: **Ambitious Model:** Focuses on active support for green initiatives in climate resilience, green growth, and sustainable agriculture. Its core element is the post-war "Green Deal for Ukraine," aiming to create a "Green Ukraine" integrated into the global economy with climate neutrality. **Pragmatic Model:** Prioritizes green goals as tools for broader objectives, including non-environmental ones. **Inertial Model:** Limits actions to isolated environmental tasks without integrating them into other sectoral goals.

Conclusions

The implementation of the green transformation of Ukraine’s regional economies during the post-war recovery requires a systematic approach that involves the integration of international experience and its adaptation to national realities, the development of public-private partnerships for the implementation of green technologies, and the creation of incentives for businesses and citizens to transition to a sustainable lifestyle.

These conclusions are based on the synthesis of economic, environmental, and social data obtained from open national and international sources, as outlined in the methodology. In particular, the analysis included Ukraine’s official statistics, analytical materials from **The Green Future Index (MIT Technology Review Insights)**, as well as the provisions of national strategic documents in the field of green transformation. A comprehensive analysis of these data has made it possible to identify the main directions, risks, and potential of regional economies for implementing the principles of a sustainable economy in the context of post-war recovery.

Keywords

green economy, regional transformation, sustainable development, environmental policy

The Drive Towards the Circular Economy: Mitigating the Challenges Faced by Albania

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Achieving a circular economy is a must for attaining sustainable development and Albania has recognized its importance since 2015 when adopted the 2030 Agenda for Sustainable Development and the UN Sustainable Development Goals. Furthermore, being a European Union candidate country, Albania is locked into the membership process which bears some clear requirement in regard to the circular economy, too. Such requirements for a transition towards a circular economy are especially set out in the Sofia Declaration on the Green Agenda for the Western Balkans 2018.

However, Albania is facing challenges in achieving this objective, and this paper intends to discuss these challenges, explore the reasons why they arise and refer to the experience of other countries in the region as the possible way ahead.

Albania is faced with some particular challenges in relation to the drive towards achieving a circular economy. The research undertaken here as part of this study, as well as various other studies conducted in the past, indicate that these changes appear in the form of inadequate regulatory framework, low resource productivity, improper waste management, limited awareness of the circular economy, etc.

In general, there is a low awareness and understanding about the circular economy concepts among both the public at large and businesses. It must be noted that about 70 percent of Albanians do not know anything about the concepts of the circular economy. This leads to a lack of support from the public and from the business entities for implementing circular economy initiatives. The regulatory framework is also not complete. Albania has undertaken steps to achieve the circular economy rather late compared to European Union countries and, subsequently, all the needed laws, regulations and policies are not in place. Previous studies also indicate that, sometimes, the efforts undertaken by Albanian public institutions lack a unified approach, thus obstructing effective implementation. The lack of a unified approach is also evident among the public institutions, businesses and the civil society, something which is important for a successful policy implementation. Furthermore, the country lacks the adequate and sufficient infrastructure for effective waste management, recycling and material recovery. About 80 percent of the municipal waste is still processed in landfills, without undergoing through the recycling process at all. In the European Union countries, the waste recycling rates are by far higher.

Addressing these challenges requires coordinated and unified policy interventions from public institutions, increased investment and better infrastructure, as well as a wide-ranging strategy for raising public awareness, and this study intends to offer alternatives based on best practices of other countries.

Recent policy roadmaps and research highlight three main directions for circular economy development: use of economic instruments, promotion of circular business models for small and medium enterprises, as well as targeted solutions for waste management.

The public at large and the business entities should be motivated in order to undertake circular economy initiatives. Therefore, the relevant public institutions of Albania should implement subsidies, taxes and other mechanisms to promote adoptions of circular economy practices. Such measures would improve resource management, waste

management, material security, etc. On the other hand, achieving a successful transition towards circular economy will require strong legal and regulatory frameworks, enhanced engagement of all the stakeholders concerned, greater investments in infrastructure, etc.

In principle, circular economy represents an economic system based on the reuse and regeneration of materials or products, especially as a means of continuing production in a sustainable and environmentally friendly way. This economic system underscores a shift toward renewable energy and materials, as we all requiring a radical change of supply chains, product design, business models, etc. Challenges faced by the whole word in regard to climate change and sustainable development have made transition to circular economy a must and Albania should adopt the measures successfully taken by other European countries.

Keywords

Albania, challenges, circular economy

Methodologies for Climate Neutrality Assessment. Review

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Introduction

Under the research project Decision-making Support System for Achieving Climate Neutrality Goals simulation modelling is used as a method for assessing climate neutrality across six sectors. To see if simulation modelling is still widely used and learn from latest trends in climate neutrality assessment across sectors and scales, ten suitable studies from 2022 to 2025 were selected. Key metrics range from life cycle assessment boundaries and greenhouse gas accounting to scenario modelling, carbon intensity, and indicators of strategy and mitigation.

Methods and Materials

To select the most appropriate academic papers for the review, certain criteria were set: (1) the study must describe, evaluate, or compare methodologies for climate neutrality assessment; (2) the study must include carbon accounting, offset verification, or net-zero measurement approaches as part of climate neutrality assessment; (3) the study must include assessment methodology components; (4) the study must consider comprehensive climate neutrality assessment; (5) the study must provide methodological innovation or evaluation.

Results

Based on the criteria defined in the materials and methods for a deeper analysis 10 the most appropriate academic papers were short-listed. From the assessment scope, 3 studies are sectoral, 2 studies are city-level, 4 studies are multi-sectoral at the national or global level, 1 study is building related. Key methodologies used for climate neutrality assessment are (1) modelling and scenarios: 5 studies; (2) strategy, action, mitigation, or offsetting indicators: 4 studies; (3) life cycle assessment and related boundaries/inventory/impact: 3 studies; (4) greenhouse gas accounting, emissions baselines, or carbon intensity: 3 studies; (5) definitions, assessment approaches, barriers, or disclosure quality: 2 studies.

Discussion

Several included studies report a lack of harmonized definitions and boundary-setting practices for climate neutrality (Huovila et al., 2022; Wang et al., 2025). Studies note that definitions of climate or carbon neutrality vary, with multiple authors highlighting ambiguous boundaries, challenges in accounting for offsetting and residual emissions, and inconsistent reporting practices. For example, Larrea et al. (2022) and Caiardi et al. (2024) reference the Intergovernmental Panel on Climate Change (IPCC) definition yet document significant variation in implementation, while sector-specific studies document further challenges in transparency and comparability (Cherepovitsyna et al., 2023; Rayegan et al., 2024). These findings document the diversity of approaches and the methodological challenges encountered in the assessment of climate neutrality.

Conclusion

Climate neutrality assessment methodologies vary widely across sectors and scales, with studies employing systematic reviews, quantitative modelling, and mixed methods while facing challenges in standardizing definitions, accounting boundaries, and reporting practices.

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Keywords

climate neutrality, assessment methodologies, review

From Waste to Worth: Reusable Packaging as a Site of Ideological Struggle of Meaning and Practice in Latvia and the US

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The media plays a pivotal role in shaping and promoting ecopiety — displaying environmental virtue, often expressed through personal lifestyle changes, consumer choices, or symbolic acts to show one's ecological awareness and commitment (Taylor, 2019). "Green media" frequently endorse this form of environmental virtue, while the audience looks up to experts in "green lifestyle" who use the media as a platform for spreading relevant and effective advice on sustainable consumption practices. Thus, some experts struggle to transition from an older mindset of a linear economy, focusing on one aspect of sustainable behavior, to adopting a more modern circular mindset that involves scrutinizing the role and impact of a specific activity in light of the entire product life cycle.

Our study investigates this problem by deconstructing the "expert talk" on green consumption, sustainability, and the circular economy. The study is informed by the following research questions: (1) What is the discourse on the use of reusable dishes; (2) What meanings are associated with green consumption, sustainability, and the circular economy that "experts" promote; and (3) In what ways do these meanings create ideological inclinations of capitalism, consumerism, sustainability, recycling, and a circular economy.

To answer our questions, we analyze media texts produced by a variety of media figures in Latvian and US contexts, including examples from television interviews, "influencer" statements repeated by mainstream media and in social media, and statements on event-specific and/or corporate websites. Our theoretical and methodological approach is informed by Critical Discourse Analysis (Fairclough, 2013). We build our transdisciplinary approach on the notions of Circular Economy (Kirchherr et al. 2017, 2023) and Ecopiety (Taylor, 2019).

Our preliminary analysis reveals that, while seemingly instilling new ways of being a consumer and organizing large-scale public events, the Latvian "expert" talk articulates a sustainable and environmentally aware action by discursively linking fashionable green lifestyle choices with pseudo-circular consumer behavior and the marketing interests of event organizers and their business partners. The US is far behind the EU in considering and implementing the use of reusable dishes, cutlery, and cups. Thus, the pop discourse celebrates the novelty of these items, with anecdotes related to reusable cups at particular music venues requested by artists who wish to make "green statements," while industry messages mostly focus on economics rather than environmental interests. We approach this meaning-making as part of the problem, rather than the solution, since the "new" approach does not permit ideological moves beyond the linear economy.

Focusing on end users by appealing to the trends and lifestyles of environmentally aware people seems only partially efficient. While individual action needs to be mobilized, this approach primarily serves the interests of the linear economy and traditional consumerism, thus maintaining the existing system. The media needs more sophisticated stories, such as the ones we explored, e.g., focusing on entrepreneurial practices that illustrate the transition from a linear to a circular economy and involving diverse players beyond end users. As society is still in the early stages of its transition to a circular economy in most areas and industries, there is currently a small group of researchers, experts, and practitioners with the necessary depth of knowledge and practical experience to implement economically feasible circular solutions. This could explain why the media gives more voice to the so-called green lifestyle influencers. Although their knowledge is not always comprehensive, they are often more proactive and visible in the social media environment.

The circular economy is an economic system that replaces the 'end-of-life' concept with reducing, reusing, recycling, and recovering materials in production, distribution, and consumption processes (Kirchherr et al., 2017, p. 229). It is seen as a "toolbox" on the path towards sustainable development. Studies emphasize that a broad alliance of stakeholders – consumers, producers, policymakers, and scholars – is needed to foster CE transition, which may complicate CE implementation. (Kirchherr, 2023). Our study contributes to this "toolbox" and alliance of stakeholders by adding the local understanding of mediated discourse on CE issues.

Keywords

circular economy, media discourse, Latvia, USA, reusable cups

Mapping Green Human Resource Management Practices in Latvian Enterprises: Insights for Sustainable Governance and ESG Reporting

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Achieving sustainability goals has become a key priority in today's business environment, encouraging companies to reassess their internal governance mechanisms and develop new functions that support long-term value creation. One increasingly emphasized aspect of sustainable governance is Green Human Resource Management (GHRM), which refers to the strategic integration of environmental and sustainability principles into human resource practices. At the same time, the European Union's new regulatory framework for sustainability reporting — particularly the Corporate Sustainability Reporting Directive (CSRD) — calls on companies to systematically disclose their performance in environmental, social, and governance (ESG) areas. As a result, GHRM is being recognized not only as a managerial innovation but also as an essential component in preparing comprehensive sustainability reports.

Although the theoretical foundation and potential benefits of GHRM have been widely discussed in international academic literature, its practical implementation in Latvian enterprises remains underexplored. Existing research tends to focus on higher education institutions or public sector organizations, while the private business sector has received significantly less empirical attention.

The aim of this study is to identify the most common GHRM functions currently implemented in Latvian enterprises and to evaluate their significance in the context of sustainable governance and ESG reporting. The following key questions are addressed: Which GHRM practices are the most prevalent in Latvian companies? What areas do these practices focus on? To what extent do these functions contribute to achieving sustainability goals and aligning with new reporting requirements?

The theoretical framework of the study is based on a review of GHRM models using academic literature and international best practices, particularly from EU member states. Based on this analysis, a methodology was developed to identify and classify GHRM practices. The main empirical method was a structured survey conducted among companies in various sectors of the Latvian economy, including manufacturing, services, and creative industries. The survey identified GHRM-related activities such as environmentally conscious recruitment and training, the use of digital solutions in HR processes, the creation of resource-efficient workplaces, and employee involvement in environmental initiatives. These practices contribute to building an organizational culture rooted in sustainability and serve as a tool for achieving sustainability goals and enhancing the quality of ESG reporting.

The findings show that while awareness of GHRM exists in many organizations, the depth and formalization of these practices vary considerably. The most widespread functions include the implementation of environmentally friendly workplace procedures (such as waste reduction and energy saving), the use of digital HR tools, and employee awareness-raising on environmental responsibility. However, only a small number of companies have incorporated GHRM into their strategic documents or explicitly linked these practices to ESG goals and indicators.

The study reveals a growing but fragmented landscape of GHRM in the Latvian business environment. Some companies demonstrate a high level of GHRM integration, while others implement such practices on an ad hoc or informal basis. This highlights the need for additional support frameworks, guidelines, and incentives to help organizations adopt GHRM more systematically. Furthermore, linking GHRM to sustainability reporting mechanisms can improve transparency and accountability, thereby contributing to a broader transition toward sustainability in the corporate sector.

Keywords

green human resource management, sustainability reporting, ESG, sustainable governance, Latvian enterprises, GHR functions, corporate sustainability

Residents' Attitudes Towards the Environment and More Sustainable Mobility in Vidzeme, Latvia

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This abstract outlines a comprehensive study investigating residents' attitudes towards environmental issues and their propensity for adopting more sustainable mobility practices within the Vidzeme region of Latvia. The escalating global environmental crisis, characterized by climate change, resource depletion, and biodiversity loss, necessitates a fundamental shift in societal behaviors, particularly concerning transportation. Mobility, a cornerstone of modern life, is also a significant contributor to environmental degradation through greenhouse gas emissions, air pollution, and noise. Consequently, promoting active mobility solutions — such as public transport, cycling, walking — has become a critical policy objective worldwide. However, the success of such initiatives is intrinsically linked to public acceptance, understanding, and willingness to change established habits.

Despite the growing emphasis on sustainable development within the European Union and Latvia's national strategies, there remains a notable gap in region-specific research concerning the socio-psychological factors influencing active mobility adoption. While general environmental awareness is increasing, the translation of this awareness into concrete behavioral changes, especially in diverse geographical and socio-economic contexts like Vidzeme, is not fully understood. Vidzeme, with its mix of urban centers, rural areas, and natural landscapes, presents a unique case study where traditional mobility patterns may diverge significantly from those in larger metropolitan areas. Understanding the nuances of residents' perceptions, values, and barriers to sustainable choices in this specific region is crucial for developing targeted and effective policy interventions.

The primary aim of this research is to assess residents' attitudes towards the environment and their current and potential engagement with active mobility options in Vidzeme, Latvia. To achieve this, the study sets forth several key objectives: (1) to identify the prevailing levels of environmental awareness and concern among Vidzeme residents; (2) to analyze current mobility patterns and preferences within the region; (3) to explore the perceived benefits and barriers associated with various sustainable transport modes; (4) to investigate the influence of demographic, socio-economic, and psychological factors on active mobility choices; and (5) to provide evidence-based recommendations for fostering more active transportation behaviors in Vidzeme.

A mixed-methods research approach was employed, combining quantitative and qualitative data collection techniques. The quantitative phase involved a large-scale survey administered to a representative sample of Vidzeme residents (n=484), utilizing a structured questionnaire designed to capture attitudes, behaviors, and socio-demographic information. The survey instrument included Likert-scale questions on environmental concern, frequency of transport mode usage, perceived convenience, cost, and safety of sustainable options, and willingness to adopt new behaviors. Quantitative data were analyzed using descriptive statistics, correlation analysis, and regression models to identify significant relationships between variables. The qualitative data approach employed in this study incorporated a comprehensive analysis of various textual sources, including relevant academic literature, scientific papers, and pertinent policy planning documents, alongside the thematic analysis of interview data.

Preliminary findings indicate a relatively high level of general environmental awareness among Vidzeme residents, with a strong recognition of local environmental challenges. However, this awareness does not always translate directly into sustainable mobility choices, as convenience and habit often outweigh environmental considerations. The car remains the dominant mode of transport, particularly in rural areas, due to perceived lack of viable alternatives, limited public transport infrastructure, and the necessity for personal vehicle use for daily commutes and errands. Barriers to sustainable mobility include insufficient public transport frequency and coverage, particularly for inter-municipal travel; a lack of safe and interconnected cycling infrastructure; and a prevailing cultural reliance on private vehicles. Encouragingly, there is a discernible willingness among a segment of the population, particularly younger residents and those in more urbanized centers, to consider and adopt sustainable options if infrastructure improvements and incentives are provided. Factors such as age, income, and proximity to public transport hubs significantly influence mobility choices.

The implications of these findings are substantial for regional planning and policy development in Vidzeme. To effectively promote active mobility, strategies must move beyond general awareness campaigns and focus on tangible improvements in infrastructure, such as expanding public transport networks, creating dedicated cycling lanes, and ensuring last-mile connectivity. Furthermore, targeted educational initiatives are needed to highlight the personal and community benefits of sustainable transport, addressing misconceptions and fostering a culture of eco-friendly mobility.

Acknowledgements

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Keywords

transport behavior, active mobility, environmental attitudes, tourism, sustainability

Entrepreneurial Mindset: Perceptions, Transformation, and Involvement at Vidzeme University of Applied Science

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Traditionally, an entrepreneurial university is viewed as a transformative institution that serves as a hub for innovation and societal impact. It integrates entrepreneurship into its vision and extends beyond the conventional roles of teaching and research by embedding economic and social development into its core mission. An entrepreneurial university acts as a driver of economic growth and innovation through entrepreneurial education, research commercialization, start-up incubation, and industry collaboration.

In collaboration with 12 partner institutions, Vidzeme University of Applied Sciences (ViA) explored the perspectives of the university community regarding entrepreneurial and innovation-related activities, attitudes, challenges, and intentions toward adopting an entrepreneurial university mindset. The study also aimed to identify key challenges and motivational factors that influence the development of an entrepreneurial university mindset at each institution. A survey at ViA was conducted among various university stakeholders, including students (62%), researchers and academic staff (20%), professional and administrative staff (14%), and university leadership (4%).

The main findings indicate that although most students have engaged in challenge-based learning or participated in entrepreneurship-related courses, relatively few have initiated start-ups or entrepreneurial ventures. The most reported barrier to starting a business was fear of failure. Nevertheless, more than half of the student respondents expressed an intention to start a business within the next three years. The majority of students did not appear interested in receiving additional information about entrepreneurship study opportunities or in being contacted by staff for support with their start-up ideas or new business ventures.

Academic and professional respondents identified four primary challenges that hinder their engagement in entrepreneurial and innovative activities: high workload, lack of incentives and rewards, insufficient administrative support, and limited financial resources.

Results show that ViA entrepreneurial and innovative transformation can be clustered under three main categories of the focus for the university – 1) mission-oriented education and research (innovative lecture, labs, placement opportunities, an openness for transformation, increasing number of participation in entrepreneurial activities) , 2) consistent institutional support (appreciation from university leaders of staff entrepreneurial activities, top priority of innovative transformation ideas, quality and knowledge of staff), and 3) active participation in ecosystem (business incentives with more involved academics, university awareness and connection with regional entrepreneurial challenges, one-stop agency for different entrepreneurial activities and information).

The main conclusions highlight that enhancing the entrepreneurial potential of Vidzeme University requires a coordinated, institution-wide approach that integrates curricular innovation, robust institutional support mechanisms, and active engagement with the regional ecosystem. Although entrepreneurial awareness and education are relatively well-established, a significant gap remains between students' entrepreneurial intent and actual entrepreneurial activity. Sustained entrepreneurial initiatives are essential to bridging this gap by fostering entrepreneurial mindsets, building leadership competencies, and aligning university efforts with regional innovation priorities.

Further efforts to cultivate an entrepreneurial mindset are being implemented within the E^3UDRES^2 (European University Alliance) project "Accelerate Future HEI", which aims to foster entrepreneurial thinking among students and young entrepreneurs in the Vidzeme region, while also developing entrepreneurial leadership, mindful management, and human resource development skills among university leaders, professional staff, and lead researchers.

Keywords

entrepreneurial mindset, entrepreneurial university, institutional transformation, innovation ecosystem

Adapting the Circular Economy Framework for Zoological Gardens

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Zoological gardens take care of planet's biodiversity and wildlife conservation and put strong effort into education of society, resource efficiency and reduction of environmental impact. These efforts are equally crucial to achieving sustainability targets. The public now wants activities that are sustainable in all aspects (Peng et al., 2025). When examining institutions such as zoological gardens, whose targets are strongly related to circular economy (CE) targets – biodiversity and conservation, it is necessary to frame the concept within this context.

Already a decade ago researchers from European association of zoos and aquariums (EAZA) declared "If zoo populations are not sustainable, neither are zoos themselves." (Leus et al., 2011). However, there is less focus on how institutions such as zoological gardens maintain their operations related to CE dimensions. Zoological gardens involved both technical and biological material flow, represented by the CE butterfly diagram (Ellen MacArthur Foundation, 2021). Recent studies emphasize plasticity and the variety of versions of how circular economy concepts coexist (Peris-Ortiz et al., 2025). Therefore, the adaptation of the circular economy framework is essential.

The research question is: How can circularity be viewed in the context of zoological gardens' primary goal to preserve wildlife? In other words, is it possible to be circular when guarding a planet's biodiversity, which itself is one of the CE targets?

Research methodology included combined data collection from literature review (keywords: "Circular economy", "Zoological gardens", "Wildlife conservation", "Adapting CE framework") as well as onsite visits (observation method) of 4 zoological gardens in Europe: Riga National Zoological Garden (Latvia), Fondazione Bioparco di Roma (Italy), Zoo Santo Inácio (Portugal), Saaremaa Zoo (Estonia).

The study frames the circularity concept for zoological gardens that focus on their main target to preserve wildlife, while operating under resource constraints. Results might be applied to the decision-making process on daily operations and further studies of the circularity of zoological gardens. The next step is to elaborate on a guide or roadmap on how to understand and organize various complex issues related to circularity in zoological gardens.

Acknowledgements

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Keywords

circular economy, zoological gardens, wildlife conservation, Europe

Media, Communication, Societal Resilience and Social Inclusion

The Role of Media Communications in Ensuring the Information Security of the State in a Hybrid Warfare: Challenges, Threats and Ways to Increase the Sustainability of Society

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Information security is an integral part of national security and is considered one of the priority areas of state policy. On the one hand, it involves creating conditions for high-quality, comprehensive information for citizens and ensuring free access to various sources of information. On the other hand, it includes mechanisms for preventing the spread of disinformation, strengthening public unity, preserving information sovereignty, countering information and psychological attacks and propaganda, as well as protecting the national information space from external manipulative influences, information wars and operations. A comprehensive solution to information security issues will allow simultaneously protecting the interests of the state and society, as well as guaranteeing citizens the right to access complete, objective and reliable information.

The article examines the role of modern information and communication technologies as a key factor in the hybrid wars of the 21st century. It is noted that information, as a strategic resource, simultaneously acts as a means of realizing the rights and freedoms of citizens and an instrument of destructive influence and manipulation of public consciousness. Based on the concept of hybrid war proposed by F. Hoffmann and the research of M. Bond, the specifics of modern conflicts are analyzed, in which a complex combination of military, political, economic and information-psychological methods of influence are used. Particular attention is paid to the role of the mass media in the formation of a "parallel reality" - a combination of facts and interpretations that affect the cognitive and behavioral reactions of the mass audience in conditions of political instability.

The purpose of the study is to analyze the impact of media communications on the information security of the state, identify the main threats of information warfare and propose strategies for increasing the resilience of society to external and internal information influences.

Methodology: analysis of scientific sources (research in the field of information security, mediators, sociology). Content analysis of media and social networks. Case Study (study of specific examples of information warfare against Ukraine). Comparative analysis of information security strategies of different countries.

Main results

• Key mechanisms of information influence (fakes, trolls, bots, manipulations through social networks) have been identified.

• Vulnerabilities in the communication system between the authorities, the media and society have been identified.

• Basic principles of information hygiene for citizens have been formulated.

• A model for increasing media literacy as a factor of societal sustainability has been proposed.

Conclusions

The priority tasks of such structures should be:

1. Control of information flows, which involves operational monitoring of the information space, detection of disinformation, fakes and attempts to manipulate public opinion, as well as timely response to such threats.

2. Providing objective and complete information means that state authorities must provide the public with reliable and verified data on current events, with a clear explanation of decisions made at all levels of government.

3. Providing professional comments and explanations from competent experts, scientists and officials, which allows to increase public awareness and reduce the space for speculation.

4. Systematic coverage of the official position of the authorities and political leaders on key issues of domestic and foreign policy. This is necessary to form a single narrative, ensure transparency of management and strengthen citizens' trust in state institutions. Therefore, an effective media and communication strategy of the state should be based on a proactive approach to information, the provision of high-quality content and active interaction with citizens. Only under such circumstances can a high level of information security be ensured, a civil society resistant to external pressure be formed, and the unity of the nation be strengthened in the face of modern challenges.

Keywords

media, security, media sustainability, social media, communication strategy

Civic Education as a Countermeasure to Hybrid Threats: The Case of Latvia

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Hybrid threats encompass the combined use of non-military and military techniques to achieve political and military objectives. Russia employs these techniques not only to cultivate the perception of invincibility in its military power as part of psychological warfare but also to discredit Latvia's statehood and democratic institutions and destabilize the domestic political situation. Civic education stands out as a key tool to enhance society's resilience against hybrid threats. Its role includes promoting knowledge, skills, and civic virtues, enabling citizens to defend their democratic states both cognitively and militarily. This paper aims to address the research question: To what extent does Latvia's civic education contribute to strengthening society's resilience to hybrid threats? The research employs in-depth interviews with Latvia's civic education teachers and youth (conducted in November 2023 -- June 2024), along with an analysis of the civic education curriculum. The focus of data gathering and analysis is to comprehend how the youth forms an understanding of Latvia's nation-building and democratic foundations, as well as their civic duty to defend the country.

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Keywords

hybrid threats, resilience, Latvia, civic education, teachers, youth

Civic Participation, Political Trust, and Political Self-Efficacy in Latvia

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Civic participation is a cornerstone of democratic societies, yet the underlying psychological and political factors that promote or hinder it remain a subject of scholarly debate. This study explores the relationships among civic participation, political trust, and political self-efficacy in Latvia to understand how individuals engage in civic activities. Drawing on a representative sample of 1005 Latvian residents aged 18 to 75 (*M* = 46.34, *SD* = 14.9), this research investigates how different forms of political self-efficacy and trust predict various types of civic participation.

The study was conducted as part of the national research program “Values in Action: promotion of responsible, secure and educated civil society in Latvia through research and model development” and data was collected via a survey in August and September 2020. Civic participation was operationalised through a comprehensive 30-item scale developed for this project, measuring behaviours ranging from electoral participation to political consumerism, NGO involvement, and social media activism. Factor analysis identified eight distinct types of civic participation.

Regression analyses were conducted to determine the predictive value of sociodemographic variables (sex, age, education), satisfaction with life, general and political trust, and three forms of political self-efficacy (internal-personal, internal-collective, external-collective). Results indicate that political self-efficacy, especially internal-personal and internal-collective self-efficacy, is the strongest predictor of civic participation in most behavioural domains. Political trust alone was not a significant direct predictor, but patterns suggest its indirect influence through beliefs related to efficacy.

Specifically, internal-personal political self-efficacy significantly predicted behaviours such as engaging with politicians, joining NGOs, political activism, and political consumerism, with standardised regression coefficients ranging from $\beta = 0.13^{*}$ to $\beta = 0.30^{***}$. Internal-collective political efficacy significantly predicted electoral participation and social engagement ($\beta = 0.26^{***}$). General self-efficacy also contributed to predicting certain forms of participation, such as involvement with NGOs. Although political trust did not consistently emerge as a direct factor, its correlations with efficacy variables propose a mediating relationship that merits further testing.

Demographic factors showed modest but consistent effects. Older participants were more likely to vote and contact officials, while higher educational attainment predicted participation in voting, political consumerism, and involvement with NGOs. Gender differences were also observed, and men were more likely to engage in institutional and expressive forms of participation, including political activism and digital participation.

The findings underscore the importance of political self-efficacy as a central driver of civic engagement in Latvia. Interventions to improve citizens' sense of personal and collective political influence through civic education, participatory experiences, and transparent institutional practices could strengthen democratic involvement. Future analyses will employ mediation models to test whether political self-efficacy is an explanatory mechanism between political trust and civic participation.

In conclusion, this study contributes to understanding Latvia's civic participation by empirically validating political self-efficacy's central role. It highlights the nuanced interplay between trust, self-efficacy, and civic involvement and offers practical implications for policymakers and educators aiming to foster engaged citizens.

Keywords

civic participation, political trust, political self-efficacy

Latvian Fact-Checkers and the Contested Field

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Fact-checking is a genre of journalism that examines public claims and issues a verdict about their truthfulness. In the contemporary information environment that is open to a wide variety of information sources, including false and misleading ones, fact-checking helps the public to better evaluate the information they may encounter in either mass media or social media.

However, a positive view of fact-checking is far from universal. It has faced opposition from politicians — especially those whose claims have been refuted — and from audience members who reject fact-checkers' authority to say whether something is true. Research shows that labeling problematic content, including adding fact-checks, is a promising intervention with many challenges (Morrow et al., 2022). Still, some studies have pointed to problems with how fact-checking is carried out. For example, their methodologies are not immune to flaws (Uscinski & Butler, 2013; Nieminen & Sankari, 2021), and different fact-checking organizations may arrive at different judgments (Lim, 2018; Marietta, Barker, & Bowser, 2015). A sign of shifting attitudes toward fact-checking was this year's announcement by the social media company Meta that it will stop fact-checking on Facebook and Instagram (Kaplan, 2025). After years of working with independent fact-checkers, Meta's CEO, Mark Zuckerberg, announced that "the fact-checkers have just been too politically biased and have destroyed more trust than they have created." Such sentiments highlight the need for continued analysis of fact-checkers' practices concerning selection, analysis, and assessment of claims.

The empirical basis of this paper consists of eight semi-structured interviews with Latvian fact-checkers from five organizations. These interviews represent the majority of those who work in the fact-checking field in Latvia.

Findings suggest that fact-checking newsrooms largely operate based on unwritten principles developed through practice. An exception is newsrooms that are part of the International Fact-checking Network or European Fact-checking Standards Network, which require member organizations to communicate how they operate to the public. When selecting which claims to evaluate, they consider such criteria as the popularity and potential impact of the claim, its origins, and relevance to the themes the organization works with (such as Russian propaganda), among others. However, there are no exact formulas that govern the selection of claims. Situational journalistic judgements also play a role in the selection process, such as whether the claim connects with a broader theme currently topical in the media or whether the analysis of the particular claim would be relevant to the readers. Verifiability of a claim plays a key role — they tend to discard those in which they are unable to arrive at reasonably certain conclusions.

Fact-checking is a collective endeavor. Each stage — case selection, sourcing, and argument development — typically involves at least one additional person besides the lead journalist. It is not uncommon for fact-checkers to receive input from other colleagues in the newsroom. Fact-checkers usually do not collaborate with colleagues from other Latvian fact-checking outlets. However, fact-checkers who are part of the International Fact-checking Network occasionally exchange help with their foreign colleagues.

Although fact-checking typically involves rendering a judgment ("false," "likely false," "lacks context"), fact-checkers do not necessarily perceive themselves as providers of "100 % truth." They accept that they are reliant on sources, which may have some limitations, and

that, in journalism, some interpretation is inescapable. They reconcile this tension by interpreting their task as presenting the public with the most trustworthy evidence they have been able to gather and disclosing their methodology, which allows the public to make up their own minds about the claim.

It can be concluded that while fact-checking is not immune to mistakes, evaluating fact-checking output requires media literacy. Without considering how various information sources can be arranged hierarchically based on their trustworthiness, how journalism works, and how cognitive biases influence the perception of information, those who dismiss fact-checking may be misdiagnosing this genre.

Keywords

fact-checking, journalism, correcting misinformation, Latvia

Science for Societal Resilience: The Role of Schools and (Social) Science Education

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In recent years, science and scientists have come under increasing scrutiny, with a growing wave of scepticism and delegitimization undermining not only scientific results but also the very foundations of scientific inquiry. This erosion of trust is particularly acute in the social sciences and humanities, disciplines that are crucial for understanding and navigating the complexities of modern society. The marginalization of these fields is not merely an academic concern – it poses a threat to informed public discourse, democratic governance, and the collective ability to respond to global challenges, namely – our societal resilience. Broadly speaking, schools and teachers are one of the most crucial players in developing trust and interest in science, understanding of science, and habits of consuming scientific content. How teachers teach about science, depends on their own science-related values, beliefs and knowledge. Hence, the aim of the study is to examine secondary school teachers' scientific literacy, their perceptions of scientific value of different school subjects, and practices of developing science literacy of students.

We look at these aspects in the context of the development of scientific school culture. As the theoretical framework of the study we employ the Social domain theory of Derek Layder and several models of scientific literacy. We pay particular attention to the Layder's domain of psycho-biography in relation to domains of social setting and contextual resources that shape teachers views and attitudes towards science, including the scientific value of various school subjects. Our empirical analysis is based on 47 semi-structured interviews with different subject teachers and a survey of teachers (N=579), where we examined the following: 1) perceived scientific value of school subjects; 2) scientific literacy of teachers; 3) attitudes towards pseudoscience. The study was carried out as part of the research project funded by the Latvian Council of Sciences (title of the project "Scientific school culture for sustainable society"; project No. lzp-2021/1-0135).

The results of our study indicate that teachers' understanding about scientific literacy refers mainly to the procedural dimension of scientific literacy. It manifests also through reported teaching practices. In teachers' views, scientific literacy is related to various other literacies, especially media literacy, information literacy. Scientific literacy, according to teachers, is related to specific professions (not necessarily their own), and perceived scientific value of school subjects aligns with the traditional curriculum hierarchy ladder (with the "mighty triad" - Physics, Chemistry, Biology – on the top). Techers' practices of developing students' scientific literacy are aligned with the external/national trends: school rankings, student final test scores, student achievements in Olympiads etc.

This study draws attention to the roots of the devaluation of science, especially the social sciences, and underscores the necessity of reaffirming science in school curricula and teacher training. What our study highlights, based on our data, is that while natural sciences often retain a baseline of trust due to their tangible technological outputs, social sciences are frequently dismissed as "soft" or overly politicized, even perceived as not being scientific. This false dichotomy which prevails in the teachers' perceptions, reflect a larger societal belief, and most certainly fails to recognize and acknowledge that the social sciences apply rigorous methodologies: quantitative, qualitative, and mixed - to investigate human behaviour, societal structures, and cultural dynamics.

This devaluation of (social) sciences, if not tackled properly, becomes dangerous in times of crisis. Whether in the context of the COVID-19 pandemic, climate change, economic inequality, or migration, the social sciences provide the frameworks for understanding collective behaviour, risk perception, and compliance with public measures. Rebuilding trust in science at schools must begin with reaffirming its core values through well-thought out teacher training. But it also requires a shift in educational policy making that fosters the right attitudes toward scientific thinking from an early age - especially regarding the social sciences. What is important to acknowledge is that science is not merely a body of facts - it is a method of inquiry that applies equally to understanding biological, physical phenomena, as to understanding social systems and individual behaviour. Dismissing social science as unscientific which is a trait that manifests itself in the empirical material collected in the present study, leads to ignoring the evidence-based practices and fails to equip society with critical resources for decision-making and long-term societal resilience.

Keywords

scientific school culture, scientific literacy, epistemic beliefs, curriculum hierarchy, school teachers, societal resilience

Organizational Change Communication in Latvia: Management Practices and Practical Challenges

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In recent years, alongside the rapid development of artificial intelligence tools and the demand for digitalization processes at the national policy level, as well as challenges in the external political and economic environment, organizations in Latvia have been implementing changes at various levels. As a result, the practice of change management and communication has become increasingly relevant, either facilitating the successful implementation of change or undermining it.

The research aimed to examine change management and communication practices, as well as the main issues in strategic change communication. To achieve this objective, a survey was conducted. Data collection took place between November 20 and December 20, 2024, through the distribution of an online questionnaire via social media platforms. A total of 191 respondents completed the survey. Of these, 55% held managerial positions and 45% were employees. Regarding organizational size, 68% represented large companies, while 32% were from small and medium-sized enterprises. In terms of ownership, 81% were employed in state-owned enterprises and 19% in privately owned companies. The gender distribution was 71% women and 29% men.

Since the critical role of *change communication* in successful change management was recognized in the research, this construct was analyzed separately. Change communication planning examines six statements like: “Leadership involves communication professionals in the process when planning changes” and “Change communication in our organization is planned purposefully”; "The communication professional is involved in the change planning process". These items were developed based on the work of Lewis (2019), Hodges (2016), Heide and Simonsson (2021), Haumer et al. (2021), and Johansson and Heide (2008). Change communication implementation includes four items: “During the change implementation process, it is clear who communicates what and with what purpose”, “During the change implementation process, leadership seeks feedback from employees”, “Communicated messages are clear and understandable - they help people understand what is expected of them”, and “The previous change communication practice has been successful”. The formulation of these items draws on Armenakis and Harris (2002), Bayraktar and Kabasakal (2022), and Cornelissen and Werner (2014). All statements were measured using the four-point Likert scale (Chang, 1994; Leung, 2011). Descriptive statistical methods were used in the data analysis.

The survey reveals that more than half of the respondents (N=191), alongside assessment of overall change management practices in their organizations, identify insufficient communication as one of the main barriers to effective change implementation. Additionally, more than 50% acknowledge that management typically begins informing employees about changes only after decisions have been made and implementation is set to begin.

Moreover, responses from managers indicate that only 8% of organizations have developed a change communication strategy, and just 14% involve communication professionals in the change planning process. In addition to this data, a significant gap is evident between the views of C-suite executives and middle managers regarding employees' opportunities to provide feedback to leadership during the planning and implementation of change. These

findings highlight systemic-level issues in the practice of change management and communication.

Limitations of the study related to the volume of collected data, which does not ensure representativeness. Therefore, the results of the study cannot be generalized to all companies in Latvia. However, the study provides insight into the trends of the change communication practices in the management level, particularly in the public sector.

Keywords

change management, change communication, leadership, internal communication

A Comparative Analysis of Family Support Policies in the Context of Norway, Estonia, Ireland, Poland, and the Netherlands

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Demographic and migration factors have had a profound impact on the Latvian economy since the country regained its independence, creating both challenges and opportunities that require in-depth analysis. This research examines these factors, emphasizing their importance for the development of the Latvian economy. To better understand the experiences of other European countries in shaping family support policies, five very different countries were selected: Norway, Estonia, Ireland, Poland, and the Netherlands. These case studies aim to provide information and recommendations for improving the Latvian policy framework, including factors related to prosperous family support systems observed in these comparable countries.

In a situation of prolonged depopulation, Latvia faces the greatest challenges, increasing population ageing and low birth rates, which contribute to population decline, negatively affecting the labour market and economic productivity (Klotmiņš and Krišjāne, 2016). The study aims to analyze how these demographic changes, combined with migration patterns, affect the Latvian economy in terms of labour participation and economic growth. In addition, the study aims to examine how family support policies in other European countries can serve as a model for Latvia to promote higher birth rates and improve job retention.

The methodology chosen for this research — a mixed-methods approach combining quantitative demographic and migration data analysis with qualitative assessments of family support policies — provides a comprehensive and nuanced understanding of Latvia's demographic challenges and policy options. This approach enables both the statistical evaluation of trends and the in-depth exploration of policy effectiveness, providing valuable insights that neither method alone can fully capture. By integrating quantitative data from sources such as the Central Statistical Office of Latvia and Eurostat with qualitative policy analysis from case studies in Norway, Estonia, Ireland, Poland, and the Netherlands, the study benefits from a robust empirical foundation to accurately track demographic and migration patterns that impact Latvia's economy. Arbidāne and Markevica's (2016) research on the dynamics of the active population provides a solid basis for understanding the current demographic picture in Latvia.

It also offers a contextualised understanding of how different family support policies shape demographic and labor market outcomes in diverse European settings, allowing the identification of best practices tailored specifically to Latvia's unique socio-economic conditions. The mixed-methods approach enhances the reliability and validity of findings through triangulation of data sources and methods, providing a well-rounded perspective that links statistical trends with real-world policy implications. Overall, this design strengthens the study's capacity to provide actionable, evidence-based insights for improving Latvia's family support framework in response to demographic and economic challenges.

Data regularly collected by the Central Statistical Bureau Republic of Latvia, as well as Eurostat's comparative statistics of European countries, show that Latvia is at a critical family policy crossroads, where proactive changes are essential to address demographic change. The challenge of an outflow of young, skilled workers has led to a decline in the available workforce, threatening economic sustainability (Indāns, 2013). On the other hand, countries such as Norway have been able to use strong family support policies to promote higher birth rates and workforce stability. Norway's complete parental leave policy and access to affordable childcare have been shown to promote both family development and economic resilience (Krūmiņš and Krišjāne, 2019). In Estonia, improved family benefits have also contributed to an increase in birth rates and better female participation in the labour market, creating a more balanced and productive economy (Freidenfelde, 2012).

Given these observations, it is clear that the strategic implementation of family support policies in Latvia could significantly strengthen the economy. Decision-makers should consider the impact of financial incentives on families, parental leave and improved childcare facilities, as well as instruments to combat the decline in birth rates and promote the return of emigrants (Zobena, 2005). Comparative analysis reveals that investments in family support can generate significant long-term economic benefits, including labour market stabilisation and productivity gains.

In conclusion, the interaction of demographic and migration factors creates both risks and opportunities for Latvia. By adopting welfare family support policies from other European countries and adapting them to the local context, Latvia could potentially mitigate the negative impact of population ageing and labour shortages. This study highlights the need for political decision-makers to prioritise family strategies that not only respond to demographic challenges but also promote sustainable economic growth and social cohesion in Latvia (Krūmiņš and Krišjāne, 2016; Arbidāne and Markevica, 2016), which would strengthen the unity of society, the interconnectedness of its structures and the mutual connection. Prioritised family strategies would also increase the degree of solidarity within society and the country as a whole. A renewed emphasis on family support could help transform Latvia's economic future and ensure its resilience in the face of ongoing demographic change.

Keywords

demography, migration, family support policy, labour, population ageing

Affordability and Accessibility as Dimensions of Transport Poverty: Survey-Based Evidence Towards Sustainable Mobility

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Transport has been recognised as one of the essential services in the Action Plan for the European Pillar of Social Rights by European Commission, highlighting its critical role in ensuring social inclusion and equal opportunities. There is an EU target of reducing the number of people at risk of poverty or social exclusion by at least 15 million by 2030. However, despite this policy recognition, challenges remain in tackling transport poverty, in particular in terms of affordability and accessibility.

This study builds on the findings of Grīnberga-Šilaua and Zemīte (2025), who studied transport poverty and its related indicators in Latvia. Taking these findings into account, the current study examines in depth the dimensions of affordability and accessibility as components of transport poverty. In 2023, the European Union established its first definition of transport poverty in Regulation 2023/955 on the Social Climate Fund. According to this regulation, transport poverty is defined as the inability or difficulty of individuals and households to afford private or public transport or their limited access to transport services necessary to achieve essential socio-economic activities. This definition highlights the importance of national and spatial context in addressing mobility disparities.

This study contributes to the growing discourse on sustainable mobility, highlighting the critical need to address transport poverty in the context of Latvia. It incorporates the transport poverty indicators identified in the European Commission's final report (2024) and uses data from various national and European sources to assess the situation in Latvia compared to EU average and neighboring countries.

This study aims to examine the dimensions of affordability and accessibility in literature and survey data available.

This study uses qualitative and quantitative methods in the context of transport poverty.

The research methodology includes a policy analysis and descriptive statistics sourced from official statistics databases. The data sources selected for this purpose included time series from 2019 where possible and using the latest available data for comparisons and ranking of the indicators. The study is based on expert assessments, in particular on the conclusions drawn and the results of ranking the selected indicators. The experts were invited to familiarize themselves with the dimensions and indicators of transport poverty and to rank the 14 indicators based on their relevance for measuring transport poverty in Latvia, with "1" being the most relevant and "14" the least.

Latvia's main policy framework, the Transport Development Guidelines for 2021–2027, emphasises the objective of creating an integrated transport system that is safe, efficient, accessible, smart and sustainable. It aims to promote economic growth, regional development and the move towards a climate-neutral economy. Thus, sustainable mobility is officially defined as putting the interests of transport users first, ensuring accessible, well-being-oriented and low-emission options. However, existing definitions often fail to take into account the practical realities of everyday travellers. The assessment of the 2024 Transport Development Guidelines shows that the planned reductions in greenhouse gas (GHG) emissions from the transport sector have not been achieved, mainly because private cars are still used. This is due to constraints related to the availability and cost of alternative mobility options, making private vehicles the most affordable choice for many people across Latvia. In several areas, public and active mobility options cannot compete with private cars in terms of travel time or convenience, creating behavioural patterns that correspond to the problems of transport poverty observed elsewhere in Europe.

Addressing these mobility inequalities is critical. Transport poverty limits and lowers people's ability to access their basic needs, such as employment, social, educational and healthcare opportunities. Exploring the specific roles of affordability and accessibility and measuring their measurement potential in the travel or other surveys, can highlight geographical and social disparities that need to be addressed.

Key findings include proposals for promoting active mobility and the transition to low-emission vehicle technologies, as well as how to make mobility more equitable. Although obstacles such as uneven infrastructure development, the high cost of sustainable transport options and the lack of integration of urban and rural transport networks continue to perpetuate inequalities in mobility access.

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Keywords

rural mobility, sustainable people mobility, transport poverty, sustainable mobility

Creative Hubs as Drivers of Regional Vitality

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Creative hubs have emerged as critical enablers of broad-based welfare and dynamic entrepreneurial ecosystems, particularly in regional contexts. These hubs serve as platforms where artistic, cultural, and technological pursuits converge, fostering innovation and socioeconomic development. By offering both physical and digital environments for interdisciplinary collaboration, creative hubs catalyse new business formation and reinforce the creative industries (Pratt & Hutton, 2021). Their experimental culture encourages risk taking and knowledge exchange, supports the development of novel business models, and contributes to regional economic resilience (Ashton, 2019). Additionally, creative hubs enhance the cultural fabric of regions and improve their capacity to respond to technological and economic transformations. In the current economic landscape, marked by growing demands for inclusive and adaptive local economies, creative hubs have become an essential infrastructure to foster innovation and societal well-being.

Beyond their contribution to the welfare of the people, creative centres play a vital role in attracting and retaining talent, thus enhancing regional vitality (Qian, 2010). Regional economies often struggle with the outmigration of skilled individuals to larger urban centres, compromising local innovation capacity. Creative hubs offer vibrant, attractive spaces that engage both local residents and international talent, contributing to the formation of a regional creative class. By promoting quality of life, cultural diversity, and entrepreneurial opportunities, these hubs stimulate local economies through cross-sector collaboration and knowledge spillovers (Muro & Katz, 2010). Their emphasis on lifelong learning and community participation further strengthens the regional appeal of skilled professionals (Fritsch & Wyrwich, 2019). In connecting culture, technology, and enterprise, creative hubs support emerging industries and extend the reach of economic development beyond metropolitan areas.

This study presents findings from a four-year longitudinal investigation into 38 creative hubs in the Twente region. The research examined commercialisation strategies, revenue models, and management practices. In-depth interviews with central coordinators and regional stakeholders were conducted to identify operational challenges and success factors. This comprehensive approach enabled an analysis of both individual hub trajectories and the wider regional ecosystem. The study highlights how creative hubs interact with their environments to foster talent, generate innovation, and contribute to social and economic objectives. The integration of programme-level data with qualitative insights provides a detailed picture of the sustainability and impact of creative centres on regional development. The following broad findings emerge.

We find that Creative hubs face a key challenge in regional development due to limited cooperation and ecosystem fragmentation. Many operate independently, focusing on niche audiences rather than fostering collaborative structures. This isolation hinders knowledge exchange and cross-disciplinary innovation, while the lack of shared programming and strategic alliances weakens regional resilience. Enhancing interhub connectivity is crucial for cultural diversity, entrepreneurship, and unlocking economic potential. Hubs also play a vital role in regional innovation by supporting technological experimentation and product development. They offer safe spaces for prototyping, thereby cultivating local innovation cultures and attracting investment. Although their role in retaining talent is modest, hubs significantly advance social inclusion. By creating welcoming spaces for professional growth and cultural interaction, they promote integration of under-represented groups and support broader societal transitions. This inclusive approach strengthens community ties and encourages participation in the creative economy, positioning hubs as essential agents of industrial renewal and social cohesion in creative regions.

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Keywords

creative hubs, entrepreneurial ecosystems, regional development

Creative Industries

Generative AI as a Catalyst for Transformative Experiences

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The rapid advancement of Generative AI (GenAI) technology offers unprecedented opportunities for creating deeply personal, impactful, and novel interactive experiences. Its capability to generate photorealistic content with increasing speed and sophistication, coupled with the ability to create almost infinite variations "on the spot" and dynamically control content creation, paves the way for new kinds of interactive systems. These systems can create interactive experiences that are unique yet easily fine-tuneable, and capable of tailoring visual content for each individual viewer. Furthermore, such systems offer the potential to create deeply personal and engaging experiences that could facilitate transformative states. This endeavor aligns with the notion of intentionally facilitating transformative experiences, a concept central to the re-emerging ethos of Cyberdelics, which posits that technology can produce experiences of awe, transcendence, empathy, and bliss, rather than robbing users of their sense of presence, promoting fear of missing out (FOMO), anger and envy. While previous research on inducing awe has often relied on non-interactive stimuli such as natural imagery, there has been a notable absence of empirical studies investigating interactive systems that leverage personalized, real-time content.

In line with this growing interest in utilising emerging technology as a catalyst for transformative experiences, this study contributes to the ongoing discussion by empirically exploring how an interactive installation can facilitate such profound encounters. The primary purpose of this research is to investigate whether GenAI-augmented self-reflection can serve as an effective and novel source of aesthetic awe. To achieve it, this experimental study combines approaches from visual arts, the unique affordances of GenAI technology, the philosophical underpinnings of Cyberdelics, and empirical methods from psychology in human-computer interaction.

At the core of the research is a digital mirror installation that augments the viewer's reflection in real-time. The installation incorporates four distinctive scenarios, each based on devised design strategies for facilitating awe experiences and differing in how GenAI dynamically transforms and augments the viewer's self-reflection. This installation was tested with a total of 40 participants across two independent experiments: one conducted in Riga, Latvia, and the other in Tampere, Finland. During these experiments, comprehensive data was collected, including participants' emotional responses via validated self-reporting scales and objective physiological measures through brain activity recordings using an EEG headset.

The experimental results confirm that GenAI-augmented self-reflection can indeed serve as a potent visual stimulus for inducing transformative experiences and aesthetic awe. Furthermore, the study reveals significant positive correlations between specific personality traits and the intensity or degree of awe reported by participants. By developing and testing a GenAI-powered interactive installation that offers real-time augmentation of the viewer’s self-reflection, the present study uniquely investigates how such deeply personal experiences can be intentionally designed for. The findings underscore the capabilities of real-time GenAI for individual personalization, a feature previously unfeasible in this context, and highlight the significant opportunities arising from the synthesis of artistic approaches and emerging technology to design for novel experiences that promote positive psychological states.

Keywords

generative ai, transformative experiences, cyberdelics, interactive installation

Gamified Narratives in Film Education: Experience from CineGame Ukraine

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In recent years, gamification has emerged as a powerful pedagogical strategy for increasing student engagement, particularly in creative disciplines where motivation, imagination, and narrative construction are essential. This paper presents the conceptual framework, design methodology, and preliminary outcomes of CineGame Ukraine – a research-based educational virtual game to enhance storytelling and storyboarding skills among emerging filmmakers in Ukraine.

The CineGame Ukraine project was developed within the framework of a Marie Skłodowska-Curie postdoctoral fellowship and is hosted by Vidzeme University of Applied Sciences. The project addresses a growing need in film and media education for learner-centered, interactive, and modular environments that combine traditional narrative theory with hands-on, experiential learning. It also responds to the challenges imposed by the war in Ukraine, which has disrupted traditional educational infrastructures and limited access to creative resources.

The core pedagogical concept of CineGame Ukraine is to integrate elements of nonlinear narrative construction, character development, and cinematic worldbuilding into a digital simulation where students progress through stages of a creative production pipeline. The game architecture is structured around key educational objectives derived from screenwriting theory, audiovisual storytelling techniques, and visual planning practices. The learning process is segmented into quests, challenges, and narrative puzzles that reflect real-world dilemmas faced by filmmakers, from defining protagonists and conflicts to designing scenes and visual metaphors.

Methodologically, the game's development followed a design-based research approach, involving multiple iterations of prototyping, expert consultations, and student feedback loops. Playtesting with Ukrainian film and media students revealed a high level of immersion and skill development, particularly in plot structuring, pacing, and visual composition. Preliminary results indicate that students who engaged with the gamified modules demonstrated greater narrative coherence and creativity in their final storyboard projects than those who followed a traditional seminar-based curriculum.

The presentation will explore the theoretical underpinnings of the project, including concepts from educational psychology, cognitive narratology, and game-based learning. It will also examine the game’s user interface, feedback systems, and adaptability to different learning styles and skill levels. Special attention will be paid to how the game’s structure supports formative assessment, peer review, and reflective practice in audiovisual education.

Importantly, CineGame Ukraine is also a resilience-building tool in crisis-affected educational contexts. The project has shown that gamification can provide continuity, motivation, and a sense of agency to students learning under duress. It helps establish a safe space for experimentation, emotional expression, and collaborative ideation – essential for cultivating creative thinking in uncertain times.

By presenting the design logic and implementation experience of CineGame Ukraine, this paper contributes to broader discussions on the role of digital innovation in the future of media education. It argues for the systematic integration of gamified environments into film

schools, particularly in post-Soviet and post-crisis regions, where traditional academic models are being redefined by digital culture, mobility, and socio-political transformation.

Keywords

gamification, audiovisual education, digital storytelling, storyboard, media literacy

“Hyper Kafka: Rooms of Memory”: An Immersive Hypertext Fiction Installation for Teaching and Disseminating Literature

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Hypertext Fiction is re-emerging as a nexus of textual nodes and navigational links yet enhanced by modern immersive media and aesthetics. As such it can stimulate the learning process towards focused research and creative interpretation on various subject matters. Drawing upon the reflections of Vannevar Bush, Ted Nelson, Roland Barthes, Gilles Deleuze, Gerard Genette, and Julia Kristeva, the authors have explored hypertext fiction as the means to holistically approach the literary work of Franz Kafka. In their course “Augmented Technologies in the Curriculum”, part of the Pedagogical and Didactical Sufficiency Program at the Department of Audiovisual Arts at the Ionian University, they guided their students to investigate, study and interpret Kafka-related excerpts, patterns, thematics, in order to create an interactive learning environment in the form of hypertext fiction. It is the authors' premise that through a dynamic, dialectic system fostering the initiative to make choices, follow different paths, and reflect on different perspectives, hypertext fiction can be used as an effective educational tool for in-depth and engaging analysis of curricula and student-centered, discovery learning practices.

In terms of methodology, the students were, in the course of one semester, first prompted to research upon Kafka's work and discuss their findings with the rest of the class. Then, through workshops on i) HTML programming, ii) graphic design, and iii) sound design, they were guided to create hypermedia rooms hosting texts, images, and sounds. Selected works were joined into an application and enhanced through a common interactive interface and scenographic props. The result was the interactive installation "Hyper Kafka: Rooms of Memory", which has been so far presented at the Library of the Philosophical School of the Athens University and the Audiovisual Festival of the Ionian University. Interface design embraced a literary feel with a dark aesthetic, incorporating a 3D environment to offer the audience a glimpse into the chaotic and minimal Kafkaesque world. The scenographic preparation included an old lamp pointing at a mouse on a desk that was decorated with pictures of Kafka's own sketches and old newspapers, reflecting a retro ambience. The hypertext fiction environment itself was projected on the wall and played back through speakers.

Preliminary evaluation of "Hyper Kafka: Rooms of Memory" has showed increased interest and acceptance of a hypertext fiction work as the core component of a learning environment. The participants of a focus group discussion (post-graduate students of German Literature) reported that the artworks succeeded in capturing Kafka’s absurdity, the technical execution was well-made, and the scenographic configuration of the physical space helpful in creating an immersive atmosphere. Hypermedia elements, such as virtual doors, passages, paths, and surprises were found to highlight the transformation, isolation, and complexity pertaining to Kafka's narrative, yet a technical introduction in navigating through the hypertext space was suggested for future applications. The authors will further evaluate and enrich hypertext fiction environments in search of the optimal educational practices.

Keywords

hypertext, hypertext fiction, literature, education, interaction, installation, immersion

EcoMind: Aspects of Ecology in New Media Art of the 21st Century

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The interdisciplinary project EcoMind covers the fields of research into contemporary art, communication of ecosystemic knowledge in new media art, and a technological capacity building in A-Frame. The particular focus is on European new media artworks classified under the theoretical umbrella of social ecology, media ecology, and eco-aesthetics. Born from biology, referring to the interrelationship of organisms and their environments, the term has acquired a range of applied meanings in other contexts. In his work The Three Ecologies (1989), Félix Guattari expanded the concept of ecology, introducing the concepts of social, environmental, and mental ecology. It led to a new dimension of understanding the simultaneous crises confronting the environment, society, and the human psyche.

The VR environment EcoMind (2025-2028) is being designed as a contemporary art gallery cooperatively by three research institutions (RISEBA, Vidzeme University of Applied Sciences in Latvia, and École Supérieure d'Art et de Design d'Orléans in France). It aims to revise societal values regarding ecology, as well as demonstrate new media arts' reflections on our experience of beauty and the sublime.

The creators of EcoMind are a group of your creative engineers using the A-Frame technological approach. The environment is meant to be used internationally as an educational tool in colleges and universities related to creative industries in order to transfer knowledge embodied in today's art. The prototype is built on the basis of the ImGame project (Misjuns et al., 2025) made at the Vidzeme University of Applied Sciences (Latvia) in the A-Frame technological framework. It intends to communicate the concept of immersiveness, its cultural context and artworks of the 21st century focused on immersion.

The matrix of *ImGame* is further employed within *EcoMind* to support sustainability objectives, ensuring that the project's virtual environment remains adaptable for the integration of new content and the authors can continue to advance the mission of ImGame, i.e., to communicate artistic ideas to the wider public not just the connoisseurs of art. Through study examples, it has been acknowledged in the research discourse that virtual galleries can effectively act "as a means to reach a broader audience" in the teaching of humanities and "foster critical dialogue" (Parsons, 2023).

EcoMind is a capacity building project at the same time to enhance the STEAM learning for the young creative engineers. The project intends to embrace the education on environmental issues and new art, while developing the team's creativity and new programming skills in A-Frame. Methodologically, the authors of EcoMind refer to studies where VR has been shown to enhance learners' satisfaction with the educational experience. As noted by researchers, spatial ability in VR can boost cognitive development, reflective thinking, and thus elevate the learning experience (Serna-Mendiburu, Guerra-Tamez, 2024). The use of VR environments in education has improved audience's engagement and exploration, "effectively integrating art and environmental knowledge". The findings of Chin-Wen Liao have validated the effectiveness of VR technology "in enhancing students' artistic creativity and environmental literacy" (Liao et al., 2025).

Next to the educational and technological issues, the project encompasses research and development of new media art's theory. Through examples of recent media and installation artworks, it intends to explore particular contemporary aesthetic concepts such as dark ecology.

Acknowledgments

Activity 1.1.1.9 "Post-doctoral Research" of the Specific Objective 1.1.1 "Strengthening research and innovative capacities and introduction of advanced technologies in the common R&D system" of the European Union's Cohesion Policy Programme for 2021-2027. Project EcoMind: Development of Serious Art Games and the Ecology of Mind in the 21st Century No. 1.1.1.9/1/24/I/009.

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Keywords

ecology, new media art, dark ecology, sublime, a-frame

Simulation and Prediction

Anomaly Detection Frameworks Taxonomy

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Introduction

In recent years, the increase of digital systems and the consequent need for data volumes have amplified the demand for intelligent systems capable of autonomous monitoring and decision-making. Anomaly detection, the process of identifying patterns in data that deviate significantly from expected behaviour (Chandola, 2009), plays a crucial role in applications such as fault detection, cybersecurity, predictive maintenance, and fraud detection (Nassif A, 2021). However, the increasingly complex nature of modern systems presents challenges in designing anomaly detection frameworks that are scalable and adaptable across various contexts (M. R. Alam, 2019). This research introduces a taxonomy of anomaly detection frameworks, focusing on their capabilities, design dimensions, and levels of abstraction. The proposed taxonomy aims to guide the evaluation of existing frameworks and the design of solutions that are robust, interpretable, and deployable in real-world environments.

Methods

This research adopts a comprehensive and systematic literature review of state-of-the-art anomaly detection frameworks over the last ten years. Literature was retrieved from major databases, including Scopus and Web of Science. Frameworks are included if they had a Field-Weighted Citation Impact (FWCI) greater than five, to ensure that highly influential and peer-recognized works were considered in this research, and the frameworks selected have added significant value in the field. Eight frameworks are ultimately selected, representing a diverse set of application domains such as cybersecurity, cloud infrastructure, logistics, and IoT systems. The aim is to identify, organize, and evaluate the core capabilities and design principles that support these frameworks. Based on the literature, the research extracts architectural and functional components, which are then synthesized into an anomaly detection framework taxonomy. Moreover, the study introduces the concept of framework abstraction levels, distinguishing between frameworks that are highly domain-specific, cross-domain adaptable, or designed with domain-agnostic generalization. This abstraction perspective allows for the evaluation of how flexibly a framework can be transferred across contexts, and how granular its architecture is in supporting different types of anomaly detection scenarios.

Results

The research results in the formulation of a structured taxonomy for anomaly detection frameworks. Eight influential frameworks were analysed to extract key characteristics and design patterns. The taxonomy comprises multiple dimensions, including: [1] Anomaly detection techniques, [2] Data type compatibility, [3] Scalability and performance optimization, [4] Explainability and interpretability, and [5] Domain specificity. These dimensions were synthesized into a hierarchical schema that comprises the core features. This taxonomy allows for horizontal comparison across domains and vertical comparison within framework complexity.

Conclusions and Future Work

This study presents a novel taxonomy and abstraction model that provides a systematic, comparative perspective on the diversity and complexity of contemporary anomaly detection frameworks. The taxonomy facilitates critical assessment of existing solutions and supports the development of more effective, domain-adaptable systems through the synthesis of key capabilities and architectural patterns.

Future research directions recommend the involvement of the following aspects:

Developing technical requirements specifications for the anomaly detection frameworks.

Evaluating data quality requirements and their impact on anomaly detection efficacy.

Assessing security requirements for the deployment of anomaly detection frameworks.

Comparative analysis with existing classification approaches will have to be also undertaken to refine the taxonomy's structure and to further enhance its relevance for academic and industry applications.

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Keywords

anomaly detection, anomaly detection framework, anomaly detection taxonomy

Coordinated Vulnerability Disclosure Process Key Dimensions Set

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Introduction

Since the enforcement of Directive (EU) 2022/2555 mandating the implementation of Coordinated Vulnerability Disclosure (CVD) processes, each EU Member State has adopted its own national approach. While some countries still rely on email-based systems to receive and process CVD reports, Latvia has taken a significant step forward by developing a dedicated digital platform for CVD management. However, a common issue across all implementations is the lack of a structured approach to the development of CVD programs when viewed through multiple dimensions. As a result, the failure to examine and address various dimensions, such as legal, technical, organizational, societal aspects and others limit the overall effectiveness and maturity of the CVD process.

Materials and Methods

This study examines the revised and enhanced stages in the life cycle of a CVD report and compares them against various relevant and influencing dimensions, such as legal, technical, organizational, societal aspects and others, based on expert input.

Results

The outcome of this study is the development of a theoretical six-dimensions tool outlining the key dimensions that influence the life cycle of a CVD report, which should be taken into account by those implementing and developing CVD programs. This tool can be applied to improve various workflows within the life cycle of a CVD report and beyond. Furthermore, the insights from the six-dimensions model will be used to enhance the Latvian CVD platform.

Discussion

Given that there is currently no formal obligation for European Union Member States to optimize CVD process workflows, despite their complexity and the diverse approaches taken, the proposed model provides significant added value by introducing six dimensions aimed at improving CVD process efficiency. It can serve as a strategic tool for enhancing national cybersecurity capabilities by leveraging CVD data for future phases, such as predicting and mitigating emerging vulnerabilities before they evolve into in actual security incidents. Nevertheless, the model has certain limitations, as its dimensions are derived mainly from theoretical considerations and expert input, and therefore require validation through empirical studies and practical application, which will form part of the author’s broader research work.

Keywords

CVD, vulnerability reporting, cybersecurity, CVD process key dimensions

Public Administration and Strategic Decision-Making Support Based on Artificial Intelligence: Constraining Factors

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Introduction

The importance of artificial intelligence is growing. The adoption of it in public administration has the potential to enhance transparency, efficiency, and responsiveness, ultimately creating greater public value (Babšek et al. 2025). Using artificial intelligence technologies in government improves policy-making processes, public service delivery, and the internal management of public administrations (van Noordt and Misuraca 2022). This study aims to analyse constraining factors that influence the strategic decision-making support within public administration based on artificial intelligence.

Methods

This research reviews the scientific literature on public administration, decision-making, and artificial intelligence. It forms part of the broader research conducted in the field of public management and support for strategic decision-making from the perspective of artificial intelligence.

Key Insights

As an essential part of public administration, strategic decisions are increasingly made with more involvement and support from artificial intelligence. Using artificial intelligence to support strategic decisions in public administration depends not only on the development, implementation, and utilization of technical solutions but also on indirectly related factors. It is essential to recognize that using artificial intelligence to support strategic decision-making in the public sector is more than just the implementation and usage of a technological solution. Equal attention must also be given to external constraining factors influencing how these decisions are adopted, perceived, and applied in practice. The research analyses aspects not primarily related to technical implementation. Specifically, it examines how constraining factors influence the creation and utilization of artificial intelligence-supported strategic decisions in public administration.

Conclusion

Analysis of the literature indicates key constraining factors that are crucial when artificial intelligence is used to support strategic decision-making in public administration: ethics, regulations, security, privacy, and social trust. The findings indicate that these constraining factors, which are not directly related to technical implementation, have a significant impact on the use and effectiveness of artificial intelligence-supported strategic decisions in public administration. he research also explores the impact of constraining factors on decision-making supported by artificial intelligence in the public sector.

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Keywords

public administration, decision-making support, artificial intelligence, constraining factors

Performance-Aware Shader Authoring for Web-Based Virtual Reality Development

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WebXR allows users to create and experience virtual, augmented, and mixed reality content directly through popular web browsers, making these immersive experiences widely accessible. However, this ease of access introduces significant performance challenges, particularly on standalone VR headsets that have limited processing power. Maintaining high frame rates (typically 72–90 Hz) and low motion-to-photon latency (under 20 ms) is critical to preventing user discomfort. Yet, content creators, often artists without deep graphics engineering expertise face a performance knowledge gap, struggling to anticipate the performance costs associated with various shader functions. Current WebXR optimization workflows are predominantly reactive, involving a time-consuming cycle of authoring, deployment, profiling with tools like Chrome DevTools or Spector.js, and iterative refinement. This post-hoc approach provides limited guidance during the crucial design phase and is inefficient, especially given the performance variability across diverse device and browser combinations. Therefore, there is a clear need for preemptive performance feedback mechanisms integrated into artist-friendly shader authoring tools.

This research addresses this gap by establishing a benchmarking methodology and developing an intuitive, point-based scoring system for a shader authoring tool called FastShaders. The goal is to provide artists with actionable, real-time performance feedback during shader creation, enabling them to predictably balance visual complexity with runtime performance constraints. The primary contributions include: (1) ShaderCarousel, an automated WebXR benchmarking system built using A-Frame and Three Shading Language (TSL), designed to systematically evaluate shader performance on standalone HMDs; (2) a novel methodology to translate empirical benchmark data from ShaderCarousel into a predictive, point-based system representing shader operation costs; and (3) the FastShaders concept — an artist-centric, node-based shader authoring tool incorporating this preemptive scoring system.

The ShaderCarousel system presents a 3D environment featuring shaders applied to geometries positioned on a rotating circular platform aligned horizontally along the XZ-plane. As the carousel continuously rotates around the Y-axis, the system incrementally adds instances of a specific shader, evenly spaced around its circumference. A fixed-perspective camera oriented along the Z-axis toward the carousel's center captures the scene. This setup generates a dynamic visual effect wherein each geometry, as it rotates around the carousel, naturally transitions in size and visibility relative to the camera's viewpoint, allowing effective observation of shader performance across varying screen dimensions. ShaderCarousel logs key performance metrics, including frame rate (FPS), draw calls, and the maximum shader instance count achievable before significant FPS degradation occurs. Test scenarios include variations in camera proximity and shader instance loads. The collected data is exported as JSON for subsequent analysis.

The methodology for deriving the point-based scoring system involves identifying key shader operations, correlating them with measured performance data, and assigning initial point values based on their observed impacts. These point values are iteratively refined by comparing predicted aggregate scores for shaders against their actual benchmarked performance.

Initial results from ShaderCarousel demonstrate its ability to differentiate performance among various generative TSL texture shaders, with complex procedural shaders incurring significantly higher performance costs. A preliminary point system was developed, assigning costs to operations such as texture sampling, noise functions, and mathematical computations. This system provides a useful, albeit approximate, guidance mechanism. Early feedback helps artists optimize shader performance from the beginning, enabling them to explore efficient design options and understand performance implications proactively. This approach aims to minimize the need for extensive shader performance adjustments later in the development process.

This research establishes a viable methodology for providing preemptive performance feedback in WebXR shader authoring. The ShaderCarousel system and the FastShaders point-based scoring concept offer a practical approach to bridging the performance knowledge gap for artists, facilitating the creation of more predictable and performant WebXR content. Future work will focus on automating quantitative analysis for point derivation using statistical modeling or machine learning, expanding device and browser testing for broader applicability, conducting formal artist user studies to evaluate usability and effectiveness, integrating more granular GPU profiling data as WebXR standards evolve, and exploring dynamic adaptation of the point system to emerging hardware and runtime environments. Ultimately, this research contributes to democratizing performant WebXR development by empowering artists with tools for proactive performance management.

Keywords

WebXR, shaders, 3D, virtual reality, HMD, authoring

Vegetation Depiction Modes and Performance Testing on Various Virtual Reality Headsets

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Introduction

As virtual reality technology keeps being utilized in various fields, the demand for immersive environments keeps growing. Still, it is particularly challenging to provide high-fidelity solutions for standalone headsets due to hardware limitations, especially if it is necessary to visualize different types of vegetation. While there are improvements in next generation headsets regarding computational power, still it is a challenge to render intricate virtual environments. Previous studies that compare virtual reality headsets rarely focus on standalone headsets and prefer to use simpler geometries for testing purposes.

The aim of this study is to evaluate performance of multiple vegetation types with differing depiction modes, such as high-polygon 3D models, use of level of detail (LOD) and billboards, on standalone VR headsets – Meta Quest 2 and Meta Quest 3.

Materials and Methods

A three-dimensional scene consisting of skybox, 20 m x 20 m floor and eight observation points was created using Unreal Engine 5.3. Three different types of vegetation – plumeria rubra, camellia and bilberry - were modelled using SpeedTree software. LOD was generated using Unreal Engine, but billboard textures were created in Blender 4.5. Plants were placed in a grid structure using hierarchical instanced static mesh component (HISM), covering the floor and their planting distances were set to represent real life scenario, which resulted in 2025 instances of bilberries, 36 instances of camellias and 16 instances of plumeria rubra.

Tests for each vegetation type were conducted separately – firstly, a test with high-polygon meshes was run, where vegetation was observed from 40 meters to five meters, frames per second captured each five meters, then test was repeated with LOD and LOD, where last model is replaced by a billboard.

Results

The gained data shows that the use of high polygon meshes yields the least optimal results for both headsets. Meta Quest 2 could not reach the recommended number of frames in none of the cases, while Meta Quest 3 had optimal performance of 72 frames per second from 25 to 40-meter observation points with plumeria rubra and camellia. Both headsets had very poor results (under 10 frames per second) with bilberry plant, which had 2025 instances, planted 45 centimeters apart.

Improved performance for plumeria rubra and camellia was noted when LOD was applied to the plants. Meta Quest 2 had 72 frames per second from 25 to 40-meter distance, Meta Quest 3 – from 10 to 40-meter distance. Tests with bilberry plants could not reach the optimal threshold, but on average Quest 2 had 3 times the frame rate it had with high-polygon model, Quest 3 – 4.2 times.

The best results were observed with billboards, especially with bilberry plants, where both headsets reached optimal performance in all distances. For plumeria rubra results were almost identical to the previous test. Camellia had less than optimal performance in distances closer than 15 meters.

Discussion

Results show that while high polygon meshes provide the best visual fidelity, their rendering is often unfeasible. The newer generation headset Meta Quest 3 was capable of providing an improved performance in all cases when compared to Meta Quest 2, yet when it came to densely planted vegetation, optimal performance proved to be unachievable. The use of LOD helped to improve framerate in all the cases and combined with billboards further improvements were noted. While the billboards proved to be useful when it comes to optimization, they could only visualize one angle of the tree, which could break the illusion of realism. It is possible that the complexity of the materials (bark, leaves, flowers) could have also impacted the results. Future research should explore user perception and immersion when experiencing different modes of depiction.

Conclusion

The tests conducted show that Meta Quest 3 has a better performance in all cases, especially when LOD and billboards are applied. While the billboards showed the best performance, they can cause a loss of immersion in close distances. Authors propose a hybrid approach, where full 3D meshes are displayed near the player, while LOD and billboards are used for more distant objects.

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Keywords

virtual reality, standalone headsets, billboards, level of detail