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Identification of Slovak Tourists' Attitudes Towards Digitalization for Circular Economy and Waste Management

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Abstract. *The research paper explores the perspectives of a chosen group of Slovak tourists on how digitization drives circular economy practices and promotes efficient waste management in tourism. The study involves data from 103 participants, who expressed their opinions on sustainability concepts like digitization, innovation, circular economy, and waste management in tourism, using a 5-point Likert scale. The research's main objective is to understand sentiments and attitudes towards integrating digitization and innovation for sustainable practices in the tourism sector. The findings reveal differences in attitudes among respondents. Visual aids like box plots are utilized to help interpret the results and emphasize how factors like interest in new technologies impact respondents' attitudes. Implementing digital technologies in tourism plays a key role in creating efficient waste management systems and reducing the environmental burden. Data tracking and processing systems enable detailed analysis of waste generation patterns, providing valuable information to optimize collection and recycling processes. Digital technologies contribute to the overall reduction of the impact of tourism on the environment through electronic reservations, intelligent transport systems and other innovative solutions. These initiatives increase waste management efficiency and minimise tourism's negative ecological impact, contributing to more sustainable and ecologically responsible tourism.*

Keywords: digitization, circular economy, tourists, waste management

Introduction

The current global economic structure is gradually moving towards the strengthening of digitization, which is supported by the development of the Fourth Industrial Revolution. Tourism, a complex sector, is also becoming an integral part of this digital transformation process, but at a slower pace due to a series of challenges and uncertainties surrounding it. Tourism reacts to global trends in the digital sphere but considers the specifics and challenges inherent to it. The advancing digitization impacts a range of aspects, including marketing and strategic management of destinations, while trying to adapt to new economic realities and increase the efficiency and competitiveness of the industry (Rodrigues et al., 2023).

Technological development has accompanied tourism since its beginnings, creating new challenges and dynamics. This sector's ongoing digital transformation process is reinforced by a series of breakthrough innovations that are significantly changing the industrial landscape and beginning to influence the field of tourism. This trend initially appeared with the advent of Industry 4.0, where the digital and physical spheres were connected into a unique system. This transformation results in a complex connection, where modern technologies redefine the tourism paradigm and bring new challenges and opportunities for this industry. This creates an intelligent value chain where data is continuously processed and exchanged in autonomous and independent

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methods. This interconnection and synergy of modern technological elements enables a dynamic transformation of the tourism industry, where information is seamlessly transferred and used to increase the efficiency and performance of the entire industry (Posada et al., 2015).

Tourism 4.0 is based on these advanced technologies to transform the industry, improve the tourism experience, and optimize operational efficiency through intelligent systems and interactive technological solutions. Digital innovation is connected to tourism, opening the door to new approaches and possibilities in this dynamic industry (Buhalis et al., 2019).

These advanced technologies can be crucial in effectively introducing a circular economy and functional waste management. Circular economy and waste management are interconnected concepts that respond to environmental challenges associated with waste production and processing. The circular economy emphasizes creating a closed system where raw materials and products are used as efficiently as possible while minimizing waste generation. Together, these approaches strive to transform the current linear model of the economy, where production and consumption generate a large amount of waste, to a more efficient and sustainable model where the use of resources is optimized, and negative environmental impacts are minimized (Contec, 2024).

Literature review

Circular economy and waste management represent innovative approaches to a sustainable economy and environmental protection. The goal of a circular economy is to support a closed system where raw materials, products and materials are considered resources with a limited lifespan. Instead of the traditional linear model that includes production, consumption and waste disposal, the circular economy strives for a circular process of recovery and reuse (Rodríguez et al., 2020). It is important to note that waste management, in the context of the circular economy, focuses on minimization and efficient waste processing through recycling, reusing, and using renewable materials.

Einarsson & Sorin (2020) believe that tourism inspired by the circular economy can ultimately lead to a more resilient industrial ecosystem optimized for all its actors without exceeding social and ecosystem-carrying capacities. We can consider distributors of travel services (travel agencies, operators, online travel agencies) as critical sectors of the tourism industry; operators of accommodation and catering services; operators of terrestrial activities (museums, attractions); event organizers; land transport operators (private bus, car/bicycle rental, train) and air transport operators. Each sector shows a different intensity of use of assets and materials, level of servitization, customer involvement, etc. For this reason, it is better to adapt circularity for individual sectors so that they work most efficiently. For example, accommodation service operators could be successful using an integrated business model; owners of accommodation facilities could cooperate more closely so that circular and sustainable considerations could significantly influence operational activities (Einarsson & Sorin, 2020). Authors Sørensen & Bærenholdt (2020) highlight the circular economy theory, which offers a business- and solution-oriented approach to environmental sustainability. The authors believe that some tourist practices can contribute to sustaining the development of waste management in tourism, applying a practice theory that emphasises changes in tourist behaviour rather than tourism products and services. Author Ezeah et al. (2015) draw attention to the effective introduction of waste management. The authors believe that the efficiency of environmental waste management is becoming the core of the current academic debate in climate change science. Tourism has increased over the past few decades and is currently considered one of the most dynamic economic activities in the world.

In connection with the circular economy and waste management, it is essential to mention the need for digitization and new technologies, which create a synergistic connection in the context of tourism, where modern technologies can shape new paradigms of sustainable development. Digitization is becoming a driving force in introducing intelligent solutions in the travel industry, from reservations to destination management to personalized experiences for travellers. At the same time, this digitization enables the monitoring and optimization of waste management through monitoring consumption, recycling, and more efficient management of waste flows. From the view of sustainable development, the circular economy and waste management are essential in the tourism industry (Andersen, 2007; Ezeah et al., 2015; Rodrigues et al., 2022; Buhalis et al., 2019; Posada et al., 2015).

Digitization and smart technologies can also have a positive effect on the tourists themselves. Thanks to their use, tourists can make the entire travel process easier and more efficient. Autor Jeong et al. (2019) highlight the function of smart tourism technology which tourists use in the destination. Authors Crouch & Ritchie (1999) also draw attention to the improvement of sustainability through intelligent tourism, which includes innovative cooperation and new technologies.

Cheah et al. (2022) underscored the potential benefits of applying new technologies (Industry 4.0) to enhance solid waste management and efficiency. However, they highlighted a lack of coherence among individual systems in waste management (cloud computing, connectivity, big data) at a larger scale. Consequently, there is a need to investigate the intricate integration of each process within the solid waste management chain. At the same time, it is essential to continuously emphasize sustainable waste management practices like reuse, refurbishment, and recycling, and integrating Industry 4.0 technologies or smart technologies plays a significant role in supporting these processes (Wilts et al. 2021).

This issue is currently the subject of limited research, indicating its relative novelty and the need for more detailed investigation. For this reason, we decided to systematically identify the attitudes and knowledge of the selected group of Slovak tourists towards the issues of digitization, circular economy, and waste management within tourism.

Methodology

Our study aims to assess differences in attitudes regarding the necessity of digitization in connection with the circular economy and waste management, key components of sustainable tourist behaviour. Conducting primary research with 103 Slovak tourists, we utilized diverse communication channels for survey distribution. The questionnaire contained two sections in which attitudes towards the importance of digitization and optimization in the circular economy in tourism were formulated, followed by motivators that contribute to supporting the circular economy (circular economy) in tourism and the importance of digital transformation and innovation. Respondents could express their disagreement/agreement with the attitude and the motivator based on a 5-point Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree, 5 – strongly agree).

Validation of research questions was achieved through hypotheses, and causal relationships were explored across seven identified attitudes. We formulated the research questions:

Is there a statistically significant interest of the respondent with the chosen attitude?

Is there a mutual connection between the selected motivators and the selected attitude?

Is there a correlation between selected motivators?

We formulated seven attitudes. In the text, we refer to attitudes as attitudes 1-7.

1. Sensors and IoT (Internet of Things) can contribute to better data collection and real-time tracking of waste flow.
2. Digital platforms can help improve the efficiency of waste sorting and recycling.
3. Digital technologies can be effectively used to monitor and track waste management.
4. Digitization and innovation can contribute to the effective management of waste management in tourism.
5. Mobile applications can promote public awareness and increase population participation in waste separation. Using artificial intelligence in waste management optimization and planning.
6. Using artificial intelligence in waste management optimization and planning.
7. Digitization can create more sustainable and ecological tourist destinations through better management of waste flows.

We formulated 4 categories, which may or may not influence the attitudes 1-7.

- Digital literacy (DL),
- Interest in new technological procedures (TP),
- Environmental responsibility (ER),
- Obtaining information from online platforms (OI).

We formulated seven hypotheses and tested attitudes 1-7.

- $H1_0$: The distribution of answers is not the same across **DL** categories.
- H1: The distribution of answers is the same across **DL** categories.
- $H2_0$: The distribution of answers is not the same across **TP** categories.
- H2: The distribution of answers is the same across **TP** categories.
- $H3_0$: The distribution of answers is not the same across **ER** categories.
- H3: The distribution of answers is the same across **ER** categories.
- $H4_0$: The distribution of answers is not the same across **OI** categories.
- H4: The distribution of answers is the same across **OI** categories.

We identified three motivators, which may or may not influence attitude 1.

- **Education and awareness campaigns**,
- **Innovations in tourism**,
- **Transparency and responsibility.**

We formulated other three hypotheses and tested attitude 1:

- $H5_0$: There is no correlation between the motivator „Education and awareness campaigns" and attitude.
- H5: There is a correlation between the motivator „Education and awareness campaigns" and attitude.
- $H6_0$: There is no correlation between the motivator „Innovations in tourism" and attitude.
- H6: There is a correlation between the motivator „Innovations in tourism" and attitude.
- $H7_0$: There is no correlation between the motivator „Transparency and responsibility" and attitude.

- H7: There is a correlation between the motivator „Transparency and responsibility" and attitude.

As part of our research, we tried to identify the correlation between motivators that contain elements pointing to the importance of digitization in the circular economy and waste management in tourism. We formulated the 21 most essential motivators that can impact a tourist. At the same time, motivators reflect attitudes. They are numbered sequentially from 1 to 21 in the results.

The current situation of the circular economy (circular economy in tourism provides environmental benefits, attracting environmentally conscious travellers who prioritize protecting biodiversity and ecosystems) - 1

Informing tourists (educational programs on circular economy benefits foster sustainable decision-making) - 2

Financial costs and benefits (adopting circular practices in tourism boosts destination economies through investments in renewables, local businesses, and recycling, fostering income generation and employment growth) - 3

Tourist responsibility (supporting tourists in showing social responsibility through their travel decisions) - 4

Education and awareness campaigns (educating tourists and businesses about circular practices and digital possibilities can enhance their engagement and promote a more sustainable approach to tourism) - 5

Cooperation with the tourism industry (creating projects that improve the living conditions of local communities and employment can motivate travellers to actively participate) - 6

Environmental sustainability (reducing environmental impacts through digitization, for example, more efficient waste flow management, minimisation of energy consumption and better transport planning) - 7

Effective resource management (optimising collection and recycling through digital technologies can identify optimal waste collection points and improve recycling processes, such as reducing landfills) - 8

Innovations in tourism (experiential tourism, where digital innovations can contribute to the creation of new experiences for tourists that are also environmentally friendly, for example, virtual realities, interactive applications, or digital maps to follow sustainable local attractions - 9

Support of sustainable behaviour (meaning education and awareness) - 10

Improved process efficiency (digital technology can help streamline tourism logistics, minimizing energy consumption and emissions) - 11

Increased destination competitiveness (destinations that invest in digital innovations in the circular economy can gain a positive reputation and attract environmentally responsible tourists, thus gaining a competitive advantage) - 12

Transparency and responsibility (using blockchain technology can ensure transparency in tracking the sources and origin of materials, which increases responsibility and trust among tourists) - 13

Innovation collaborations (promoting innovation partnerships and digital platforms can help foster collaboration between destinations, businesses and local communities in the circular economy and innovation) - 14

Smart containers and waste bins equipped with sensors that monitor the level of waste (waste containers with sensors inform managers about fullness, optimizing collection planning and

reducing inefficiencies. Bins also monitor sorting, providing information for effective collection) - 15

RFID technology (allows to track and identify waste containers through contactless identification and makes it possible to track and identify waste containers through contactless identification using radio wave signals; this simplifies the tracking of waste movement and allows better management of collection and processing) - 16

Mobile applications for waste management (an application for devices that can provide information on waste collection planning and allow waste monitoring at local landfills and waste sorting facilities for residents) - 17

GPS and IoT (track the movement of collection vehicles in real-time and allow the movement of collection vehicles to be tracked in real-time; this technology can be used to optimize waste collection routes, reducing costs and emissions) - 18

Data Analytics (analytical tools process data that can provide important information about the amount, composition, and trends of waste, which is important for planning and optimizing waste management) - 19

Automated robotic systems (systems can sort waste into recyclable and non-recyclable components; these systems can quickly and accurately identify materials, increasing recycling efficiency) - 20

Blockchain (is used to create a transparent and secure system for tracking the origin of waste. In this way, public and business confidence in sustainable behaviour increases) - 21

We formulated one hypothesis and tested motivators:

- $H8_0$: There are not more than three correlations between motivators.
- H8: There are at least three correlations between motivators.

Selected statistical methods were performed, including the Mann-Whitney U Test. This non-parametric statistical test compares two independent samples without strict distributional assumptions, making it particularly suitable for ordinal data or situations where normality assumptions are challenging. The primary aim of this test is to determine whether the samples originate from a common population, assessing statistical significance based on rank-based comparisons. We used The Kaiser–Meyer–Olkin (KMO) Test. It is a descriptive statistic that plays a pivotal role in factor analysis. Its primary objective is to assess sampling adequacy, determining whether common variance among variables justifies applying factor analysis. Represented as a numerical index between 0 and 1, higher KMO values indicate superior suitability for subsequent factor analytic procedures. Following the KMO test, Bartlett's Test was employed as a significance hypothesis test crucial in factor analysis. This test systematically examines the hypothesis that variances among different groups are equivalent, influencing the decision to proceed with subsequent parametric or factor analytic techniques. Bartlett's Test assumes a normally distributed dataset. Factor analysis was used to uncover relationships among observed variables, aiming to distil the essence of underlying factors and elucidate correlation patterns within observed variables. This method assumes that observed variables are influenced by a limited number of factors, facilitating the extraction of meaningful structure from complex data. We used Principal Component Analysis. This analysis, a multivariate statistical technique employed in data analysis for dimensionality reduction and feature extraction, was also utilized. Principal components are linear combinations of the original variables determined to capture the maximum variance present in the dataset. We used a box plot. It is a graphical representation used to display the distribution

of a dataset. The length of the box signifies the spread of the middle 50% of the data. Whiskers extend from the edges of the box to the minimum and maximum values within a specified range, often determined by a multiplier of the IQR, providing insight into the overall data distribution. In the end, we performed ANOVA. It assesses differences among group means in a sample, determining if significant variations exist between means of three or more independent groups. It partitions total variance into components, including group differences and random variability, providing an overall test for mean equality across multiple groups. We performed Linear regression to find the correlation between selected motivators and attitude. Linear regression models the relationship between a dependent variable and independent variables by fitting a best-fitting line, minimizing the difference between observed and predicted values. It's used for prediction and understanding variable relationships, providing coefficients for the linear equation's slope and intercept.

Results and discussions

In the following section of our research, we present the outcomes obtained through a combination of selected mathematical, general, and statistical methodologies. Based on the Mann-Whitney U Test results, we noticed a difference in respondents' answers in two categories – TP for attitude 4 and OI for attitudes 1-7, except attitude 3. We rejected null hypotheses. In categories – DL (for 1-7), ER (for 1-7), and TP (for 1, 2, 3, 5, 6 and 7) were not found statistically significant differences. We did not reject the null hypotheses shown in Table 1. For a better graphical presentation of the results, we present box plots for selected attitudes (which we consider the most interesting) in connection with the selected characteristics of the respondents.

Table 1. Results based on the Mann-Whitney U Test

Attitude	DL (Sig.)	Decision	TP (Sig.)	Decision	ER (Sig.)	Decision	OI (Sig.)	Decision
1	0.15	Do not reject $H1_0$	0.13	Do not reject $H2_0$	0.16	Do not reject $H3_0$	**0.00**	**Reject the $H4_0$**
2	0.19	Do not reject $H1_0$	0.02	Do not reject $H2_0$	0.24	Do not reject $H3_0$	**0.00**	**Reject the $H4_0$**
3	0.24	Do not reject $H1_0$	0.07	Do not reject $H2_0$	0.06	Do not reject $H3_0$	0.07	Do not reject $H4_0$
4	0.17	Do not reject $H1_0$	**0.01**	**Reject the $H2_0$**	0.56	Do not reject $H3_0$	**0.02**	**Reject the $H4_0$**
5	0.13	Do not reject $H1_0$	0.72	Do not reject $H2_0$	0.62	Do not reject $H3_0$	**0.02**	**Reject the $H4_0$**
6	0.59	Do not reject $H1_0$	0.12	Do not reject $H2_0$	0.16	Do not reject $H3_0$	**0.01**	**Reject the $H4_0$**
7	0.93	Do not reject $H1_0$	0.15	Do not reject $H2_0$	0.21	Do not reject $H3_0$	**0.02**	**Reject the $H4_0$**

Asymptotic significances are displayed. The significance level is 0.050.
Source: Authors' own research.

Figure 1 shows the difference in the respondents' answers concerning the attitude 1. The answer scale was expressed in values from 1 to 5, where 1 is total disagree and 5 is total agree. At the same time, we considered whether the respondent was interested in new technological procedures. Respondents interested in new technological procedures achieved an average answer of 4, i.e., expressed their agreement with the attitude. Respondents who are not interested in new technological procedures achieved an average answer of 3, i.e., expressed a neutral attitude.

In contrast, Figure 1 also shows the difference in the respondents' answers concerning attitude 3. At the same time, we considered whether the respondents obtained information from online platforms. Respondents who obtained information from online platforms achieved an average answer of 5, i.e., expressed their total agreement with the attitude. Respondents who did not obtain information from an online platform achieved an average answer of 3, i.e., expressed a neutral attitude.

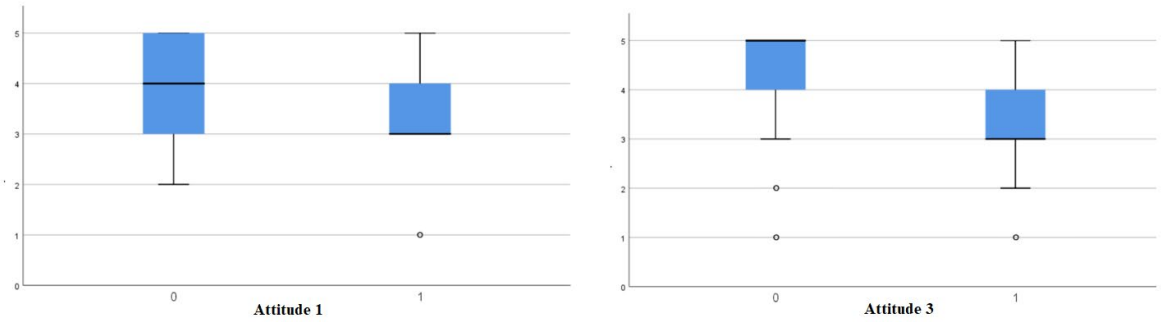

Figure 1. Boxplot for Attitude 1 and Attitude 3

Source: Authors' own research.

Figure 2 shows the difference in the respondents' answers concerning the attitude 6. Respondents interested in new technological procedures achieved an average answer of 4, i.e., expressed their agreement with the attitude. Respondents who are not interested in new technological procedures achieved an average answer of 3, i.e., expressed a neutral attitude. The result is similar to Figure 1.

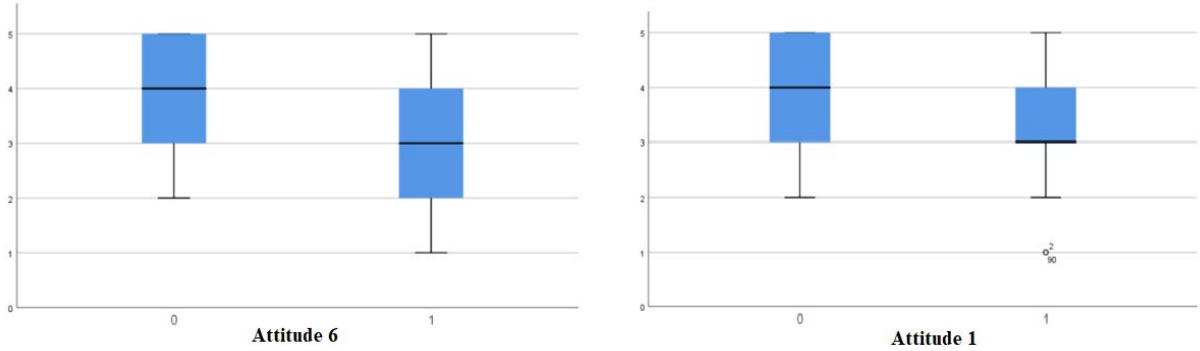

Figure 2. Boxplot for Attitude 6 and Attitude 1

Source: Authors' own research.

In the end, Figure 2 shows the difference in the respondents' answers concerning the attitude. At the same time, we considered whether the respondents obtained/did not obtain information from an online platform. Respondents who obtained information from the online platform achieved an average answer of 4, i.e., expressed their agreement with the attitude. Respondents who did not obtain information from the online platform achieved an average answer of 3, i.e., expressed a neutral attitude.

Before initiating the factor analysis, we ensured the suitability of the research variables. The Kaiser-Meyer-Olkin (KMO) adequacy test confirmed that all variables measured the same latent construct. Moreover, the results indicated that none of the variables needed exclusion from

subsequent analyses. Subsequently, Bartlett's sphericity test was performed, affirming that the correlation matrix of the selected variables was not unity. This outcome validated the appropriateness of the chosen variable set, as detailed in Table 2.

Table 2. KMO and Bartlett´s Test of Sphericity

KMO test		0,928
Bartlett´s Test of Sphericity	Chi-Square	1706,184
	df	210
	Sig.	0,000

Source: Authors' own research.

Kaiser's criterion makes it possible to select three factors that explain 92,80 % of the variability of the original manifest variables.

Table 3. Correlation between motivators based on Exploratory Factor Analysis

Correlation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	1,00	0,46	0,41	0,37	0,48	0,39	0,31	0,38	0,33	0,34	0,27	0,39	0,33	0,42	0,38	0,33	0,23	0,21	0,25	0,35	0,23
2	0,46	1,00	0,56	0,68	0,68	0,59	0,54	0,51	0,43	0,51	0,56	0,51	0,43	0,54	0,46	0,42	0,41	0,42	0,45	0,50	0,54
3	0,41	0,56	1,00	0,72	0,64	0,53	0,46	0,52	0,42	0,45	0,43	0,45	0,45	0,56	0,40	0,40	0,42	0,43	0,42	0,57	0,43
4	0,37	0,68	0,72	1,00	0,67	0,59	0,54	0,43	0,43	0,48	0,42	0,44	0,42	0,43	0,36	0,30	0,38	0,43	0,44	0,53	0,44
5	0,48	0,68	0,64	0,67	1,00	0,68	0,64	0,64	0,59	0,68	0,58	0,63	0,65	0,57	0,51	0,44	0,47	0,56	0,56	0,67	0,61
6	0,39	0,59	0,53	0,59	0,68	1,00	0,69	0,58	0,69	0,71	0,61	0,57	0,50	0,64	0,57	0,53	0,52	0,62	0,64	0,61	0,64
7	0,31	0,54	0,46	0,54	0,64	0,69	1,00	0,61	0,66	0,66	0,59	0,58	0,51	0,47	0,61	0,59	0,56	0,60	0,59	0,69	0,58
8	0,38	0,51	0,52	0,43	0,64	0,58	0,61	1,00	0,62	0,69	0,66	0,66	0,58	0,59	0,52	0,43	0,55	0,44	0,52	0,56	0,51
9	0,33	0,43	0,42	0,43	0,59	0,69	0,66	0,62	1,00	0,71	0,60	0,63	0,61	0,58	0,51	0,49	0,52	0,51	0,57	0,54	0,46
10	0,34	0,51	0,45	0,48	0,68	0,71	0,66	0,69	0,71	1,00	0,62	0,60	0,59	0,58	0,53	0,51	0,61	0,59	0,60	0,59	0,58
11	0,27	0,56	0,43	0,42	0,58	0,61	0,59	0,66	0,60	0,62	1,00	0,57	0,46	0,59	0,49	0,49	0,50	0,55	0,52	0,62	0,63
12	0,39	0,51	0,45	0,44	0,63	0,57	0,58	0,66	0,63	0,60	0,57	1,00	0,72	0,68	0,50	0,53	0,57	0,44	0,59	0,63	0,55
13	0,33	0,43	0,45	0,42	0,65	0,50	0,51	0,58	0,61	0,59	0,46	0,72	1,00	0,66	0,49	0,50	0,51	0,46	0,52	0,56	0,48
14	0,42	0,54	0,56	0,43	0,57	0,64	0,47	0,59	0,58	0,58	0,59	0,68	0,66	1,00	0,55	0,60	0,51	0,47	0,51	0,50	0,52
15	0,38	0,46	0,40	0,36	0,51	0,57	0,61	0,52	0,51	0,53	0,49	0,50	0,49	0,55	1,00	0,70	0,67	0,46	0,58	0,54	0,54
16	0,33	0,42	0,40	0,30	0,44	0,53	0,59	0,43	0,49	0,51	0,49	0,53	0,50	0,60	0,70	1,00	0,76	0,63	0,63	0,60	0,54
17	0,23	0,41	0,42	0,38	0,47	0,52	0,56	0,55	0,52	0,61	0,50	0,57	0,51	0,51	0,67	0,76	1,00	0,61	0,71	0,60	0,50
18	0,21	0,42	0,43	0,43	0,56	0,62	0,60	0,44	0,51	0,59	0,55	0,44	0,46	0,47	0,46	0,63	0,61	1,00	0,75	0,75	0,64
19	0,25	0,45	0,42	0,44	0,56	0,64	0,59	0,52	0,57	0,60	0,52	0,59	0,52	0,51	0,58	0,63	0,71	0,75	1,00	0,76	0,59
20	0,35	0,50	0,57	0,53	0,67	0,61	0,69	0,56	0,54	0,59	0,62	0,63	0,56	0,50	0,54	0,60	0,60	0,75	0,76	1,00	0,63
21	0,23	0,54	0,43	0,44	0,61	0,64	0,58	0,51	0,46	0,58	0,63	0,55	0,48	0,52	0,54	0,54	0,50	0,64	0,59	0,63	1,00
Sig.																					
1		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,01	0,00	0,01
2	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
3	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
4	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
5	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
6	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
7	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
9	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
13	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
14	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00	0,00
15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,00
16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,00
17	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00	0,00
18	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,00
19	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,00
20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,00
21	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	

Source: Authors' own research.

Based on the result, we can interpret that each item has a loading corresponding to each in case they reach a value higher than 0.40 (including 0.40). We found a correlation in components (motivators) which met the requirement. Detailed results are shown in Table 3.

Table 4. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.779	56.090	56.090	11.779	56.090	56.090
2	1.487	7.080	63.170	1.487	7.080	63.170
3	1.055	5.023	68.193	1.055	5.023	68.193
4	0.922	4.392	72.585			
5	0.713	3.394	75.978			
6	0.642	3.056	79.035			
7	0.592	2.821	8.856			
8	0.505	2.406	84.262			
9	0.492	2.343	86.604			
10	0.404	1.925	88.529			
11	0.386	1.839	90.369			
12	0.339	1.614	91.982			
13	0.283	1.348	93.330			
14	0.263	1.253	94.583			
15	0.219	1.044	95.627			
16	0.204	0.970	96.597			
17	0.182	0.866	97.464			
18	0.156	0.743	98.207			
19	0.142	0.676	98.882			
20	0.127	0.604	99.486			
21	0.108	0.514	100.000			

Extraction Method: Principal Component Analysis.
Source: Authors' own research.

We focus on eigenvalues, which indicate the total explained variance for a given principal component. Employing the Extraction method - Principal Component Analysis, we found that Component 1 has an eigenvalue of 11.77, explaining 56.09% of the variance. Component 2 has an eigenvalue of 1.48, representing 7.08% of the variance, and Component 3 has an eigenvalue of 1.05, explaining 5.02%. Since we extracted the same number of components as there are items, the values in the "Extracted Sums of Square Loadings" column match those in "Initial Eigenvalues." Our objective was to reduce the variable set. Following the criterion that components should have eigenvalues greater than 1, the recorded result is presented in Figure 5.

Generally, the first component reaches the highest total variance, while the last component reaches the lowest, but all three components reach values higher than the Eigenvalue. From Figure 5, we can see that component 1 reached the highest total variance. Components 2 and 3 also reached a variance higher than 1. The break occurs in component 4, where the variance reaches a value lower than 1.

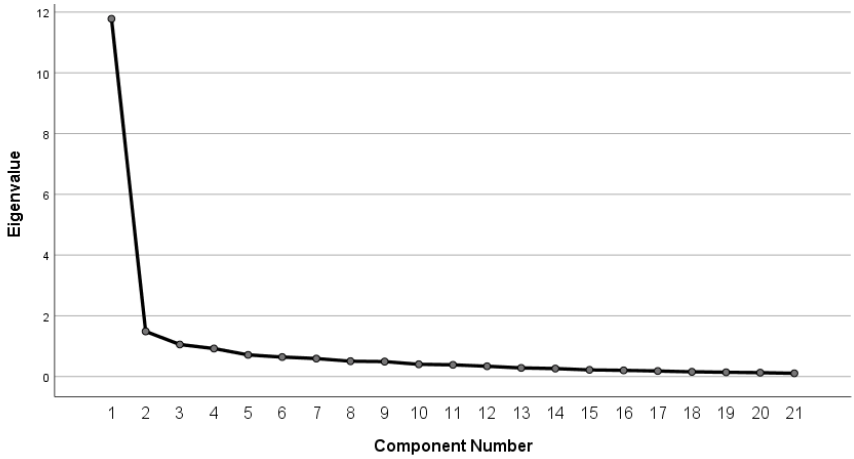

Figure 5. Scree Plot

Source: Authors' own research.

Table 5. Component Matrix

Items	1	2	3
1	0,48	0,44	0,21
2	0,71	0,40	-0,17
3	0,67	0,42	-0,20
4	0,66	0,48	-0,37
5	0,83	0,31	-0,07
6	0,83	0,06	-0,09
7	0,80	-0,07	-0,10
8	0,77	0,09	0,27
9	0,76	-0,04	0,26
10	0,81	-0,05	0,11
11	0,75	-0,02	0,03
12	0,78	0,02	0,34
13	0,73	0,03	0,36
14	0,76	0,08	0,32
15	0,72	-0,22	0,10
16	0,73	-0,39	0,02
17	0,74	-0,40	0,00
18	0,74	-0,32	-0,37
19	0,79	-0,33	-0,19
20	0,82	-0,12	-0,25
21	0,75	-0,12	-0,20

Extraction Method: Principal Component Analysis.
Source: Authors' own research.

Based on the result, we identify the following findings: Items 5 and 6 correlate with the highest value of 0.83 with component 1, and item 1 correlates with the highest value of 0.44 with component 2. The results are shown in Table 6.

Table 6. Anova

Regression model	df	F	p
	3	19.5	<.001

Source: Authors' own research.

Based on the result of ANOVA, our regression model is statistically significant. In the linear regression framework, we examined whether there is a correlation between the selected factors and attitude. We identified the following findings.

Table 7. Result based on Linear Regression

	Coefficient B	P-value
(Constant)	1.35	0.00
Education and awareness campaigns	0.31	0.00
Innovations in tourism	0.33	0.00
Transparency and responsibility	0.02	0.88

Source: Authors' own research.

Based on the result of Linear regression, we found a correlation between the motivator "Education and awareness campaigns" and attitude 1, i.e., the coefficient reached the value of 0.31 and the motivator "Innovations in tourism "and attitude 1, i.e., the coefficient reached the value of 0.33. Both results are statistically significant. There is a correlation between motivators and attitude 1. However, the result for the last motivator indicates a statistically insignificant result. In this case, we did not find a correlation between the motivator and attitude. The results are shown in Table 7.

Our results come close to those of other studies that have dealt with similar issues as Cheah et al. (2022), Rodrigues, V., Eusébio, C., & Breda, Z. (2023) or Ezeah, Ch., Fazakerley, J., & Byrne, T. (2015). We perceive the respondents' opinions as key to creating the kind of awareness that can improve tourists' environmental behaviour by making tourists understand the circular economy and waste management in tourism better.

Our results show that the respondents (tourists) are aware of the importance of introducing new technologies and supporting education, as they consider them as essential components that can contribute to sustainability in tourism. At the same time, new technologies bring concerns about use and challenges that must be overcome.

We consider the following elements to enhance sustainability in connection with tourism's economic, social, and environmental aspects:

- Implementation of blockchain technology to ensure transparency in payments.
- Digital Sustainability Information Boards.
- Smart bookings and travel optimization.
- Digital waste monitoring system.
- Smart transport management and digital education on sustainable travel.

In our opinion, we support the importance of digitization and new technologies and emphasise the need to educate tourists about responsible behaviour. For this reason, we consider digital education about sustainable travel beneficial. The development of online educational materials and applications can provide tourists with information and tools to promote sustainable travel behaviour. Also, a digital ride-sharing platform allows tourists to share transportation and minimize individual travel, reducing the carbon footprint. Implementing intelligent reservation systems and technologies to optimize routes for transport and accommodation can reduce unnecessary travel and increase efficiency. Deploying digital information boards can provide tourists with information about sustainable approaches and practices in a region. On the other hand, digitalization used in monitoring the waste system can ensure the monitoring of waste generation in areas frequented by tourists to improve waste management. The implementation of blockchain technology helps ensure transparency.

We identified several limits in our research. A smaller sample: In the future, we would like to expand the research with more respondents who will help us understand the individual contexts. Time Factor: Long questionnaires or time-consuming surveys can tire respondents and affect their ability to provide accurate answers. Answers from memory: Respondents may have limited memory, and their ability to recall events or experiences accurately may be limited. Fear of anonymity: If respondents are concerned about maintaining their anonymity, this can lead to dishonest answers or even refusal to participate in the survey. External Factors: Unforeseen external events such as political, economic, or social changes can affect the research environment.

Conclusion

In conclusion, our analysis using the Mann-Whitney U Test indicates noteworthy differences in respondents' answers in two categories: TP for attitude 4 and OI for attitudes 1-7 (excluding attitude 3). The rejection of null hypotheses suggests a statistically significant distinction in these aspects. However, no statistically significant differences were found in categories DL (for 1-7), ER (for 1-7), and TP (for 1, 2, 3, 5, 6, and 7), as evident from Table 1 where null hypotheses were not rejected. We used box plots for selected attitudes to enhance the visual representation of results, focusing on characteristics such as interest in new technological procedures and information sources (online platforms). The graphical presentations provided insights into how these factors influence respondents' attitudes. Furthermore, utilizing Principal Component Analysis, we identified key findings regarding the correlation of specific items with principal components, contributing to a better understanding of the variance within the dataset. Finally, the linear regression analysis results highlighted significant correlations between certain motivators, such as "Education and awareness campaigns" and "Innovations in tourism," and attitudes. The coefficients, reaching values of 0.31 and 0.33, respectively, underscore the influence of these motivators on shaping respondents' attitudes. However, it's crucial to note the statistically insignificant result for the last motivator, indicating a lack of correlation between this motivator and attitude in this context.

The answer to research question 1 is: There is a statistically significant interest of the respondent with the chosen attitude. Based on the Mann-Whitney U test, we reject the null hypothesis for the category “interest in new technological procedures” and attitude 4. We reject the null hypothesis for the category "obtaining information from online platforms” and attitudes 1, 2, 4, 5, 6, 7. However, we did not find statistically significant differences in the categories – “digital literacy” (for 1-7), “environmental responsibility” (for 1-7), and “interest in new technological procedures” (for 1, 2, 3, 5, 6 and 7). We did not reject the null hypotheses.

The answer to research question 2 is: There is a mutual connection between the selected motivators and the selected attitude. Based on the result of Linear regression, we reject $H5_0$ and $H6_0$. There is a correlation between the motivator „education and awareness campaigns” and attitude 1. There is a correlation between the motivator „innovations in tourism” and attitude 1. Due to statistically insignificant results for the third motivator, we do not reject $H7_0$. We did not find the correlation.

The answer to research question 3 is: There is a correlation between selected attitudes. We reject $H8_0$. We found more than 3 correlations between motivators.

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