

Article

Potential Integration of Metaverse, Non-Fungible Tokens and Sentiment Analysis in Quantitative Tourism Economic Analysis

Sergej Gričar ^{1,*} , Violeta Šugar ² , Tea Baldigara ³  and Raffaella Folgieri ⁴

¹ Faculty of Business and Management Sciences, University of Novo Mesto, Na Loko 2, 8000 Novo Mesto, Slovenia

² Faculty of Economics and Tourism “Dr. Mijo Mirković”, Juraj Dobrila University of Pula, Zagrebačka 30, 52100 Pula, Croatia; violeta.sugar@unipu.hr

³ Faculty of Tourism and Hospitality Management, University of Rijeka, Primorska 42, 51410 Opatija, Croatia; teab@fthm.hr

⁴ Department of Philosophy, University of Milan, Via Festa del Perdono 7, 20122 Milano, Italy; raffaella.folgieri@unimi.it

* Correspondence: sergej.gricar@gmail.com or sergej.gricar@uni-nm.si

Abstract: With the emergence of the metaverse, countries’ digital efforts to create tourism opportunities have given rise to the possibility of capitalising on digital content which, along with physical tourism experiences, can generate further income and enhance a country’s reputation. Non-fungible tokens (NFTs), a unique application of blockchain technology, offer an enabling technology in several sectors, including tourism. Therefore, this study aims to explore the official tourism websites of Croatia and Slovenia and analyse current NFT applications in tourism economics. The methodology focuses explicitly on sentiment analysis, blockchain and machine learning. The paper introduces various applications currently in place, including Slovenia’s “I Feel Nft” project. The research shows that the main benefits of using NFT and sentiment analysis in the tourism economy are the promotion and presentation of major tourist destinations, exhibitions, works of art, and companies’ products in tokens, digital content and souvenirs. The adoption of sentiment analysis and NFTs in the tourism economy is still open to proposals for implementing public quantitative data metrics. Therefore, the scientific contribution of this research is essential in terms of operational recommendations and defining metrics for measuring the effectiveness of those methodologies and their applications in the tourism economy. On top of that, the practical contribution lies in monitoring the influx of tourists, and highlighting their increase over time and the significance of new technology in time series tourism research.

Keywords: Croatia; tourism demand; Slovenia; tourism economics



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1. Introduction

As the world of tourism continues to evolve, keeping up with the latest trends and technologies is crucial for staying ahead of the competition. That is why the potential integration of non-fungible tokens (NFTs) and sentiment analysis in quantitative tourism economic analysis is worth exploring. By leveraging the power of NFTs and sentiment analysis, businesses in the tourism industry can gain valuable insights into consumer behaviour and preferences which can inform marketing strategies and drive revenue growth. With the right tools and expertise, this innovative approach has the potential to revolutionise the way we think about tourism economics.

This paper has two primary objectives. Firstly, it aims to examine sentiment analysis using Slovenian and Croatian tourism websites as examples. Secondly, it seeks to determine the significance of NFTs in these countries’ tourism industries. Therefore, the study aims to identify the most effective methodology that financial experts of the tourism board should implement to enhance economic performance. Furthermore, our research investigates the

design of tourism demand in the metaverse to identify possible contributions to the tourism business that the use of NFTs could enable. Overall, the study research path is to close the gap between the mentioned innovative approaches in tourism economics and their impact on quantitative bench design to generate exponential exposure and boost tourism demand, even in times of uncertainty.

Indeed, the application of these approaches has not been researched enough, especially jointly. That said, by exploring possible links between the two and their potential application, we can receive insight to answer the research question of how to increase revenue in tourism economics. Investing in digital content for tourism does not guarantee a direct return on investment, but it is generally adopted to improve a nation's reputation and attract more tourists. Consequently, it would be highly desirable if digital investment could also generate revenue. In this context, NFTs are a new technology that can capitalise on digital content and transform it into possible revenue streams for the tourism industry. This study mainly explores the potential applications of NFTs and the metaverse in tourism by analysing current experiences and the state of the art, also considering insight given by sentiment analysis on official tourist websites. Given the innovative nature of the topic and the limited applications of NFTs in tourism, this paper provides a preliminary review of recent projects, suggesting further possible applications and giving a critical view of the achievements of the already-in-place projects.

The article's structure is designed to provide a clear and comprehensive understanding of the research work conducted. The introduction sets the stage by outlining the main objectives and research questions. The literature review critically analyses what is already known in the field and identifies the research gaps this study aims to fill. The article is divided into the following subsections: first, About the Sentiment Analysis; second, About the Non-Fungible Tokens; and last, the Advantages and Disadvantages section. The Material and Methods section thoroughly explains the research design, data collection methods and analytical techniques employed to obtain meaningful results. This section is divided into the Sentiment Analysis and Non-Fungible Tokens subsections. The Results section is also divided and presents the key findings in a structured and comprehensible manner, highlighting the implications of the research work. The first subsection provides the results of the sentiment analysis and the second subsection presents the results for NFTs in Tourism Demand. Finally, the Discussion section summarises the main findings and critically evaluates their significance. The Conclusion section is divided into three subsections and highlights the areas of policy implications, future research directions, scientific contribution, and impact and limitations of the study.

2. Literature Review

The literature ([Ampountolas et al. 2023](#); [Feng et al. 2022](#); [Go and Kang 2023](#); [Lin et al. 2023](#); [Nobanee and Ellili 2023](#); [Monaco and Sacchi 2023](#); [Thapa 2023](#)) seeks merged definitions of quantitative economics, sentiment analysis in tourism, and NFTs in tourism, which is challenging. The compilation of studies below explores diverse aspects of emerging technologies such as the metaverse, NFTs, and blockchain in the context of tourism, innovation management, and economics and information systems. The first considered study ([Ampountolas et al. 2023](#)) examines the metaverse's potential to transform tourism, including demand forecasting, user behaviour, and its impact on the industry. Another study ([Feng et al. 2022](#)) focuses on NFTs as a secure information storage and innovation protection solution. Utilising a scoping review, the authors ([Nobanee and Ellili 2023](#)) outline the influence of NFTs on innovation management and information systems, revealing potential gaps in the existing literature and suggesting future research directions. The final study by [Monaco and Sacchi \(2023\)](#) discusses the metaverse's benefits and challenges in the tourism food and wine sectors, emphasising its potential as a tool for advancing research through virtual collaboration. Overall, these studies contribute valuable insights into the evolving landscape of the considered technologies and their implications across various industries.

In more detail, in response to the increasing importance of understanding the impact of the metaverse on daily interactions, a comprehensive study (Ioannidis and Kontis 2023) investigates the potential transformation of tourism through the metaverse and its underlying technologies. The study analyses a broad array of academic and business sources to identify nineteen ways in which the metaverse could revolutionise tourism economics. These transformations include addressing industry challenges such as trust and security concerns, decision-making confidence, queue management, and risks tourists face during planning and travelling. The study underscores the value of integrating the metaverse into the tourism sector, providing additional marketing channels for companies and destinations and fostering trust with target audiences.

In a parallel exploration, Gricar (2023) delves into the complex process of predicting tourism demand, employing econometric and quantitative time series analysis. The study reviews the existing literature and concludes that virtual tourism, augmented reality, big data and artificial intelligence can potentially enhance demand forecasting in time series econometrics.

Shifting the focus to the innovative realm of NFTs, Behl et al. (2023) contribute a unique study that investigates the potential of NFTs to revolutionise innovation management and information systems. The study identifies theoretical frameworks based on contracts, diversity theory, portfolio theory and likelihood theory. It also highlights gaps in the literature, particularly in under-researched areas like behavioural psychology and social psychology theories, while emphasising the need for appropriate regulations for different types of digital tokens. Additionally, Monaco and Sacchi (2023) contribute a paper focusing on the benefits and challenges of the metaverse, particularly in tourism. This study emphasises the metaverse's potential as a tool for advancing tourism research through virtual collaboration and interdisciplinary projects. It highlights challenges related to social acceptance, affordability, environmental sustainability and managing sensitive data within the metaverse. In summary, these studies collectively provide a rich understanding of the evolving landscape of technology, including sentiment analysis, NFTs, and blockchain, and their potential implications across various industries such as tourism and innovation management. They offer valuable insights and recommendations for future research and practical applications in these rapidly advancing fields, which have emerged since 1980 (Katschnig 2022).

Nevertheless, Jo (2023) conducted an empirical study to investigate the factors that shape users' intention to continue using the metaverse in the context of tourism. The study highlights the importance of perceived usefulness as a driving force behind utilitarian benefits and perceived enjoyment for hedonic benefits. Utilitarian, hedonic and symbolic benefits influence users' continuance intention. The study provides practical insights for researchers and industry professionals to navigate the evolving landscape of virtual experiences in the context of tourism.

2.1. About the Sentiment Analysis

The influence of advertising messages on tourism has been widely recognised in numerous studies (McCabe 2010; Wu et al. 2008; Hamouda 2018). To this extent, the Internet provides valuable information about visitors' moods, interests, and concerns, such as safety, terrorism, and health issues. In a previous study (Folgieri et al. 2021), we expanded our research on models to incorporate sentiment analysis data, enabling us to enhance further the accuracy of our predictions made with other methods mutated from artificial intelligence, such as artificial neural networks (ANN) (Folgieri et al. 2018, 2021; Mamula et al. 2019; Gricar 2023). This approach considers collective trends and factors arising from unexpected events and enables us to gather information from social media to comprehend how to direct an advertising campaign. Recent statistics have indicated that people heavily rely on the Internet to search for information about unknown events, such as the COVID-19 pandemic and travel, rather than printed media. In their work,

MacSween and Canziani (2021) emphasise that tourists (34.4%) utilised online resources to obtain information compared to printed travel magazines or other sources.

We contend that a workbench that provides content managers with predictions (by ANN) and moods (by sentiment analysis tools) would be beneficial in combating misinformation disseminated on the Internet. Content managers should consider sentiment analysis results when devising campaigns to counter messages that fuel social media panic during unexpected events (Dhaoui et al. 2017). This approach is also crucial in fighting the disproportionate impact of media and public sentiment on discontinuing airline services and implementing travel restrictions for visas, entry restrictions, or border controls (Depoux et al. 2020).

Based on the results of prior research conducted by Folgieri et al. (2018), Mamula et al. (2019), and Folgieri and Bait (2014), it has been established that creating effective tourism advertising campaigns that are resistant to the negative influence of misinformation is of the utmost importance. In light of this, a methodology of five phases has been developed to provide content providers with approach suggestions and tools for correctly setting up such campaigns. The initial phase, referred to as “objectives definition” (Maronkova 2018), mandates the identification of the campaign’s objective, platform(s) for disseminating messages and target audience. Second, targeted data collection can be carried out during the subsequent phases by accurately defining the campaign’s aim. Third, identifying the platform(s) aids in determining the appropriate language to utilise, and content providers must consider specific considerations when composing the message. For instance, images and videos are more effective than words, and language and sentence structure must be tailored to the platform. On social media platforms such as Twitter or Facebook, messages should be brief and enticing, while advertisements on websites or in magazines should include coordinated images and extensive information about the location, history, environmental conservation and nature. Quick-response (QR) codes or links to additional resources can be included to enhance user convenience. Fourth, the tone of the message should remain positive and devoid of any indication of recent unexpected events. Interactivity is critical to improving user experience, and this can be achieved by encouraging visitors to leave feedback, join a tourist community, or share photos and experiences, for example, by giving them rewards such as free NFTs, as discussed in the next paragraph. Last, real-time chat can also enhance interactivity, and content providers can automate the process by utilising chatbots to provide users with information and respond to queries based on textual or voice recognition inputs. Intelligent automation can be seamlessly integrated into websites or social media platforms with manual or automatic updating of their knowledge base.

Additionally, machine learning algorithms such as natural language processing can be utilised to develop virtual assistants that offer a more human-like user interaction. Accurate target audience identification is also essential in guiding the platform and language choice. A simple checklist has been provided to facilitate content providers in ensuring that all necessary variables have been considered.

2.2. About the Non-Fungible Tokens

In the preceding section, the discussion revolved around the positive impact that digital platforms can have on a nation’s reputation through the analysis of sentiment and tourism economics. The advent of virtual reality and the metaverse has made virtual tourism a crucial aspect of the tourism industry. The global pandemic has further accentuated the significance of countries’ digital efforts to create tourism opportunities (Akhtar et al. 2021). However, the decrease in tourist numbers and financial returns in the tourism sector due to recent shocks can only be partially compensated by the revenue generated from digital content and its production expenses. The returns on such investments are indirect, primarily manifesting in the form of an improved image of the country, resulting in a higher influx of tourists and revenue. It would be highly desirable if the investments made in the digital era could generate income. Recent technological advancements have opened up new avenues, such as applying blockchains through NFTs,

which offer unique opportunities in different sectors including tourism. The present study explores the possible applications of NFTs in tourism by analysing existing experiences. As the topic is innovative and there are few NFT experiences in the tourism industry, this paper represents an initial review of ongoing projects that employ NFTs. The applied methodology primarily comprises qualitative analysis and discussions concerning the potential evolution of this technology in the tourism industry.

NFTs are digital signatures based on blockchain technology that are used to authenticate unique digital assets. The term “fungible” refers to the property of being replaceable by an identical item that is mutually interchangeable, like most objects we encounter daily, such as money or a pen. However, when an item is unique, it becomes non-fungible. For example, a room with a breathtaking view at a specific time of year is non-fungible because another room, time or view cannot replace it. An NFT represents a unique digital asset whose authenticity and ownership are certified by the blockchain. It can be linked to an investment in the real world or represent a digital asset. An NFT can be transferred, sold, or borrowed like a real-world asset. To create an NFT, a digital file is converted into a digital asset that is stored on the blockchain, and the resulting commodity can be placed on the market, bought, sold, or resold. Blockchain technology enables the verification of an NFT’s state and the tracking of all trading activity among users. To participate in the NFT market, users need a digital wallet such as Coinbase or Metamask that supports the cryptocurrencies used in NFT marketplaces. Opensea is the most well-known marketplace, but there are also marketplaces dedicated to specific sectors, such as music. At the same time, the Ethereum blockchain is the most commonly used; other options exist, such as Binance (BNB currency), Solana (Sol currency), and non-crypto alternatives like Coinbase. An initial fee is usually required to place an NFT on a marketplace, which varies based on the cryptocurrency market’s fluctuation, also known as gas. However, gas-free alternatives such as the Polygon Network (MATIC currency) exist. Opensea, the leading NFT marketplace, allows users to sell their assets in multiple currencies. Once on the market, the NFT can be sold at a fixed price or auctioned. To increase the value of an NFT, it is usually produced in limited editions, making it particularly attractive to collectors and suitable for auctions.

NFTs have experienced a significant popularity surge, particularly in digital art. Their association with virtual art objects and the “virtualisation” of tangible art pieces has made them a valuable tool in cultural tourism (Trček 2022). Notably, museums and cultural heritage institutions have already incorporated NFTs to generate income by trading these digital assets. One of the advantages of NFTs is their ability to provide certainty regarding authorship, authenticity, royalties and duration, thanks to the implementation of blockchain technology. For artists and work owners, NFTs present a unique opportunity to increase revenue.

Additionally, museums, galleries and events can create NFTs based on digital reproductions of performances that cannot typically be monetised. This technology is also widely used in the music sector, allowing musicians and composers to reach potential audiences directly and create a fanbase that can benefit from supporting their favourite artists while monetising their collections of works that may gain fame over time. The financial transactions associated with NFTs are significant, as evidenced by the Opensea marketplace’s rise from 1.3 million in July 2021 to more than 13 billion in January 2022 alone. The total market cap for NFTs is currently estimated at around USD 31.4 billion, accounting for 1.53% of the total market cap for cryptocurrency, currently at USD 2.05 trillion. From a financial perspective, NFTs are attractive to investors across all industries (Folgieri et al. 2022).

NFTs are being increasingly used beyond digital art. They have the potential to revolutionise the tourism industry by offering secure and innovative ways to purchase tickets for events, attractions, travel and hotels. Decentralised networks made for the Internet of Things (IoTeX) are open-source platforms that combine Internet of Things (IoT) and blockchain and are some of the early adopters of NFTs in tourism. They allow NFTs to

be mined as “travel evidence,” enabling users to digitally sign data such as the location, weather and other collectible evidence of a location’s visit. IoTEx has also collaborated with a blockchain-based travel agency to register tourist trips through blockchain, associating them with “proof of travel” NFTs. This initiative could lead to other applications, like collecting NFT badges by completing specific itineraries within an area, turning a holiday into a cultural adventure (Alzoubi et al. 2022). Using NFTs in tourism is advantageous because blockchain technology ensures security. For example, Slovenia has issued NFTs through the “I Feel NFT” project to promote tourism. These NFTs include 15,000 unique digital 3D icons, exclusive panoramas and 360 high-resolution photographs, all digitised and secured by blockchain. The NFT cards provide access to several complete services in the country, such as events, museums and attractions. Slovenia also plans to establish NFT certificates for tour operator training courses, certifying them as “Slovenia Experts”.

Mantas et al. (2022) have proposed a model for NFTs as digital gifts, where visitors can create personalised e-souvenirs consisting of a collage of selfies and photos. In this case, creating an NFT would provide digital ownership of the postcard. Ngo (2022) has demonstrated how the Vietnamese Ministry of Culture, Sports and Tourism facilitates the integration of NFTs into tourism activities. The author collected data on tourism-related initiatives on Phu Quoc Island, using the Delphi technique to evaluate the outcome. The findings indicate a strong interest in introducing NFTs for booking and luggage checking, while travel agencies would integrate the technology in automatic commissions for all the travel intermediaries involved in the tourism procedure. Mofokeng and Fatima (2018) proposed using NFTs to aid wildlife conservation in South Africa. The authors suggested that NFTs could be used to create digital collectable assets to finance wildlife conservation and generate new opportunities in tourism.

In conclusion, blockchain and NFTs can be used to raise funds and attract visitors to cultural heritage sites that may not be adequately protected or funded. A decentralised system can transparently transfer revenues to foundations responsible for preserving and maintaining cultural heritage.

2.3. Advantages and Disadvantages of Sentiment Analysis and Costs of NFTs in Tourism

New technologies in tourism have both positive and negative implications, which have been critically analysed in recent studies. For example, Ma et al. (2018) thoroughly review sentiment analysis, including its origin, development and application in the hospitality sector. Through a sample case demonstration on TripAdvisor review data using Leximancer, the authors offer a step-by-step guide for researchers and students to learn these techniques and contribute to a broader understanding of their use in hospitality. Similarly, Alaei et al. (2019) highlight the transformative impact of technological advancements on tourism information dynamics, emphasising the crucial role of sentiment analysis in managing the vast amount of data generated through social media in the context of Big Data in tourism. Xiang et al. (2017) employ text analytics to examine three major platforms, TripAdvisor, Expedia and Yelp, to address a critical gap in existing research on online consumer reviews within hospitality and tourism. By focusing on the entire hotel population in Manhattan, New York City, the study reveals significant discrepancies in the representation of the hotel industry across these platforms, including variations in linguistic characteristics, semantic features, sentiment, rating and usefulness. A survey paper by Gandhi et al. (2023) delves into the burgeoning field of sentiment analysis in artificial intelligence and natural language processing, specifically focusing on the evolving landscape of multimodal sentiment analysis. The authors recognise the shift towards opinions shared online through diverse modalities, including videos, and explore the latest advancements in machine learning and deep learning within multimodal sentiment analysis. The paper authored by Chang et al. (2023) presents a heuristic model for conducting sentiment analysis on luxury hotel reviews, which makes a significant contribution to the field of visual and multimedia analytics by utilising a range of analytical techniques, including information analytics, geospatial analytics, statistical analytics and data management. The research is

grounded in practical applications of visual and multimedia analytics and seeks to address the challenges posed by large-scale, high-dimensional, and geospatial data generated by hotel customers on the Internet. In a related study, [Shakhovska et al. \(2020\)](#) investigated the growing trend of customer communication shifting from live interactions to virtual platforms such as calls, video calls, chats and emails. The authors argue that there are notable advantages in analysing services provided through user participation, such as surveys and feedback, and non-participation, such as chat correspondence analysis.

Tourism sentiment analysis provides many advantages for tourism stakeholders, enabling them to discern public perceptions, preferences and satisfaction levels by scrutinising sentiments articulated in online reviews and social media. Identifying positive sentiments can be leveraged for marketing and promotion, while negative sentiments can prompt timely interventions and service improvements. Moreover, sentiment analysis facilitates the comprehension of emerging trends, allowing the tourism industry to adapt strategies to meet evolving consumer expectations. Nevertheless, challenges abound, including the need for sophisticated algorithms to accurately interpret nuanced sentiments, potential biases in the data and the dynamic nature of online discourse, which necessitates continuous monitoring and adjustment of analytical models.

NFTs in tourism offer notable advantages and challenges. NFTs offer tourists exclusive and verifiable collectables, providing a novel way to create unique digital assets and experiences, enhancing the overall tourism experience, creating new revenue streams and promoting sustainable practices, such as NFTs linked to environmental initiatives. However, challenges such as the environmental impact of blockchain technology associated with NFTs, issues of inclusivity and accessibility and the need for widespread adoption and awareness among tourists and businesses must be addressed. Additionally, the speculative nature of NFT markets may introduce volatility and uncertainties that can impact their long-term viability as a tourism asset. Therefore, carefully considering these factors is essential for integrating NFTs into the tourism industry.

[Ioannidis and Kontis \(2023\)](#) conducted an extensive literature review to identify nineteen potential ways that metaverse technologies can revolutionise the tourism industry, offering solutions to longstanding issues and providing valuable insights for academia and industry stakeholders. The study highlights the transformative impact of the metaverse on tourism. Conversely, there is a paucity of relevant research on the subject of NFTs in tourism, and the chapter by [Onder and Treiblmaier \(2023\)](#) is, therefore, most critical for identifying the advantages and disadvantages of NFTs in tourism. In response to the profound economic impact of the COVID-19 pandemic on the tourism industry, this study delves into potential revitalisation through technology, specifically exploring the adoption of NFTs and tokenisation of tourism assets. By providing an overview of tokenisation and its potential benefits, the study introduces three theoretical perspectives to rigorously investigate the phenomenon in the tourism sector while acknowledging challenges such as regulatory uncertainties and security risks.

3. Materials and Methods

Tourism is a crucial industry for many countries, and Slovenia and Croatia are no exception. Nestled in central and southeastern Europe, Slovenia and Croatia share a border and abundant cultural and natural treasures (Figure 1). Slovenia's topography ranges from the Alpine region in the north to the scenic coastline of the Adriatic Sea in the southwest, with Ljubljana and Lake Bled among its many tourist hotspots. The country is renowned for its commitment to sustainable and nature-based tourism, focusing on preserving its pristine landscapes. Meanwhile, Croatia lies south of Slovenia, showcasing a spectacular Adriatic Sea coastline and a wealth of historic cities, such as Dubrovnik, Pula and Split. The country offers a delightful blend of cultural and sun-and-sea tourism, with Dubrovnik's medieval architecture and the charming Dalmatian islands attracting visitors in droves. Although each country has a unique appeal, they contribute significantly to the region's diverse tourism landscape, drawing in travellers with their rich cultural heritage and

brehtaking natural beauty. The varying magnitudes of their economic contributions to the national gross domestic products are noteworthy, ranging from a modest 5% in Slovenia to a substantial 20% in Croatia (Gricar et al. 2021).



Figure 1. Map of Slovenia and Croatia in central and southeastern Europe. Source: <https://mundomapa.com/en/map-of-europe/> (accessed on 15 December 2023).

3.1. Sentiment Analysis

The methodology used in this study for sentiment analysis involves applying natural language processing techniques to examine a varied set of textual information. By extracting sentiment-related features and using machine learning algorithms, sentiments are classified into predefined categories, comprehensively comprehending the emotional tone conveyed in the text.

Using user logs, developers can teach a chatbot manually or automatically. However, a more efficient approach is to use machine learning artificial intelligence algorithms, such as natural language processing algorithms, to train the chatbot. Although setting up a virtual assistant with such algorithms requires more initial investment, it is more cost-effective in the long run than a call centre. Additionally, the chatbot can be used in various contexts and campaigns by simply adapting the knowledge base domain. Data collection can be done by accessing statistics related to the period under consideration. To extract the main topics from web pages, a consideration pool was designed to perform concept extraction. The algorithms first examine the titles and then, based on the occurrence of the most cited words, the amount of text around each concept. Then, the natural language processing process evaluates the sentiment of the text against the extracted images. Pictures can also contain usernames and hashtags.

The process of concept extraction was conducted in two distinct steps. Firstly, automatic detection of concepts was carried out and explained in detail. Secondly, a sentiment evaluation was performed, incorporating user-defined concepts for scoring. The scoring values ranged from -10 to $+10$, with a neutral score around 0 . The concepts automatically extracted for Croatia included Croatia, Hrvatska, nature, VisitCroatia and #croatiafulloflife.

On the other hand, for Slovenia, the concepts were Slovenia, Fonda Fish, #myway, Instagram, Discover Slovenia and Tourism Council. Additionally, #feelsLOVEnia and @FeelSlovenia were added to the previous concepts to evaluate the sentiment further. The final step of the sentiment analysis algorithm involved extracting topics.

During the pandemic, sentiment analysis became famous for obtaining accurate and up-to-date information on tourist trends. In particular, social media content has become increasingly crucial for identifying emerging patterns. By analysing emotions expressed in texts, reviews and ratings, sentiment analysis has enabled researchers to extract valuable insights (Barbosa et al. 2015) For example, data from TripAdvisor have been collected and classified as positive or negative to reveal underlying moods and trends. Similarly,

Twitter data have been analysed to measure customers' perceptions of their hospitality experiences, while Facebook comments have been scrutinised to better understand users' opinions on the hospitality industry (Philander and Zhong 2016). A comparison between machine learning and lexicon-based methods for sentiment analysis has shown that both approaches yield comparable results, with sentiment analysis proving to be a relatively straightforward and user-friendly method. Nonetheless, combining sentiment analysis with other techniques is essential to obtain a more comprehensive view of the data.

To collect data, statistical information about the relevant time period must be accessed and fed into ANNs. The choice of platform(s) employed in the previous phase should guide the selection of sources for sentiment analysis, which may include magazines, websites and social media. Once the data have been collected and the sources for sentiment analysis have been identified, content providers are advised to proceed with the analysis phase. This involves utilising ANNs and sentiment analysis tools to gain insights into the general mood of the target audience. We recommend using a generic backpropagation ANN and any available sentiment analysis tool. However, our future goal is to design and develop more specialised tools as part of our methodology.

When analysing content in preparation for an advertising campaign, it is important to consider all factors that impact user experience and interaction, such as media, interactivity and language. We recommend using a checklist designed to ensure that all relevant information is considered and incorporated into the campaign. However, content providers should be aware of the potential for subjective bias due to the human aspect of the process. Therefore, we suggest another step of testing the message with a panel of users representing the target audience. This can be aided by sentiment analysis tools to measure the message's positivity. We recommend conducting cognitive tests during the testing phase to gauge emotional engagement. These tests should be tailored to the current campaign and can be administered through online questionnaires. Participants should be presented with images and keywords to guide the test and asked questions about the message's content and emotional impact. Our multifaceted approach incorporates econometric analysis of statistical data using ANNs and sociological and linguistic analysis through sentiment analysis on social media and other sources. Additionally, we integrate human insight from the user panel. Thanks to information communication technology (ICT) and machine learning (artificial intelligence, AI) tools, our approach is technology-driven in every aspect.

At this research stage, we have designed the framework and a prototype of the sentiment analysis tool. Intending to test the model, we applied the guidelines and the prototype to the official guide to Slovenia (<https://www.slovenia.info/en>, accessed on 15 December 2023) and the Official website of the Croatian National Tourist Board (<https://croatia.hr/en-gb>, accessed on 15 December 2023). We defined the objectives we wanted to achieve. Considering certain events' impact on tourism, we aimed to counteract their effect. We tested the website to verify whether the advertising messages were optimistic enough to attract visitors. We developed a checklist to confirm that the website was balanced in light of the message and the target audience. The checklist comprises the following criteria:

- Presence of images on all web pages of the website;
- Presence of videos on the website;
- Texts that are appealing and positive;
- Information that is clear and easily accessible;
- A well-organised website;
- A multilingual website;
- An interactive website that allows comments or photo sharing or provides a community;
- An interactive virtual assistant aimed at enhancing the users' experience;
- A website designed to cater to different types of tourists based on their age range and travel preferences.

3.2. Non-Fungible Tokens

The methodology employed in this study entails a comprehensive analysis of blockchain technology, with a particular focus on smart contracts, to develop distinctive digital assets and experiences. Additionally, this investigation evaluates the integration of these assets into the tourism industry while delving into the associated technological, economic and environmental ramifications.

Based on the analysis of success stories and feedback from online sources about NFTs and blockchain, a set of guidelines has been developed to implement a strategic approach linked to these digital assets. First and foremost, it is imperative to remember that NFTs should be linked to unique digital or non-digital objects. Thus, defining a distinguishing characteristic that renders each NFT non-replicable is necessary. The key features that must be considered while creating an NFT include uniqueness, non-replicability, collectability and the possibility of transferring ownership. Simplicity in the acquisition mechanism is critical in ensuring that visitors with limited digital skills can easily enjoy an NFT. Hence, simplifying the acquisition process can significantly enhance the visitor experience, promote the usage of NFTs in the future and foster the development of digital skills.

User experience (UX) surveys are both highly effective and easy to implement when gauging the effectiveness of a product, service or brand. Several methods are commonly used, including the Net Promoter Score (NPS), sentiment analysis, and rating and ranking variations. The Net Promoter Score measures the ratio of promoters to detractors and ranges from -100 to $+100$. Sentiment analysis helps to identify the positive and negative sentiments associated with a product or service. Lastly, keeping tabs on the ratings and ranking of competitors is also essential, particularly when it comes to innovative campaigns such as NFT-based ones. It is also necessary to conduct a comprehensive evaluation from a quantitative standpoint, tracking the increase in visitors and the growth of tourism economics. By adopting these evaluation criteria, it is possible to better understand how well a product or service is performing and pinpoint areas for improvement.

4. Results

This segment presents the findings of a research question aimed at determining how to boost revenue in tourism economics by using two innovative methods and applications. The analysis focused on two central European nations, examining their worth and potential through sentiment analysis and NFTs. Slovenia is a trailblazer in introducing NFTs to the global tourism market.

Sentiment analysis has been conducted on both nations, revealing a significant opportunity for expanding tourism in the Balkan Peninsula. This presents a promising avenue for growth in the region's tourism industry, particularly concerning attracting more visitors from around the world.

4.1. Results of the Sentiment Analysis

The sentiment analysis tool performed concept extraction in two steps. The first step was to detect concepts as described automatically. The second step was to evaluate the resulting sentiment. The evaluation score ranges from -10 to $+10$, where a result around 0 is considered neutral. The figures below illustrate the detected concepts and related topics, along with their corresponding sentiment evaluation, for the Croatian and Slovenian tourist board websites. Figure 2 shows the concepts seen for the Croatian website, while Figure 3 shows those detected for the Slovenian website.

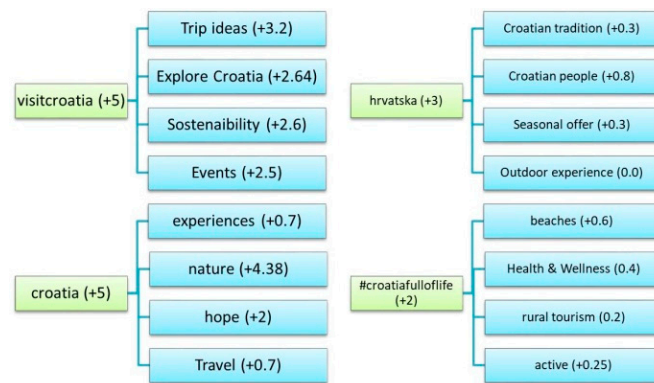


Figure 2. Sentiment evaluation for Croatian tourist board website. Source: Gricar et al. (2021); Authors compilation. Note. Hrvatska—Croatia.

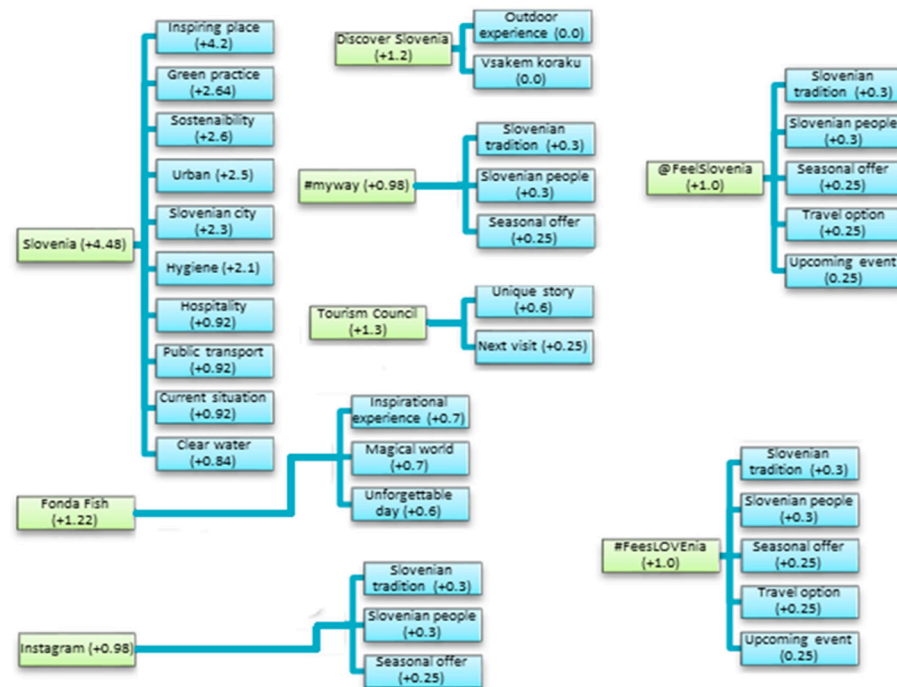


Figure 3. Sentiment evaluation for Slovenian tourist board website. Source: Folgieri et al. (2021); Authors' compilation.

The sentiment analysis tool is a metaverse-powered tool that uses natural language processing techniques to analyse text and determine its emotional tone. It performs concept extraction in two steps. In the first step, it automatically detects the concepts present in the text. These concepts can be anything from names of people, places or things to abstract ideas or themes. In the second step, the tool evaluates the sentiment of the text. The sentiment score ranges from -10 to $+10$, where a score of 0 is considered neutral. A score below 0 indicates negative sentiment, while one above 0 indicates positive sentiment. The sentiment analysis tool can analyse any text, including social media posts, customer reviews and news articles. Figures 2 and 3 illustrate the detected concepts and related topics and their corresponding sentiment evaluation for the Croatian and Slovenian tourist board websites. The sentiment analysis tool is valuable for businesses and organisations seeking insight into their customers' or audiences' perceptions of their products, services or brands. By leveraging this tool, they can optimise their revenue streams, as price is the only element in the marketing mix that generates profit, while all other components incur costs.

Based on the analysis presented in Figure 2, the sentiment expressed towards tourism in Croatia seems fairly neutral. While this is not necessarily bad, it suggests room for improvement in promoting the country as a tourist destination.

Some positive emotions associated with specific terms could be leveraged to create a more compelling message. For example, the terms “nature”, “hope”, “events”, “sustainability”, “trip ideas” and “explore” all appear to evoke positive feelings. Therefore, incorporating these themes into promotional materials could help to create a more well-rounded message that resonates with potential visitors. Overall, Croatia has the potential to become a popular tourist destination. By analysing the sentiment expressed in online conversations and incorporating these findings into marketing strategies, it is possible to create a more compelling message that encourages more people to visit the country of Croatia.

We developed a natural language processing prototype for sentiment analysis on Slovenian website content. Our analysis shows a generally upbeat tone with room for improvement, especially in light of event issues. Using our prototype tool, we extracted concepts to detect main topics from the website’s pages. We ran the concept extraction in two steps; first, we automatically noticed concepts and evaluated the sentiment. Our sentiment analysis algorithm also extracted topics showing positive or negative patterns. In addition to language selection, it is also essential to consider the design and layout of the website. A cluttered or confusing Slovenian tourist board website can lead to frustration and a negative emotional response from visitors.

On the other hand, a well-designed website with straightforward navigation and visually appealing graphics can create a positive emotional response and encourage visitors to explore further. Furthermore, it is essential to remember that emotions play a significant role in decision making. By creating a positive emotional connection with visitors, tourism websites can increase the likelihood of visitors travelling to a particular destination. This can be achieved through storytelling, as shown in an example in Appendix A, highlighting unique experiences and showcasing the destination’s natural beauty and cultural richness.

The findings suggest that tourism websites should prioritise language, design and emotional appeal to create a positive and memorable experience for visitors. By doing so, tourism websites can attract more visitors and make a lasting impression that encourages visitors to return and recommend the destination to others. Based on the checklist presented in the Method section, the website was replete with images, without any video, comprised appealing texts and clear and easy access to information, well-organised, multilingual, with low interactivity (it only allows designing a trip and putting places in a favourite list), without a chatbot but providing traditional contacts and targeted to several types of visitors per age range and typology.

In addition to the initial impression of a destination, several other factors can influence revenue and income in the tourism industry. These include seasonality, accessibility, local events and marketing strategies. Considering all these factors, decision makers can make informed decisions that lead to higher revenue and income. Moreover, it is crucial to understand the basic equation that determines the highest income in the tourism industry. This equation,

$$TR = P \cdot Q, \quad (1)$$

takes into account the price (P) of a particular service or product, the quantity (Q) sold and the total revenue (TR) earned. Tourism businesses can maximise their income and revenue by finding the optimal balance between these factors.

Finally, with the rise of blockchain technology, NFTs have emerged as a potential tool for the tourism industry. NFTs can be used to create unique digital assets that can be traded and sold, potentially opening up new revenue streams for tourism businesses. However, before implementing NFTs, it is essential to evaluate the current state of the destination website and ensure that it is optimised for maximum revenue and income.

4.2. Results for the NFTs in Tourism Demand

NFTs can potentially be a valuable tool for enhancing visitor engagement in the tourism sector. They offer a unique and collectable digital souvenir for travellers to commemorate their experiences and share them with others. This can bridge the gap between physical and digital visitors and provide hospitality entrepreneurs and artists with an innovative way to promote their offerings. From the exhibitors' perspective, NFTs can be used to track trips, providing valuable data for statistical and econometric purposes. Additionally, NFTs can be used as a loyalty card, allowing travellers to earn rewards and discounts on flights and stays in tourist facilities. The traceability of NFTs also makes it possible to create a reliable secondary market for these rewards, benefiting companies and consumers. In this review, we have explored the potential application of NFTs in tourism.

The Slovenian Tourist Board has launched an innovative project called 'I Feel NFT', showcasing 15,000 unique digital 3D icons and 360-degree photographs. These NFT cards are secured by blockchain technology, ensuring their authenticity and uniqueness. These NFT cards are even more remarkable because they offer exclusive access to Slovenia's top-tier events, museums and attractions without additional costs or evaluations. This means that holders of these NFT cards can enjoy a range of experiences that are not available to the general public. The 'I Feel NFT' project is an excellent example of how blockchain technology can be used to create new and exciting opportunities for tourism. It provides a visual collection of digital assets and offers for visitors to Slovenia.

5. Discussion

A recent case study (Folgiери et al. 2022) highlighted the potential economic impact of NFTs in tourism, showing how they can generate significant revenue and interest. The study recommends that to assess the success of such initiatives entirely, it is crucial to gather quantitative data on visitor number turnover and conduct a sentiment analysis. Additionally, it suggests evaluating key performance indicators such as Net Promoter Score and rating and ranking. Unfortunately, the evaluation of these key performance indicators was not feasible in the reported case due to undisclosed data. This underscores the importance of making NFT-related transactions easily accessible to everyone, regardless of their digital literacy level. Doing so can help ensure that NFTs can become a viable and sustainable source of revenue for the tourism industry. The present study examines the salient features of NFTs as observed in the 'I Feel NFT' initiative in Slovenia. The analysis delves into their collectability, potential for transfer of ownership and ease of procurement, utilisation and accessibility.

The sentiment analysis conducted on the Croatian and Slovenian tourist board websites has revealed that visitors are attracted to terms such as "nature", "sustainability" and "explore", indicating a great interest in the topic of sustainability. However, the sentiment analysis tools used in the present and previous works have shown that the content on these websites needs improvement to elicit more positive sentiments in visitors. The analysis revealed that the website had not received much attention from visitors, as there were no mentions of the website on blogs, microblogs or bookmarks. The most frequently used words were "national", "Slovenia" and "park".

To enhance the positivity of website content, content providers should review their material in light of previously established steps. The final stage involves repeating the tasks previously mentioned, filling out the checklist once more, requesting feedback from a panel of users and reevaluating sentiment analysis to gauge whether the website's overall sentiment has improved. The language utilised and emotions evoked in tourism advertising significantly impact the attraction of visitors, particularly during international events that create concerns in the population. Our approach, which operates a multimodal model supported by machine learning and sentiment analysis tools, has effectively captured the mood and trend of prospective visitors, enabling the redirection of tourist flows towards different destinations and broader timeframes. Our proposal represents a novel attempt to design a systematic approach to advertising campaigns in the tourism industry, blending

the creative and scientific aspects of the process. This work is founded on our research path and question, allowing us to pinpoint the appropriate tools, guidelines and tests to guide content providers in this process and achieve the research's objective.

The potential of NFTs in tourism has been thoroughly examined, exploring various applications currently used by travel agencies, airlines and cruise companies, and a case study from the Economic Development Ministry of Slovenia's "I Feel Nft" project. Possible implications and future developments of these initiatives have also been considered, along with the design of potential guidelines and metrics for measuring their success. While the paper lacks a quantitative analysis of the presented case studies due to the absence of publicly released data, there is still significant interest in NFTs within the hospitality industry and tourism. However, their limited usage can partially be attributed to a lack of technological awareness and the potential pitfalls of minting and selling NFTs. Despite criticisms regarding the environmental impact of the minting process, NFTs remain an attractive opportunity for the tourism economy due to their uniqueness and the trust guaranteed by the blockchain. While they are not yet mainstream, further investigation into their potential is warranted and this work offers important operational proposals, guidelines and metrics for measuring the effectiveness of NFTs in the tourism economy.

6. Conclusions

This study offers valuable insights into sentiment analysis on tourism-related websites in Croatia and Slovenia. It reveals that visitors are strongly attracted to sustainability-related terms while identifying a need for content improvement to elicit more positive sentiments. The proposed multimodal approach effectively captures prospective visitors' moods and trends by integrating machine learning and sentiment analysis. The theoretical framework and guidelines set the foundation for further model development, including specifically designed tools, apps and a virtual assistant tailored to tourism needs.

The study answers the research question, revealing new avenues for generating higher revenues by implementing innovative technologies and enhancing the attractiveness and informativeness of websites. Additionally, producing NFTs can be utilised to engage customers in a differentiated and segmented manner, which can drive higher demand for tourism.

6.1. Policy Implications and Future Research Directions

For policymakers and content providers in the tourism sector, the findings suggest a need for a strategic review of website content to enhance positivity and align with the preferences revealed by sentiment analysis. The proposed multimodal model provides a systematic advertising campaign approach, integrating creative and scientific elements. Policymakers should consider supporting the development of tools and apps from machine learning and facilitating the implementation of the proposed framework. Moreover, the virtual assistant concept, tailored to tourism, holds promise in efficiently guiding visitors during unforeseen events and resource constraints. The model also aids in selecting pertinent topics from the web and social networks, shaping Q&A indications for effective virtual assistants.

This study provides comprehensive insights into sentiment analysis and the potential of NFTs in tourism for Croatia and Slovenia. The study recommends extending the findings to other countries so that policymakers and tourism content providers in various regions could strategically review their website content to align it with visitors' sentiments, emphasising sustainability-related terms. The study proposes a multimodal approach integrating machine learning and sentiment analysis, a versatile model applicable across different cultural contexts. Policymakers globally should support the development of tools, apps and virtual assistants tailored to tourism needs, enhancing communication efficiency during unexpected events.

Future research should focus on empirically validating and refining the proposed multimodal model in diverse tourism contexts. Quantitative analyses of case studies

would enhance the study's robustness. Further exploration into the potential of NFTs in the tourism economy is warranted, addressing barriers to technological awareness and environmental considerations. Research could explore expanding the toolkit, incorporating additional technological advancements and refining operational proposals. Further investigation into economics can explain the costs of NFTs for tourism companies.

6.2. Scientific Contribution and Impact

This research makes a valuable scientific contribution through its operational proposals and metrics for evaluating the effectiveness of methodologies used in the tourism economy. It also provides practical insights by tracking tourist influx, highlighting its potential new growth over time and emphasising the importance of technology in tourism research. As the tourism industry constantly evolves, ongoing research must ensure that the model remains adaptable in dynamic and unpredictable environments. Qualitative case studies and quantitative time series measurements can enhance the strength of findings, addressing technological and environmental barriers specific to each country's context.

This study bridges the creative and scientific aspects of the tourism economy, presenting a multimodal step that offers a nuanced understanding of visitor sentiments and trends. This step can facilitate a systematic approach to new campaigns, and the proposed virtual assistant and toolkit provide practical tools for tourism stakeholders to navigate challenges and seize opportunities. Additionally, exploring the use of NFTs in tourism adds a futuristic dimension, offering valuable insights and operational proposals. However, while NFTs can bring innovation and positive effects, they also pose environmental concerns that require careful consideration and mitigation strategies in their implementation. Overall, this comprehensive analysis enriches the scientific discourse on the interplay of economics and technology in shaping the tourism landscape. It contributes to a holistic understanding of the potential benefits and challenges of sentiment analysis and NFTs in the tourism industry alongside econometrics and time series.

6.3. Limitations of the Study

Several limitations to this study should be taken into consideration. Firstly, the findings are based on sentiment analysis of tourism-related websites in specific regions (Croatia and Slovenia). As such, the generalisability of results to a broader global context may be constrained by regional variations in online content and user behaviour. Additionally, the study primarily focuses on website sentiments, which may not fully capture the nuanced and dynamic nature of tourist perceptions and experiences. While machine learning and sentiment analysis provide valuable insights, their effectiveness relies on the quality and quantity of available data, and variations in data quality could impact the accuracy of the analysis.

Furthermore, the study acknowledges the potential pitfalls associated with NFTs, including environmental concerns and limited technological awareness. However, a comprehensive exploration of these challenges and possible mitigations is beyond the scope of this study.

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Appendix A

Somewhere in the past lived a boy, Emanuel. He was a clever boy and had several superpowers. One of them was flying, and people around him were surprised. Emanuel walked around without any stress and would fly when he needed to. He would fly, then soar like a bird, smooth but fast. But Emanuel would only use his superpowers to help others. Nevertheless, many people tried to steal them. It happened at least several times in one year, about 2019 times, to be exact. That year, many locals in the town where Emanuel lived did not trust this superpower anymore. The vast majority of them were afraid of it. The city council wanted to steal this superpower. They prepared the town exhibition, and people walked around the city square shouting, steal it! Steal it! The superpower is dangerous! Emanuel was afraid of older people; he was not a bad boy. On that occasion, he left the city. On the way to another town, gangsters took his superpower and used it for robberies in the city where the boy lived.

After this, the boy was sad and without energy. Like many things, he was not alone. A supergirl lived in the city 2023 miles away. They met, and the girl promised to help him. This was the beginning of their plan. After a year and a half, Emanuel got his superpower back. This was a celebration day for the city for the next 1000 years, whilst robberies were finally stopped, and the new tourism economy, e.g., freelancers using sentiment analysis and NFTs, was established.

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