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The Relationship between the Number of Cryptocurrency Acceptance Sites and the Intensity of Tourism in Terms of Legal Regulation

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Abstract: *The research delves into the nexus between cryptocurrencies and tourist activity, with a special focus on the facet of legal regulations. The study's objective is to fathom how cryptocurrencies influence the tourism sector, and how legal standards bear on transactions involving cryptocurrencies within the tourism industry.*

The principal aim is to unravel the interconnection between the employment of cryptocurrencies in tourist services and its concurrent legal governance in four handpicked countries: Spain, France, Croatia, and the Netherlands.

Clustering was achieved through SOM and PCA methodologies, which, in unison, proffer profound insights into the data's architecture and interconnectedness. The data was collected through scraping with an API key. The research underscores that blockchain technologies, including but not limited to Ethereum's advancements that extend beyond just Bitcoin, are steadily gaining a more influential role in tourism. Moreover, legal guidelines, especially within the EU, wield significant influence over transactions and operations associated with these digital assets.

1. INTRODUCTION

Since Önder et al. (2017) stated that *„most academic communities have been slow in picking up the blockchain and investigating its potential implications"*, the topic has grown and it is the focus of tourism research. The tourism industry is a dominant sector in worldwide economic development.

While the technological environment has had a significant impact on both the supply and demand sides of the touristic system, the recent digital revolution has fundamentally transformed the way the tourism sector operates (Rátz, 2023) while the sector's digital transformation is now an ongoing process, enhanced by a set of disruptive innovations that changed the industrial panorama and are starting to be transferred into the tourism sector (Rodrigues et al., 2023, p. 1).

The COVID-19 epidemic generated huge changes in this sector and broke the trends discussed by Nam et al. (2021). According to Önder and Gunter (2022), this period of our history made contactless payments particularly important and that has driven also cashless economies. Not only hygiene but also quick and secure solutions, and sustainability became prior. The possibility to use the internet and electronic devices adds to the improvement of tourism significantly. It ensures that visitors (tourists) can look for and create their trips by themselves (Erceg et al.,

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2020), meanwhile, real-time information makes decisions easier and adds not only to planned, but also to impulse spending of tourists.

Technologies like Blockchain belong also to the newest digital solutions for spending money through their device. Erceg et al. (2020) mentioned "app-capitalism" has a strong effect on financial decisions as well. The cryptocurrency, mostly Bitcoin has triggered a lot of media attention and so put blockchain technology in focus of interest of various industries. As tourism is a dynamically developed industry where modern technological solutions add extremely to competitiveness, the touristic sector started to adopt possibilities ensured by Blockchain technology first.

Thanks to this technology the creation of decentralized currencies (like Bitcoin) can be created and security is ensured by digital contracts, which are called smart contracts. According to the definition by the Court of Justice of the European Union (2015), *"Bitcoin is a virtual currency used for payments between private individuals over the Internet and in certain online shops that accept it; users can purchase and sell the currency on the basis of an exchange rate."* In Judgment in Case C-264/14 the Court stated, that *"The exchange of traditional currencies for units of the 'bitcoin' virtual currency is exempt from VAT"*. That decision ensures an important legal background on the tourism market and helps travellers to buy more and higher levels of services. Furthermore, it minimizes the need for a central authority, banks, or other third parties (Valeri & Baggio, 2021), like online travel agents (Önder & Treiblmaier, 2018).

Our research focuses on **France, Spain, the Netherlands, and Croatia**. The delimitation was made on the following basis: France and Spain as classic tourist destinations and Croatia as one of the most dynamically developing countries, are typical tourist destinations. The Netherlands has strong tourism as well but with other characteristics. The Netherlands is rather a sending country where domestic tourism also plays an important role.

2. BLOCKCHAIN, THE TECHNOLOGY

Blockchain technology is a decentralized and secure system with data management, made up of a list of transaction bundles called blocks, that is the information and hash collection. These blocks contain every transaction secured before on the chain, a given transaction could supersede every 'blocks' substances. Blocks are linked together and they form a secure chain (Erceg et al., 2020; Nakamoto, 2008; Önder et al., 2017; Thees et al., 2020).

"A world with little or no intermediaries where there is no need to build trust between people and transactions are completed in seconds. This is the promise of Blockchain Technology." (Dogru et al., 2018, p. 1)

Blockchain provides not only data integrity but also security, anonymity (Thees et al., 2020), transparency, trust, privacy (Erceg et al., 2020), and collaboration among stakeholders (Balasubramanian et al., 2022) but it is decentralized and can be used without the control of a third-party organization or government.

The tourism industry has seen a slow but growing influence of blockchain technology since 2008 (Nam et al., 2021). From a tourist point of view, it enhances the tourism experience, rewards sustainable behaviour, ensures benefits for local communities and reduces privacy concerns (Tyan et al., 2020), builds trust among parties, and helps to solve problems firsthand.

3. SMART TECHNOLOGY, SMART CONTRACT AND SMART CITIES – SUSTAINABILITY IN TOURISM

"Bringing smartness into tourism destinations requires dynamically interconnecting stakeholders through a technological platform on which information relating to tourism activities could be exchanged instantly." (Buhalis & Amaranggana, 2015, p. 378).

Blockchain as a distributed database can guarantee the reliability and validity of information. Erol et al. (2022) noted that *"this is highly critical in building sustainability in tourism"*. WTO also stated that the installation of environmentally efficient new technology can ensure sustainability goals (UNWTO, 2005). It has three generations (BTCWires, 2019; Nam et al., 2021). The newest, third generation of technology made smart contracts enabled through applications.

Touristic experience requires digital opportunities. The use of information and communication technologies (ICTs) is unavoidable.

Real-time information is crucial in the decision-making of tourists. Koo et al. (2019) stated that new realities in tourism are caused by ICTs over destinations, travellers, and businesses. Smart tourism destinations are able to offer authentic travel experiences thanks to real-time information about all tourism services, like tracking tourists, managing lost luggage, providing fast check-in procedures, and facilitating travel insurance so it can enhance the tourism experience (Dogru et al., 2018; Tyan et al., 2020).

4. IMPORTANCE OF BLOCKCHAIN TECHNOLOGY FOR THE EUROPEAN UNION

One of its pillars is the European Blockchain Partnership (EBP), launched before the COVID-19 pandemic.

"The EU wants to be a leader in blockchain technology, becoming an innovator in blockchain and a home to significant platforms, applications and companies." (European Commission, 2023). EBP's main focus has been building the European Blockchain Services Infrastructure (EBSI). According to the website of EBSI at the beginning of 2021, 21 projects from 18 European countries participated in the first pilot programme (European Commission - EBSI, 2021). EBSI is a peer-to-peer network of interconnected nodes running a blockchain-based services infrastructure. Until October 4, 2021 (the latest update on the official EBP site), there are 30 members of the program (European Commission, 2022). The Netherlands, France and Spain signed the Declaration of EBP on the Digital Day in 2018. Croatia joined the partnership in 2019 according to the European Commission (2021).

5. TOURISM IN THE SURVEYED COUNTRIES

Thanks to Regulation (EU) No 692/2011 of the European Parliament and the Council of the European Union (Official Journal of the European Union, 2011) and the Council Directive 95/57/2011 (EUR-lex, 2011), it is required in the EU that the Member States provide a regular set of comparable tourism statistics. According to these data, the tourism sector is a dynamically growing sector in terms of nights spent in tourist accommodation (Eurostat, 2023). The data show that the number of nights spent in tourist accommodation increased between 2017 and 2019 in the countries surveyed, except in Spain, where there was a slight decrease. According

to the Eurostat (2022) statistics, for international tourists, Spain was the top destination in 2021 with 114 million nights spent in tourist accommodation establishments, which is 19.5 % of the EU total. Half of the nights spent in Spain were concentrated in five NUTS 3 regions: Mallorca, Tenerife, Gran Canaria, Barcelona, and Malaga.

Croatia (63 million nights) was the third most popular tourist destination, and France was the fifth with 57 million nights. Despite the above-mentioned percentages the highest international travel receipts in 2021 were recorded in France (€34.5 billion) followed by Spain (€29.2 billion).

From this point of view (nights spent by domestic and international guests at tourism accommodation establishments per inhabitant), tourism in the Netherlands is also intensive and it is above the average of the EU (Eurostat, 2022). Tourism in the Netherlands has been decreasing since 2019 (Eurostat, 2022). The Netherlands has ambitious objectives for sustainable development and digital transformation. The agenda, Perspective Destination Netherlands 2030, states that travellers use more and more digital resources and platforms for inspiration and information, so they can more easily and faster book a trip. Digital solutions ensure transparency when it comes to prices and products, while big data offers new insights into tourism planning (UNWTO, 2023a).

Spain declared also that one of the most important initiatives of its tourism development is the preservation of cultural and natural values. The country has the Sustainable Tourism Strategy 2030, for the challenges of the sector in the medium and long term, pushing the three pillars of sustainability: socio-economic, environmental, and territorial (UNWTO, 2023b).

Croatia also has The Sustainable Tourism Development Strategy until 2030 and is in the process of developing a new Tourism Law, which will be in line with the Sustainable Development Strategy (UNWTO, 2023c).

6. REGULATORY BACKGROUND OF CRYPTOCURRENCIES IN TOURISM ACTIVITY IN THE SURVEYED COUNTRIES

The Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937 (further defined as MiCA) defines a crypto asset as any digital representation of rights or values that can be transferred and stored electronically using distributed ledger technology (DLT) or similar technology. The MiCA distinguishes between three types of crypto assets:

1. **asset-based tokens:** designed to maintain stable value by referencing the value of multiple fiat currencies that are legal tender, or one or more commodities, or one or more crypto-assets, or a combination of these assets;
2. **electronic money token:** the main purpose of which is to be used as a medium of exchange and to maintain a stable value by referencing the value of a fiat currency that is legal tender;
3. **user token:** provides digital access to a good or service available on a DLT and is accepted only by the issuer of the token in question. NFTs are excluded from MiCa's scope.

The digital opportunities offered by blockchain technology and smart contracts affect public administrations and bring with them the need for regulation. It comes from the fact that major economies have been contentious about blockchain technology and regulation, specifically cryptocurrencies (Kwok & Koh, 2019).

France enacted a new genre of regulation, the PACTE-law (Law n° 2019-486 - Plan d'Action pour la Croissance et la Transformation des Entreprises). Furtherly France decided to provide an optional visa for initial coin offerings ("ICO") and a mix of mandatory registration for some intermediaries coupled with a voluntary licence for all intermediaries. This optional regime (or so it seems) is a new type of regulation: neither soft law, nor a default rule, nor totally hard law. Most provisions require an opt-in but once the option is exercised, there are constraining rules that will apply.

The Netherlands has an innovation-friendly approach under a liberal, yet cautious relationship between regulatory, supervisory and governmental entities and market players. The Netherlands has a three-headed regulatory power: the Authority of Financial Markets (AFM), the Dutch Authority for Consumers and Markets (ACM) and The Dutch Central Bank (DNB), which together regulate the financial sector and markets (DNB, n.d.).

AFM and DNB have adopted a taxonomy that distinguishes between three overlapping categories of cryptocurrencies: transaction crypto(s); utility crypto(s); and investment crypto(s). These categories are highly interconnected, as these "cryptos" could have multiple functions simultaneously, and their function may change over time. The Dutch regulatory approach to the possibility of creating regulatory arbitrage through blockchain experiments, by attracting projects and competing with others, needs to be seen in terms of the country's competitiveness in a European - but global - financial and economic context.

In Spain, cryptocurrency is largely unregulated because cryptocurrencies are not financial instruments under Spanish law, except that they cannot be treated as legal tender, which is exclusively reserved for the euro as the national currency. However, some main regulations are regarding the issue of cryptocurrencies. The Fifth Money Laundering Directive (5MLD) was transposed into Spanish Law through the Royal Decree-Law 7/2021. Also, Law No 10/2010 on the Prevention of Money Laundering and Terrorist Financing mandates that virtual currency exchangers and e-wallet providers are included among the entities required to comply with its regulations. The Spanish National Securities Market Commission's (CNMV) proposal provides a normative definition of crypto assets, stating that a crypto asset is a *"digital representation of an asset or right that can be electronically transferred or stored by using distributing ledger technologies or other similar ones".*

Regardless of their nationality, if services relating to "Virtual Currency Exchange for Fiat Currency" or "Services for the Custody of Electronic Wallets" are offered or provided in the Spanish territory, these individuals or entities will have to be registered with the Registry of the Spanish Central Bank ("SCB") created for these purposes.

In Croatia, virtual currencies are defined as "*a digital representation of value that is not issued or guaranteed by a central bank or a public authority, is not necessarily attached to a legally established currency, and does not possess a legal status of currency or money, but is accepted by natural or legal persons as a means of exchange and which can be transferred, stored and traded electronically."*

Since "virtual currency" is a synonym for "cryptocurrency", the Croatian government has implicitly provided cryptocurrencies with a legal definition.

The fact that the Croatian government does not explicitly regulate cryptocurrency raises two considerations. First, Croatian authorities do not issue licences to cryptocurrency firms. Cryptocurrency

investors must be aware that cryptocurrency trading is considered a simple "financial transaction" in Croatia. It is unclear just how big the crypto market is in Croatia, but the Blockchain and Cryptocurrency Association counts a few hundred people as members. Ascertainable, there are 18 crypto companies registered with the Croatian authorities. One of those companies is Electrocoin, an exchange that reported €72 million in revenue last year.

7. RESEARCH RESULTS

In order to conduct an in-depth investigation and establish stronger correlations in which aggregated data do not distort the relationships, the authors determined the level of each of our regional statistical studies at the NUTS 3 level. In this research, tourism intensity is interpreted based on the number of nights spent in tourist accommodations according to NUTS 3, for which data was provided by Eurostat (2023). Consequently, a total of 221 NUTS 3 regions across four countries were included in the analyses.

The number of cryptocurrency acceptance locations was collected through scraping methodology using an API key. This was based on the CoinMap database, accessed through their official API key. The data collection occurred in September 2023, using Python code within the Jupyter framework. This process gathered information about the names, categories, dates, countries, states, localities, and geocodes of the cryptocurrency acceptance locations. To obtain accurate location data, an instance of Geolocator was implemented in the code. Additionally, it checked the validity of coordinates using Geolocator and handled incorrect coordinates.

A total of 20,012 data points were collected for the selected four countries. The NUTS 3 divisions were deduced from the settlement level using Eurostat's LAU list, allowing both tourism and cryptocurrency-related data to be interpreted at the same level – the NUTS 3 level.

In examining the relationship between cryptocurrencies and tourism, this paper found it worthwhile to begin by conducting a relevance test. Specifically, the authors sought to answer the question: *Q1 - are cryptocurrencies primarily used for tourism services in the four selected countries, and if so, to what extent?*

The following hypotheses were put forward in the study:

H1: they are primarily used in the tourism sector.

H2: the number of nights spent at tourist accommodations correlates with the number of cryptocurrency acceptance locations in the examined regions.

For the four selected countries, establishing a clustering neural network was justified to explore whether there are specific patterns in the grouping of categories at the settlement level. The clustering neural network analysis method, through SOM (Self-Organizing Maps) and PCA (Principal Component Analysis), is suitable for examining the research question - whether there are groupings of categories at the settlement level.

In this context, SOM and PCA serve as complementary methods in data analysis, particularly in this case, where the data is provided by a big data file. The authors found both methods justified because SOM allows for the clustering of data in a lower-dimensional space, aiding in the

visual identification of patterns and groupings while preserving the topological properties of the data. This is reinforced by the linear transformation technique of PCA, which repositions the data in a new coordinate system where the variables (principal components) are independent. This enables dimensionality reduction without significant loss of information. In the PCA process, data is transformed to maximise variance, so the first principal component represents the greatest variance, the second the second greatest, and so on. This helps identify the most significant patterns and trends in the data. For the neural network analysis, data was normalised, upon which the SOM was trained. During the training process, typographical errors were collected to examine how the error changes over iterations.

The Self-Organizing Map (SOM) was trained on the normalised data over 1000 iterations. The following Figure 1 illustrates the SOM map, where distances between different cells are represented by colour intensity (darker areas indicate greater distances). To interpret this, the authors also created a U-matrix that represents the distances between neurons of the SOM, as shown in figure 2, to which the authors added the centroids of the clusters. These two maps help identify different clusters and their distances from each other. Identifying clusters aids in understanding the data structure and the relationships between different categories.

During the categorization process, the neural network model divided data into 120 distinguishable categories. As evident from the data, the trio of nightlife, food, and lodging – categories directly related to tourism – collectively have the most significant influence in the clusters. This influence is not distorted by the shopping category, as both locals and tourists utilize the opportunities it presents. This is reinforced by the fact that typical local services – like groceries and sports, and the categories with negligible presence, such as ATMs and local services – greatly underperform in weight compared to the other categories. Reflecting on the Q1 research question, the authors can conclude that, based on the examined data and the methods used in the study, cryptocurrencies are utilized in tourism in the examined regions with considerable intensity.

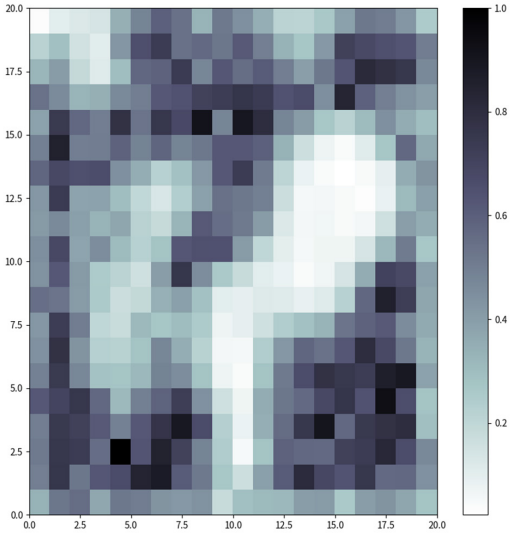

Figure 1. The SOM Map
Source: Own research

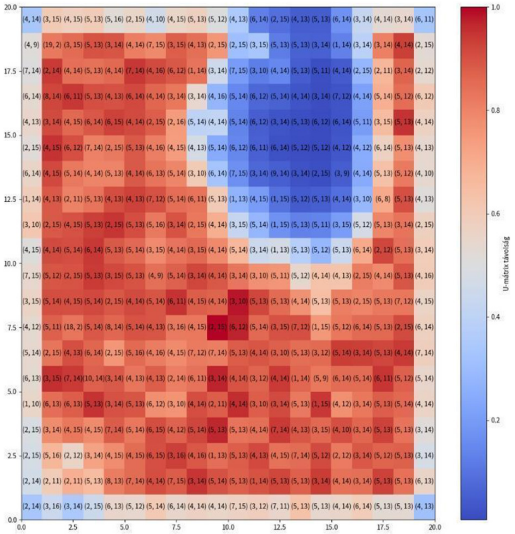

Figure 2. The U-Matrix
Source: Own research

During the SOM clustering, input data (settlements and categories) were organised on a two-dimensional map, creating a data table with X and Y coordinates, where similar data points are located close to each other. Different parts of the map represent clusters, which denote groups of

data. The most prominent groupings in terms of categories are as follows: Nightlife: 44 clusters; Shopping: 38 clusters; Food: 34 clusters; Lodging: 31 clusters; Transport: 5 clusters; Sports: 1 cluster; Grocery: 1 cluster.

The notation "Nightlife: 44 clusters" signifies that the "Nightlife" category is the dominant category in 44 distinct clusters. A deeper examination of the data reveals that, according to the methods used in this study, cryptocurrencies are predominantly used in tourism in the examined regions, thereby validating the hypothesis (H1).

To gain a better understanding of the clustering neural network, Principal Component Analysis (PCA) was employed, which involves creating linear combinations of the original variables. In our analysis, the first few principal components account for a significant portion of the data's variance. As we increase the number of principal components, the cumulative variance also increases, albeit at a diminishing rate. The first principal component alone explains a substantial part of the data's variance. However, as we increase the number of principal components, the increase in cumulative variance decreases, indicating that each additional principal component contributes less to the total variance.

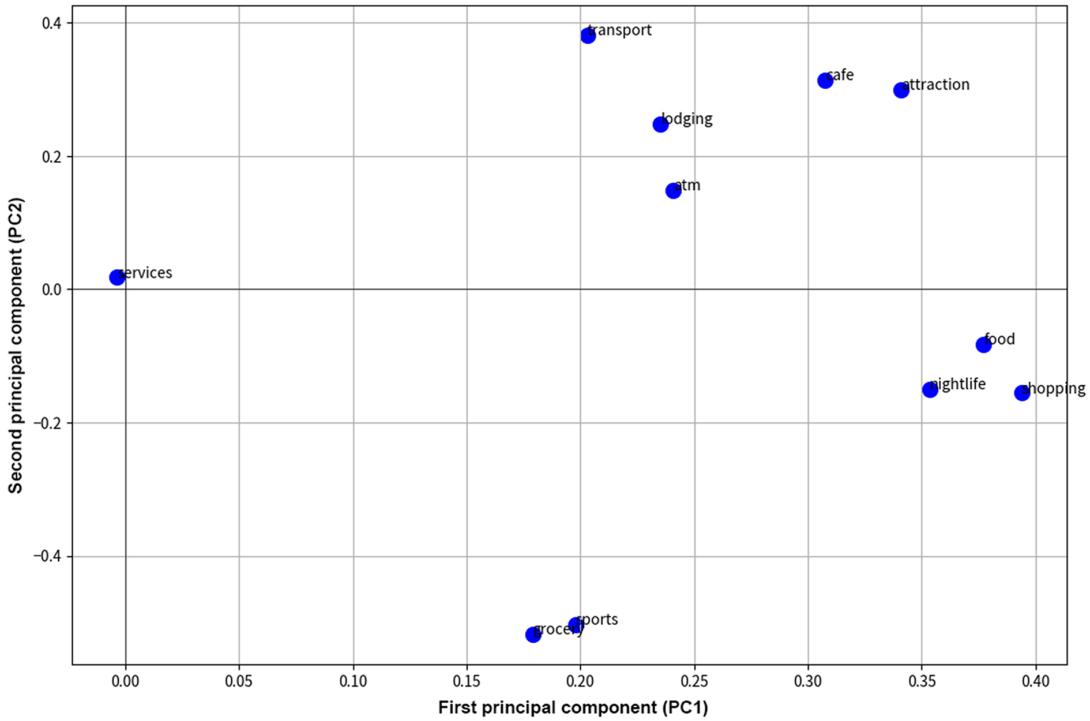

Figure 3. Loadings of the Categories in the First Two Principal Components
Source: Own research

Figure 3 illustrates the loadings of categories in the first two principal components. Categories located close to each other on the figure, such as "nightlife" and "cafe," show similar patterns across settlements, suggesting that places with vibrant nightlife likely also have numerous cafes. This observation indicates regions where cryptocurrencies are more widely accepted in tourism. Categories situated further from the origin demonstrate greater loadings in a particular principal component. For instance, the "shopping" category shows a substantial loading in the first principal component (PC1), indicating that shopping is a critical factor across settlements. This has implications for the tourism sector, suggesting that shopping opportunities with cryptocurrency play

a significant role in tourists' choice of cities. Categories near the origin exhibit lower loadings in both principal components, implying they contribute less to the explanation of variance in the data, such as sports or groceries. The wide distribution of categories on the figure indicates that settlements offer unique experiences in different categories. For the tourism sector, this means cities should diversify their offerings to attract various types of tourists.

Based on PCA results, the tourism sector might benefit from diversifying offerings and leveraging connections between categories. For example, in a city where nightlife is popular, investing in cafes and restaurants could be advantageous. Similarly, enhancing shopping opportunities can be crucial, as they significantly influence tourists' city choices. Cities should also identify unique or outstanding categories to use in their tourism marketing.

This analysis not only strengthens the answer to our research question but also confirms that, according to the examined data and methods, cryptocurrencies are intensely used in tourism in the studied regions. To demonstrate the correlation between cryptocurrency acceptance locations and tourism intensity, and to examine our hypothesis *H2 – that the number of nights spent at tourist accommodations correlates with the number of cryptocurrency acceptance locations in the regions* – correlation analyses were conducted. The authors interpreted the data at the NUTS 3 level, considering the number of guest nights spent at tourist accommodations as the dependent variable (Y) and the number of cryptocurrency acceptance locations in the NUTS 3 region as the independent variable (X).

The consolidated data analysis yielded the following results: The correlation coefficient value of 0.458693 indicates a moderately strong positive relationship between the number of nights spent at tourist accommodations and the number of cryptocurrency acceptance locations within a country's NUTS 3 regions. It can be concluded that as the number of cryptocurrency acceptance locations in a region increases, the number of guest nights generally increases as well.

The 95% confidence interval indicates the level of certainty we have in the value of the correlation coefficient. In this case, the authors can say with 95% confidence that the true correlation coefficient value lies between 0.332622 and 0.568658. This means that even under the most pessimistic estimate, there is a positive correlation between the two variables.

The p-value "<.0001" suggests that it is highly unlikely that the observed correlation coefficient occurred by chance. This implies a probable genuine relationship between the two variables, and not merely due to random fluctuations in our sample.

The positive covariance value indicates that as one variable increases, so does the other, consistent with the positive correlation value.

Based on these results, the authors can say that the number of nights spent at tourist accommodations is positively correlated with the number of cryptocurrency acceptance locations in the country's NUTS 3 regions. As the number of cryptocurrency acceptance locations in a region increases, the number of guest nights typically increases as well.

With these findings, the authors consider our hypothesis *H2 to be validated, confirming that the number of nights spent at tourist accommodations correlates with the number of cryptocurrency acceptance locations in the examined regions.*

8. CONCLUSION

In our research, the authors conducted a detailed analysis of the current status and potential impacts of cryptocurrency applications in the tourism industry across four examined countries. Our study paid special attention to key aspects highlighted in the literature, such as the application of digital payment tools in tourism and the economic impacts of tourism.

During our literature review, the authors tracked the global trends in cryptocurrency applications in tourism. Digital payment tools like cryptocurrencies are increasingly gaining traction in the tourism sector, as supported by several studies. The application of cryptocurrencies in tourism not only diversifies payment methods but also offers new opportunities for the hospitality industry, such as reducing transaction costs and speeding up payment processes.

Our research concluded that there is a moderate positive correlation between the number of cryptocurrency acceptance points and the intensity of tourism in the four countries studied. Through the use of Self-Organizing Maps (SOM) and Principal Component Analysis (PCA) methods, the authors determined that cryptocurrencies in tourism primarily appear in accommodations, nightlife, and shopping centres. This correlation is particularly pronounced in Spain, France, the Netherlands, and Croatia.

The application of cryptocurrencies in tourism signifies not just a diversification of payment methods but also opens new opportunities in the tourism sector, such as faster and simpler service for guests and promoting sustainable tourism. Additionally, cryptocurrencies allow for transactions without intermediaries, reducing costs and increasing transaction security.

According to our research, the increase in the use of cryptocurrencies correlates with an increase in the number of nights spent at tourist accommodations, indicating that this payment method is becoming increasingly accepted in the tourism sector. This trend could be particularly important for the digitalization and sustainable development of tourism, especially in the countries the authors studied, where tourism is a significant economic factor.

In conclusion, the growing acceptance of cryptocurrencies in tourism opens up new opportunities for the sector, particularly in terms of digitalization and sustainability. Our research highlights that the use of cryptocurrencies in tourism not only emerges as a new payment tool but also contributes to the transformation of the tourism sector.

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