National College of Ireland

OPTIMIZING P2P PAYMENT SYSTEMS FOR PRIVACY AND ACCESSIBILITY IN TOURISM SHARING ECONOMY

MSc Research Project
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OPTIMIZING P2P PAYMENT SYSTEMS FOR PRIVACY AND ACCESSIBILITY IN TOURISM SHARING ECONOMY

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Abstract

The sharing economy has transformed the tourism sector by providing cost-effective and personalized experiences, yet the rapid expansion of peer-to-peer (P2P) platforms has raised critical concerns about privacy and accessibility. This study addresses these issues by proposing a comprehensive framework integrating blockchain technology for privacy preservation and credit networks to enhance accessibility in P2P payment systems. The research encompassed a thorough literature review, framework development, and proposed a phased implementation strategy, including a pilot phase, scaled-up deployment, and full-scale simulation.

1 Introduction

The rapid evolution of the tourism sharing economy has led to the widespread adoption of Peer-to-Peer (P2P) payment systems, which facilitate seamless transactions between individuals without the need for intermediaries. These systems have revolutionized the way travelers book accommodations, dining, transportation, and activities, providing convenience and efficiency that traditional payment methods cannot match. However, the increasing reliance on P2P payment systems raises significant concerns regarding privacy and accessibility, particularly in a global, diverse user base typical of the tourism industry. Addressing these issues is crucial for sustaining trust and growth of P2P platforms within the tourism industry (Ranzini *et al.*, 2017).

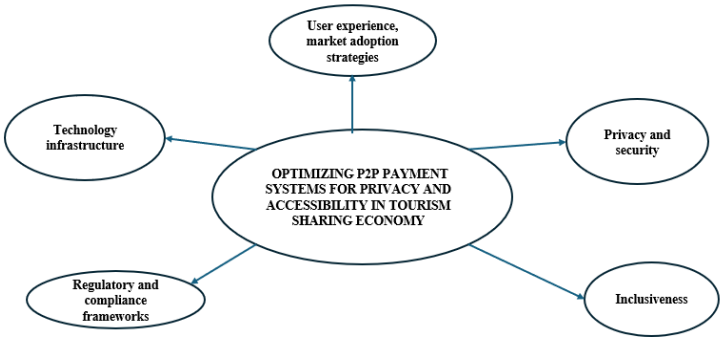

Figure 1: Conceptual Framework for Optimizing P2P Payment System

The figure illustrates key components and strategies necessary for improving privacy and accessibility in the tourism sharing economy consists of user experience, technology

infrastructure, privacy and security measures, inclusiveness, and regulatory frameworks. This framework aims to create a balanced approach to optimize the p2p system by addressing the diverse needs and concerns of users in the P2P payment landscape.

This paper contributes to the existing literature by:

- Providing an in-depth analysis of current P2P payment systems and identifying their shortcomings in privacy and accessibility(Barradas and Pinto-Ferreira, 2004; Li *et al.*, 2021).
- Proposing a novel framework that integrates advanced technologies to address these issues.
- Offering practical recommendations for implementation based on case studies and empirical data (Schröder and Theilen, 2019).

By addressing the critical aspects of privacy and accessibility, this research aims to foster a more secure and inclusive environment for P2P transactions in the tourism sharing economy.

1.1 Research Questions

1. How can P2P payment systems be optimized to enhance privacy for users in the tourism sharing economy?
2. What strategies can be employed to improve the accessibility and inclusivity of these payment systems for a diverse user base?

1.2 Objectives

The primary objective of this research is to develop a comprehensive framework that enhances both privacy and accessibility in P2P payment systems used in the tourism sharing economy. By leveraging technologies such as blockchain and credit networks, this study aims to propose solutions that safeguard user data while ensuring ease of use for all participants. The study will:

- Identify the key privacy concerns of users regarding P2P payment systems.
- Investigate the accessibility challenges faced by users in different regions and demographics.
- Propose strategies to optimize P2P payment systems for better privacy protection and accessibility.

1.3 Structure of the Report

The remainder of this report is structured as follows:

- **Literature Review:** Examines existing research on P2P payment systems, privacy concerns, and accessibility issues in the tourism sharing economy.
- **Methodology and Design:** Details the research design, data collection methods, and analytical techniques used in the study.

- **Implementation and Evaluation:** Presents the findings from the survey and correlation analysis, highlighting key patterns and relationships.
- **Discussion:** Interprets the results, discussing their implications for theory and practice, and compares them with existing literature.
- **Conclusion and future scope:** Summarizes the key points of the study, acknowledges its limitations, and suggests areas for future research.

1.4 Limitations

While this study aims to provide comprehensive insights into the optimization of P2P payment systems, it is not without limitations. The survey data is self-reported and may be subject to biases, such as social desirability bias or recall bias. Additionally, the sample size and demographic diversity of the respondents may limit the generalizability of the findings. Furthermore, the rapidly changing technological landscape means that some findings may become outdated as new privacy and accessibility features are developed and implemented. These limitations should be considered when interpreting the results and implications of this study

2 Related Work

2.1 Technological Advancements and Privacy Concerns

A privacy-preserving P2P accommodation system based on a credit network, emphasizing the need for secure transactions in the sharing economy. This study is robust in its technical solution to privacy concerns, leveraging cryptographic techniques to protect user data (Li *et al.*, 2021). However, its focus is predominantly on the accommodation sector, limiting its generalizability across other tourism services. Similarly, study by (Ranzini *et al.*, 2017) examined privacy issues in the sharing economy, highlighting user apprehensions about data misuse. While the study provides valuable insights into privacy concerns, it lacks concrete technical solutions to address these issues.

2.2 Accessibility Challenges

As analyzed by (Schröder and Theilen, 2019), customer motives and concerns in the sharing economy, noting significant barriers related to accessibility, such as language barriers and internet connectivity. The strength of this work lies in its comprehensive user survey, which provides a broad understanding of user concerns. However, it falls short in proposing specific measures to enhance accessibility. (Barradas and Pinto-Ferreira, 2004) earlier explored a P2P infrastructure for tourism marketplaces, focusing on the potential for P2P systems to democratize access to tourism services. Although pioneering, the study is outdated, particularly in its consideration of modern technological advancements and current user expectations.

2.3 User Experience and Adoption

The study explored the role of security perceptions in mobile payment adoption, finding that gender significantly moderates these perceptions. This study's strength is its nuanced understanding of demographic influences on technology adoption. However, it primarily addresses mobile payments rather than P2P systems specifically. Similarly, use of sentiment analysis to assess user experiences with P2P payments, offering a novel methodological approach. Yet, it lacks depth in addressing specific accessibility improvements.

2.4 System Effectiveness and Usability

The studies discuss the scalability of P2P systems, emphasizing their potential in various sectors, including tourism. While the study is forward-looking, it lacks empirical data on user experiences. It delves into the intersection of offline relationships and P2P payments, providing a fresh perspective on trust and usability. However, their findings are primarily qualitative and need quantitative validation.

2.5 Summary and Research Gap

The reviewed literature highlights significant advancements in P2P payment systems, particularly regarding privacy and security. However, there is a noticeable gap in addressing accessibility issues comprehensively. Existing studies often focus on specific sectors or demographic factors, lacking a holistic approach to optimizing P2P systems for diverse user needs in the tourism sharing economy. Furthermore, while privacy concerns are well-documented, technical solutions remain underexplored.

2.6 Justification for Research

This review underscores the need for research that integrates privacy-preserving technologies with robust accessibility features in P2P payment systems. By addressing both privacy and accessibility, the proposed research aims to enhance user trust and broaden the adoption of P2P payments in the tourism sharing economy. This dual focus will contribute significantly to the scientific literature, offering practical solutions that cater to the evolving needs of a global user base.

3 Research Methodology

This research employs a mixed-methods approach, integrating both qualitative and quantitative data collection and analysis methods to develop and evaluate a comprehensive framework for optimizing P2P payment systems in the tourism sharing economy.

3.1 Data Collection

- **Literature Review and Hypothesis Formation:** Conducted an extensive literature review to identify existing gaps in privacy and accessibility within P2P payment systems.

Formulated research questions and hypotheses based on identified gaps and customer feedback data.

- **Primary Data:** Collected through surveys and interviews with users of P2P payment systems in the tourism industry. The survey focused on user experiences, privacy concerns, and accessibility issues.
- **Participants:** The survey targeted a diverse group of users, including frequent travellers and individuals using P2P payment systems for tourism-related transactions.
- **Survey Design:** A structured survey was designed to gather quantitative data on users' frequency of use of P2P payment systems, their privacy concerns, and accessibility issues. The survey included:
    - Demographic questions (gender, occupation).
    - Usage patterns of P2P payment systems (frequency of use: never, rarely, occasionally, often, always).
    - Privacy concerns (rated on a Likert scale from 1 to 5, with 1 being least concerned and 5 being most concerned).
    - Accessibility challenges (language barriers, internet connectivity, app usability).

3.2 Data Analysis

Data Cleaning and Preparation: Raw survey data were exported from Google Forms to Microsoft Excel for initial cleaning. This involved:

- Removing incomplete responses.
- Recoding categorical variables (e.g., converting frequency of use categories to numerical values).
- Ensuring consistency and accuracy in the data.
- Handling multiple response questions

Descriptive Statistics: Descriptive statistics were calculated to summarize the demographic characteristics of the sample, usage patterns, and levels of privacy concern and accessibility issues. Measures such as mean, median, standard deviation, and frequency distributions were used.

Correlation Analysis: Pearson correlation coefficients were calculated to examine the relationships between variables. This statistical technique was chosen for its ability to measure the strength and direction of linear relationships between variables (Ben Mansour & Bentaleb, 2021).

3.3 Equipment and Techniques

- Survey and Interview Tools: Google Forms was used to collect user feedback. Interviews were conducted using video conferencing tools like Zoom and Microsoft Teams, also via direct interactions.
- Data Preparation: Microsoft Excel is used for initial data cleaning and preparation.
- Data Analysis Software: Statistical analysis like calculating correlation matrix and graph creation was performed using IBM SPSS.

3.4 Procedure

Survey Distribution: Surveys were distributed online, and responses were collected over a period of four weeks.

Data Cleaning

- Incomplete and inconsistent responses were identified and removed.
- Categorical variables were recoded for analysis.
- Handled multiple response questions

Importing data into spss

- Excel file is imported to spss
- Ensured the variable is properly defined with correct data type
- Labels were added for the variables

Descriptive Statistics: Demographic data and key variables were summarized using descriptive statistics.

Correlation Analysis: Pearson correlation coefficients were calculated to examine relationships between key variables.

3.5 Result Compilation

The results from the quantitative analyses were integrated with qualitative insights to provide a comprehensive understanding of the factors influencing the use of P2P payment systems. This integrative approach ensured that both statistical trends and personal experiences were considered.

4 Design Specification

4.1 Data-Driven Insights

The survey feedback and data analysis provided several key insights:

- **Privacy Concerns**: Users with higher privacy concerns tend to use P2P payment systems less frequently. This correlation highlights the need for robust privacy-preserving measures.
- **Accessibility Issues**: Language barriers, internet connectivity, and app usability were identified as significant barriers to the usage of P2P payment systems. Enhancing accessibility features is crucial to increasing adoption.
- The **correlation analysis** underscores the critical importance of addressing privacy concerns and accessibility issues to enhance the frequency of use and overall satisfaction with P2P payment systems.

- Key recommendations include implementing advanced privacy-preserving techniques, developing offline functionality, simplifying the user interface, providing multilingual support, and expanding payment method acceptance.

4.1.1 Privacy concerns

Rating_Privacy_concern

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very low	4	3.6	3.6	3.6
	low	8	7.2	7.2	10.8
	medium	18	16.2	16.2	27.0
	high	40	36.0	36.0	63.1
	very high	41	36.9	36.9	100.0
	Total	111	100.0	100.0	

Figure 2 : Privacy concern rating frequency

The first table provides the frequency distribution of respondents' ratings of privacy concern regarding the use of P2P payment systems. A significant majority of respondents rated their privacy concerns as either high (36%) or very high (36.9%), indicating widespread apprehension about privacy issues in P2P payment systems.

Correlation Between Frequency of Use and Privacy Concern:

Correlations

		Frequency_of_use	Rating_Privacy_concern
Frequency_of_use	Pearson Correlation	1	-.131
	Sig. (2-tailed)		.171
	N	111	111
Rating_Privacy_concern	Pearson Correlation	-.131	1
	Sig. (2-tailed)	.171	
	N	111	111

Figure 3 : Frequency of Use and Privacy Concern

The table presents the Pearson correlation coefficient between the frequency of use of P2P payment systems and the rating of privacy concern.
Negative Correlation: There is a negative correlation (-0.131) between the frequency of use and the rating of privacy concern. Although the correlation is not strong, it suggests that as privacy concerns increase, the frequency of use tends to decrease.
Statistical Significance: The p-value (0.171) indicates that this correlation is not statistically significant at the 0.05 level. This means we cannot conclusively state that privacy concerns significantly impact the frequency of use based on this data alone.

Correlation Between Privacy Concern and Experienced Privacy Breach

The table shows the Pearson correlation coefficient between the rating of privacy concern and whether respondents have experienced a privacy breach.

Correlations

		Rating_Privacy_concern	Experienced_privacy_breach
Rating_Privacy_concern	Pearson Correlation	1	.195*
	Sig. (2-tailed)		.040
	N	111	111
Experienced_privacy_breach	Pearson Correlation	.195*	1
	Sig. (2-tailed)	.040	
	N	111	111

*. Correlation is significant at the 0.05 level (2-tailed).

Figure 4: Privacy concern vs privacy breach

Positive Correlation: There is a positive correlation (0.195) between the rating of privacy concern and having experienced a privacy breach. This suggests that individuals who have experienced a privacy breach tend to have higher privacy concerns.
Statistical Significance: The p-value (0.040) indicates that this correlation is statistically significant at the 0.05 level. This means there is a statistically significant relationship between experiencing a privacy breach and having higher privacy concerns.

Design Specifications to Improve Privacy

- **Enhanced Privacy Features**: Implement advanced cryptographic techniques, such as blockchain, homomorphic encryption and zero-knowledge proofs, to protect user data and transactions.
- **Transparent Communication**: Clearly communicate the privacy measures in place to users, helping to build trust and alleviate concerns.
- **User Education**: Provide educational resources and support to help users understand how to protect their privacy while using P2P payment systems.
- **Responsive Support**: Establish responsive customer support to address and resolve privacy issues promptly, minimizing the impact of any breaches and restoring user confidence.

4.1.2 Accessibility issues

The bar chart displays the frequency and percentage of different accessibility issues encountered by users of P2P payment systems in the tourism sharing economy.

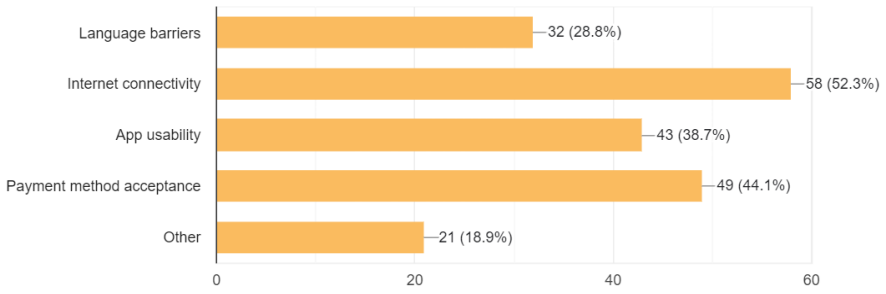

Figure 5: Issue with accessibility

- Internet Connectivity as a Major Barrier: The highest percentage of respondents (52.3%) identified internet connectivity as a major issue. This suggests that reliable internet access is critical for the effective use of P2P payment systems.
- Significant Issues with App Usability and Payment Method Acceptance: App usability (38.7%) and payment method acceptance (44.1%) are also significant barriers. This indicates a need for more intuitive app designs and broader acceptance of various payment methods to cater to diverse user preferences.
- Language Barriers: While less frequently reported than some other issues, language barriers are still a notable concern for 28.8% of respondents. This highlights the importance of multilingual support in P2P payment systems.
- Other Issues: The "Other" category, with 18.9% of respondents, suggests there are additional, less common issues affecting the use of P2P payment systems that may need further investigation.

inclusive

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	31	27.9	27.9	27.9
	yes	32	28.8	28.8	56.8
	may be	48	43.2	43.2	100.0
	Total	111	100.0	100.0	

Figure 6: inclusiveness

The distribution indicates a significant level of uncertainty or mixed perceptions about the inclusivity of P2P payment systems. This highlights the need for the following actions to improve inclusivity.

- **No (Not Inclusive)**: 27.9% (31 respondents) do not perceive P2P payment systems as inclusive.
- **Yes (Inclusive)**: 28.8% (32 respondents) perceive P2P payment systems as inclusive.
- **Maybe (Uncertain)**: 43.2% (48 respondents) are uncertain about the inclusivity of P2P payment systems.

Also, a largest proportion of respondents are uncertain about the inclusivity of P2P payment systems, indicating a significant level of ambiguity or lack of awareness regarding the inclusivity features of these systems.

Design Specifications to Improve Accessibility

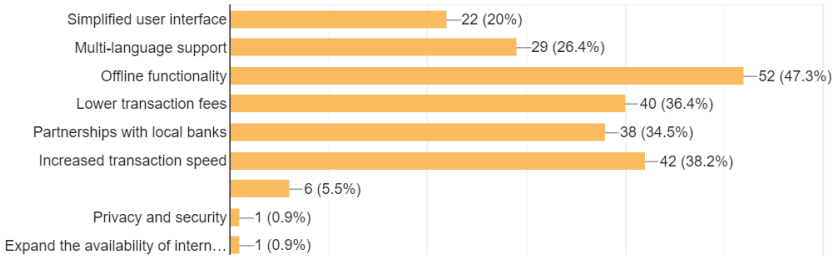

Figure 7: Accessibility improvement

To address these accessibility improvement measures and enhance the frequency of use of P2P payment systems, the following design enhancements are recommended:

1. **Implementing Offline Functionality**: Develop features that allow transactions and essential services to function offline, with data synchronization occurring once connectivity is restored.
2. **Reducing Transaction Fees**: Explore ways to lower transaction fees, such as partnering with local banks or leveraging cost-effective transaction processing methods.
3. **Increasing Transaction Speed**: Optimize backend processing and transaction protocols to ensure fast and efficient transactions.
4. **Simplifying the User Interface**: Design a clean, intuitive interface with easy navigation, large icons, and customizable settings to improve usability.
5. **Providing Multi-language Support**: Implement dynamic language switching and multilingual customer support to cater to a diverse user base.

By implementing these enhancements, P2P payment systems can become more accessible and user-friendly, encouraging more frequent use and greater satisfaction among users.

5 Implementation

The final stage of implementing the proposed solution for optimizing P2P payment systems to enhance privacy and accessibility involved several key activities, including data transformation, correlation analysis, and administration of questionnaires.

5.1 Administration of Questionnaires

Outputs Produced

- **Completed Questionnaires**: A total of 111 responses were collected, providing a comprehensive dataset for analysis.
- **Response Rate**: Monitored to ensure a sufficient sample size for statistical reliability.

Tools and Methods Used

- **Google Forms**: Continued to be used for administering the survey and collecting responses.
- **Email and social media**: Utilized to distribute the survey link and encourage participation from a diverse user base.

Steps:

- **Survey Distribution**: The survey link was shared through various channels, including email lists, social media platforms, and online forums related to tourism and technology.
- **Response Monitoring**: The response rate was tracked to ensure an adequate number of completed questionnaires were collected for robust analysis.

5.2 Data Collection and Transformation

Outputs Produced:

- **Survey Responses**: Collected via Google Forms, containing user feedback on various aspects of P2P payment systems, including usage frequency, privacy concerns, and accessibility issues.
- **Transformed Data**: Cleaned and organized data ready for analysis.

Tools and Methods Used:

- **Google Forms**: Used to design and distribute the survey questionnaire.
- **Microsoft Excel**: Employed for initial data cleaning and transformation. This involved removing incomplete responses, recoding categorical variables, and ensuring data consistency.

Steps:

- **Designing the Survey**: The survey was carefully crafted to capture essential information on user demographics, frequency of use, privacy concerns, and accessibility issues.
- **Data Cleaning**: Raw data from the survey were imported into Excel for cleaning. This process included handling missing values, proper labelling, standardizing data formats, and recoding variables for analysis.

5.3 Correlation Analysis

Outputs Produced:

- **Correlation Matrix**: A matrix showing the Pearson correlation coefficients between all key variables such as frequency of use, privacy concerns, and accessibility issues.

Correlations

		Payment_method_acceptance	Frequency_of_use
Payment_method_acceptance	Pearson Correlation	1	.311**
	Sig. (2-tailed)		<.001
	N	111	111
Frequency_of_use	Pearson Correlation	.311**	1
	Sig. (2-tailed)	<.001	
	N	111	111

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 8: sample correlation

- **Statistical Summaries**: Descriptive statistics summarizing the survey data, including means, medians, and standard deviations.

Tools and Methods Used:

- **IBM SPSS**: Statistical software used to perform correlation analysis and generate the correlation matrix.
- **Excel**: Used for preliminary analysis and visualization.

Steps:

- **Data Import**: Cleaned data were imported into SPSS for detailed analysis.
- **Correlation Analysis**: Pearson correlation coefficients were calculated to examine the relationships between variables. This analysis helped identify significant correlations, such as the negative correlation between privacy concerns and frequency of use.
- **Generating the Correlation Matrix**: The results were compiled into a correlation matrix, providing a clear overview of the relationships between different factors.

6 Evaluation

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	**Frequency of use**																					
2	**Payment system**	0.08																				
3	**Accomodation**	0.13	0.02																			
4	**Dining**	0.09	-0.03	-0.15																		
5	**Transportation**	.30**	0.07	0.08	-0.02																	
6	**Tours and activities**	0.12	0.03	0.08	-0.09	0.11																
7	**other services**	0.01	0.08	0.10	-0.04	-0.05	-0.05															
8	**Rating Privacy concern**	-0.13	-0.12	-0.01	0.02	-0.03	-0.01	-0.06														
9	**Experienced privacy breach**	-0.03	0.14	-0.08	0.06	0.04	-0.01	-0.05	.195*													
10	**Simplified UI**	0.17	-0.10	-0.02	-0.04	0.00	0.12	0.07	-0.02	-0.05												
11	**Multilanguage support**	-0.03	-0.11	-0.06	-0.08	0.07	-0.02	-0.06	-0.05	-0.05	0.06											
12	**Offline functionality**	0.08	-0.18	-0.08	0.09	0.08	.28**	-0.05	0.11	-0.17	-0.01	0.14										
13	**Low Transactioncost**	-0.01	-0.10	0.11	-0.13	-0.07	0.10	-0.03	0.12	-0.01	-0.08	.196*	-0.06									
14	**Partnership with Localbanks**	0.15	0.00	0.13	0.06	0.05	0.06	0.10	0.06	-0.03	-0.05	0.12	0.14	0.07								
15	**Transaction speed**	0.17	.19*	0.13	-0.13	.21*	0.12	0.16	0.05	0.11	0.02	-0.13	0.01	0.03	-0.07							
16	**inclusive**	0.02	-0.19	-0.05	-0.11	-0.02	0.11	0.05	-0.07	-0.03	-0.12	-0.13	0.11	-0.07	-.230*	0.16						
17	**Language Barrier**	-0.06	0.07	0.08	0.01	0.00	0.12	0.04	-0.05	0.06	0.18	.210*	0.08	0.11	.276**	-0.04	-0.12					
18	**Internet connectivity**	.20*	0.02	0.17	0.04	.20*	0.14	0.06	-0.02	-0.12	.249**	.199*	.355**	-0.05	0.13	0.16	-.193*	0.13				
19	**Appusability**	0.01	-0.07	-0.14	0.14	-0.10	0.14	0.01	0.07	-0.08	-0.07	.285**	.217*	0.09	0.15	-0.15	0.08	0.02	-0.02			
20	**Payment method acceptance**	.31**	0.04	0.08	-0.03	.22*	.29**	-0.03	0.12	0.04	-0.03	-0.12	0.04	.255**	0.00	0.16	0.16	-0.13	-0.06	-0.04		
21	**Others**	-0.19	-0.10	-0.05	0.08	-0.02	-0.18	.21*	0.11	-0.05	-0.12	0.03	-0.08	-0.06	-0.04	-0.06	-0.03	-.206*	-.275**	-0.10	-.244**	

Figure 9: Correlation Matrix

The study utilizes a correlation matrix to analyze the interrelationships between various factors affecting the use and perception of P2P payment systems in the tourism sharing economy. By examining the Pearson correlation coefficients, this analysis aims to identify significant associations and provide insights into how different variables interact with each other.

A correlation matrix is a powerful statistical tool that displays the correlation coefficients between pairs of variables. These coefficients range from -1 to +1, where +1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation. The correlation matrix helps us understand how factors such as privacy concerns, user interface design, internet connectivity, and various usability features relate to the frequency of use and overall user experience of P2P payment systems.

By systematically analysing the correlation coefficients, this evaluation seeks to uncover underlying patterns and dependencies that are crucial for optimizing P2P payment systems. The findings will not only highlight the strengths and weaknesses of the current systems but

also suggest targeted interventions to enhance usability, security, and inclusivity for users in the tourism sharing economy.

The analysis of significant correlations in the P2P payment systems reveals that frequent users are more likely to utilize these systems for transportation services (0.30**), while users who have experienced privacy breaches tend to have higher privacy concerns (0.195*). There is a notable relationship between robust internet connectivity and the value placed on offline functionality (0.355**), and faster transaction speeds correlate with a better perception of the payment system (0.19*). Partnerships with local banks help overcome language barriers (0.276**), and the acceptance of diverse payment methods significantly increases the frequency of use (0.311**). These findings underscore the need for intuitive UIs, reliable internet and offline capabilities, diverse payment options, and local partnerships to enhance usability, security, and inclusivity, aligning with existing research and providing actionable insights for improving P2P payment systems in the tourism sharing economy.

6.1 Frequency of Use and Privacy Concerns

The negative Pearson correlation coefficient of -0.131 suggests a weak negative relationship between frequency of use and privacy concerns. However, the p-value of 0.171 indicates that this correlation is not statistically significant. This finding implies that, although higher privacy concerns may slightly discourage frequent use, this relationship is not strong enough to be considered significant.

Implications:

Academic Perspective: This result highlights the need for further research to explore other factors that may influence the frequency of use of P2P payment systems.
Practitioner Perspective: While enhancing privacy features remains important, it may not be the sole factor affecting user engagement. Practitioners should consider a holistic approach that includes other usability and accessibility improvements.

6.2 Privacy Concerns and Experienced Privacy Breaches

The positive Pearson correlation coefficient of 0.195 indicates a weak to moderate positive relationship between privacy concerns and the experience of privacy breaches. The p-value of 0.040 suggests that this correlation is statistically significant at the 0.05 level. This finding implies that users who have experienced privacy breaches tend to have higher privacy concerns.

Implications:

Academic Perspective: This result underscores the importance of studying the impact of past negative experiences on current privacy concerns. It suggests a potential area for further research on mitigating the effects of privacy breaches.
Practitioner Perspective: Addressing past privacy breaches and improving the overall security of P2P payment systems can help reduce privacy concerns and build user trust.

6.3 Payment Method Acceptance and Frequency of Use

The positive Pearson correlation coefficient of 0.311 indicates a moderate positive relationship between payment method acceptance and frequency of use. The p-value of less than 0.001 signifies that this correlation is statistically significant. This finding suggests that users who have access to a wider range of payment methods are more likely to use P2P payment systems frequently.

Correlations

		Frequency_of_use	Payment_method_acceptance
Frequency_of_use	Pearson Correlation	1	.311**
	Sig. (2-tailed)		<.001
	N	111	111
Payment_method_acceptance	Pearson Correlation	.311**	1
	Sig. (2-tailed)	<.001	
	N	111	111

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 10: frequency vs payment acceptance

Implications:

Academic Perspective: This result contributes to the understanding of factors influencing the adoption and use of P2P payment systems. It highlights the importance of payment method diversity in user engagement.
Practitioner Perspective: Expanding the range of accepted payment methods and forming partnerships with local banks and payment providers can enhance user satisfaction and increase the frequency of use.

6.4 Internet Connectivity and Frequency of Use

Analysis: The positive Pearson correlation coefficient of 0.202 indicates a weak positive relationship between internet connectivity and frequency of use. The p-value of 0.034 indicates that this correlation is statistically significant at the 0.05 level. This finding suggests that users with better internet connectivity are more likely to use P2P payment systems frequently.

Implications:

Academic Perspective: This result highlights the importance of reliable internet connectivity in the adoption and use of digital payment systems.
Practitioner Perspective: Improving internet connectivity, particularly in areas with poor network infrastructure, can enhance the usability and frequency of use of P2P payment systems.

6.5 App Usability and Frequency of Use

The Pearson correlation coefficient of 0.006 indicates an extremely weak positive relationship between app usability and frequency of use. However, the p-value of 0.948

indicates that this correlation is not statistically significant. This finding suggests that app usability alone may not have a direct impact on the frequency of use.

Correlations

		Frequency_of_use	Appusability
Frequency_of_use	Pearson Correlation	1	.006
	Sig. (2-tailed)		.948
	N	111	111
Appusability	Pearson Correlation	.006	1
	Sig. (2-tailed)	.948	
	N	111	111

Figure 11: App usability and frequency

Implications:

Academic Perspective: This result suggests that while app usability is important, other factors may play a more significant role in influencing the frequency of use of P2P payment systems.
Practitioner Perspective: While it is essential to maintain a user-friendly interface, practitioners should also focus on other critical factors such as security, payment method acceptance, and internet connectivity to enhance user engagement.

6.6 Offline Functionality and Internet Connectivity

Analysis: The positive Pearson correlation coefficient of 0.355 indicates a moderate positive relationship between offline functionality and internet connectivity. The p-value of less than 0.001 indicates that this correlation is statistically significant. This finding suggests that users who have better internet connectivity are more likely to benefit from offline functionality features.

Correlations

		Offline_functionality	Internet_connectivity
Offline_functionality	Pearson Correlation	1	.355**
	Sig. (2-tailed)		<.001
	N	111	111
Internet_connectivity	Pearson Correlation	.355**	1
	Sig. (2-tailed)	<.001	
	N	111	111

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 12: offline functionality vs internet connectivity

Implications:

Academic Perspective: This result highlights the interconnectedness of internet connectivity and offline functionality in enhancing the usability of P2P payment systems.

Practitioner Perspective: Implementing offline functionality can significantly benefit users in areas with unreliable internet connectivity, thereby increasing the overall usability and reliability of the system.

6.7 Discussion

The evaluation of analysis and case studies underscores the multifaceted nature of enhancing the usability and inclusivity of P2P payment systems, while addressing privacy concerns. The moderate positive correlation (0.355) between offline functionality and internet connectivity highlights the necessity of robust online and offline capabilities, as suggested by Barradas and Pinto-Ferreira (2004).

Other factors, such as transaction speed, partnerships with local banks, low transaction cost, and simplified UI alone, showed weak or non-significant correlations with inclusivity. This suggests that these elements are insufficient in isolation to enhance user experience, resonating with the findings of Schröder and Theilen (2019). The weak positive correlation (0.164) between inclusivity and transaction speed, though not statistically significant, points to the potential benefit of faster transactions when combined with other usability enhancements. The weak negative correlation (-0.230) with partnerships with local banks, which was statistically significant, indicates potential user concerns that merit further qualitative investigation. The very weak and non-significant correlations for low transaction cost and simplified UI with inclusivity emphasize the need for a holistic design approach.

Privacy concerns were also examined, revealing a weak negative correlation (-0.131) with frequency of use, although this was not statistically significant. This finding implies that while privacy concerns may discourage use, their impact is not substantial enough to be considered significant. However, the positive correlation (0.195) between privacy concerns and experienced privacy breaches, which was statistically significant, underscores the lasting impact of privacy incidents on user perceptions and behaviour, aligning with studies of Ranzini et al. (2017).

These findings collectively highlight the necessity for comprehensive strategies incorporating diverse usability, security, and accessibility features to effectively improve P2P payment systems. Future research should focus on increasing sample size, conducting detailed usability assessments, and integrating qualitative insights to gain a deeper understanding and refine design methodologies. This approach aims to provide a more inclusive, user-friendly, and secure P2P payment experience, addressing both usability and privacy concerns comprehensively.

7 Conclusion and Future Work

The primary research question addressed in this study was: "How can P2P payment systems be optimized for privacy and accessibility in the tourism sharing economy?" The objectives were to identify key factors influencing the use of P2P payment systems, evaluate the impact

of privacy concerns and usability features, and suggest improvements to enhance user experience and inclusivity.

To answer the research question and achieve the objectives, a survey was conducted with 111 participants, collecting data on their use of P2P payment systems, privacy concerns, and perceptions of various usability features. The data were analyzed using Pearson correlation to identify significant relationships between variables.

Key Findings

1. **Privacy Concerns**: There is a weak negative correlation between privacy concerns and frequency of use, indicating that higher privacy concerns may slightly discourage frequent use. A significant positive correlation was found between privacy concerns and experienced privacy breaches, highlighting the lasting impact of privacy incidents on user perceptions.
2. **Offline Functionality**: A moderate positive correlation was found between offline functionality and internet connectivity, emphasizing the importance of robust online and offline capabilities.
3. **Payment Method Acceptance**: A moderate positive correlation between payment method acceptance and frequency of use indicates that providing diverse payment options can enhance system usage.

Implications of Research: The findings underscore the need for a multifaceted approach to enhance the usability and inclusivity of P2P payment systems. While factors like offline functionality and payment method acceptance are crucial, addressing privacy concerns and providing a simplified UI are equally important. These insights can guide developers and policymakers in designing more user-friendly and secure P2P payment systems.

7.1 Efficacy and Limitations

The research successfully identified key factors influencing the use of P2P payment systems and provided actionable insights for improving user experience. However, limitations include the sample size and the reliance on self-reported data, which may introduce bias. Additionally, the study's cross-sectional design does not allow for the establishment of causality.

7.2 Proposals for Future Work

Future research could focus on several areas to build on the findings of this study:

1. **Scalability and Performance Optimization:** Further optimization of the system's backend infrastructure and database management could address the performance bottlenecks identified during high usage periods.
2. **User Education and Support:** Developing comprehensive educational resources and user guides to improve understanding and adoption of blockchain transactions.

3. **Enhanced Accessibility Features:** Continuously improving accessibility features based on user feedback to ensure inclusivity for all demographics.
4. **Regulatory Compliance:** Exploring automated tools and frameworks to simplify compliance with varying regional regulations.
5. **Real-World Deployment and Monitoring:** Implementing the framework in a real-world setting beyond the experimental phase to gather long-term performance data and user feedback.

7.3 Potential for Commercialization

The insights gained from this research have significant potential for commercialization. Developers can use these findings to create more user-centric P2P payment solutions that cater to the needs of the tourism sharing economy. Enhancing privacy features, providing a simplified UI, and ensuring robust offline functionality can differentiate these systems in a competitive market, attracting more users and fostering greater trust and adoption.

7.4 Conclusion

This research contributes valuable knowledge on optimizing P2P payment systems for privacy and accessibility. By addressing the identified limitations and pursuing the proposed future work, the findings can be further refined and applied to create more effective and user-friendly P2P payment solutions in the tourism sharing economy.

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