RESEARCH ARTICLE

Encouraging Digital Participation of Communities in Tourism Development: The Future of AI, VR and Blockchain for Local Communities

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Abstract

This study explores the readiness and perspectives of local communities in the Bardhaman district of West Bengal regarding the adoption of emerging digital technologies, Artificial Intelligence (AI), Virtual Reality (VR) and Blockchain, in tourism development. As tourism increasingly shifts toward digital transformation, understanding community-level awareness, perceived benefits, challenges and willingness to participate becomes essential for designing inclusive and sustainable tourism strategies. Using a mixed-method survey administered to 120 respondents, the study examined awareness of digital tools, perceived socio-cultural and economic benefits, technological challenges and preferred modes of digital engagement. Results indicate high awareness of AI and VR, strong agreement on the benefits of digital participation and significant willingness among community members to engage in technologically enabled tourism activities. However, challenges such as limited internet infrastructure, digital literacy gaps and concerns regarding cost and data security remain notable barriers. Despite these constraints, the findings reflect an encouraging environment for integrating AI-driven services, VR-based cultural experiences and blockchain-enabled financial systems into community-led tourism initiatives. The study highlights critical infrastructural and training needs while emphasising the transformative potential of digital tools in empowering communities, enhancing cultural preservation and promoting sustainable tourism development.

Key Words: *Digital participation; Community-based tourism; Artificial Intelligence (AI); Virtual Reality (VR); Blockchain; Tourism development; Digital literacy; Bardhaman district; Emerging technologies; Sustainable tourism*

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1. Introduction

Tourism development is increasingly shaped by rapid advancements in digital technologies, offering new avenues for community engagement, cultural preservation and economic growth. As destinations around the world embrace digital transformation, local communities, often the custodians of cultural heritage and unique tourism assets, play a critical role in ensuring sustainable and inclusive tourism practices. Emerging technologies such as Artificial Intelligence (AI), Virtual Reality (VR) and blockchain are redefining how tourism services are designed, delivered and experienced. AI supports intelligent decision-making and personalised visitor interactions; VR offers immersive and accessible cultural and heritage experiences; and blockchain ensures secure, transparent and community-centered economic transactions. Despite their transformative potential, the extent to which communities are aware of, benefit from and are willing to adopt these technologies remains an important area of inquiry. Understanding these dynamics is essential for designing strategies that promote digital participation and empower local stakeholders. This study explores the levels of awareness, perceived benefits, challenges and willingness among community members to engage in digitally enabled tourism initiatives. By examining these factors, the research highlights pathways through which AI, VR and blockchain can strengthen community-driven tourism development and contribute to a more equitable and technology-enabled future for local tourism sectors.

Digital participation is transforming community-based tourism by enabling local communities to engage in the tourism process through digital platforms for promotion, e-bookings, content creation and storytelling. AI helps deliver personalised services through chatbots, predicts visitor needs by analysing behaviour and optimises resource use to support sustainability. For instance, a rural cooperative in Vietnam uses AI to guide agro-tourism scheduling. VR offers immersive cultural experiences, preserving heritage through 360° content and enabling virtual visits that benefit both education and pre-trip promotion, as seen with Indigenous Canadian communities using VR for storytelling and trails. Blockchain enhances transparency and trust through direct payments, craft authenticity verification and eco-tourism credits, such as in a Thai village using a decentralized booking system. However, adoption is challenged by digital literacy gaps, high costs, infrastructure limits, cultural sensitivity concerns and unclear regulations. To address these, strategies include community-led digital training, cross-sector collaboration, culturally inclusive tech design, pilot initiatives for scalable learning and supportive policies to foster digital inclusion and safeguard community interests.

The integration of AI, VR and blockchain technologies into tourism development presents a transformative opportunity for local communities to actively participate in the digital economy. AI can personalise tourist experiences, analyse visitor patterns and enhance local business visibility, enabling communities to tailor services efficiently. VR allows remote exploration of cultural sites and heritage experiences, providing global exposure without the environmental impact of mass tourism, while simultaneously empowering local artisans and guides to showcase their offerings digitally. Blockchain ensures transparent, secure transactions and smart contracts, fostering trust between tourists and local service providers and supporting fair economic participation. Collectively, these technologies not only enhance the accessibility and inclusivity of tourism but also promote sustainable development by decentralising control, preserving cultural heritage and encouraging community-driven initiatives. As communities adopt these tools, they become active stakeholders in shaping tourism experiences, paving the way for a future where digital participation drives both economic growth and cultural preservation (Figure 1).

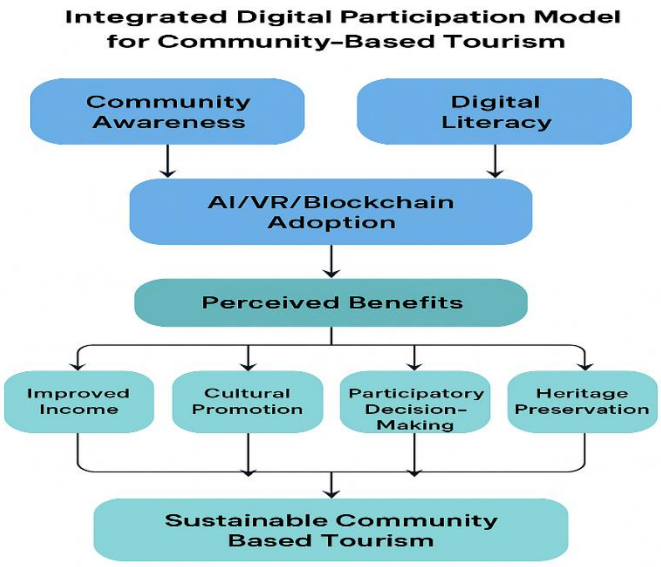

Figure 1: *Integrated digital participation model for community-based tourism.*

2. Literature Review

The role of digital technologies in transforming the tourism sector has received growing academic attention in recent years. As tourism moves toward more sustainable and inclusive models, community participation has been recognised as a critical component of development strategies [1]. The integration of technologies like Artificial Intelligence (AI), Virtual Reality (VR), and Blockchain has opened new avenues for empowering local communities and enhancing their engagement in tourism planning and promotion. According to Murphy, sustainable tourism must be rooted in community involvement to ensure cultural sensitivity and long-term viability [2]. However, traditional approaches often limit active participation due to a lack of access, education, or platform applications in tourism include personalised recommendation systems, sentiment analysis, and smart tourism infrastructure. AI can help local communities better understand tourist behaviour, manage resources efficiently, and develop targeted marketing strategies [3]. Furthermore, AI-powered chatbots and virtual assistants can enhance communication between local stakeholders and visitors, facilitating smoother participation and improved service delivery [4]. VR technologies have enabled immersive experiences that allow tourists to explore destinations virtually before visiting. For communities, VR offers a means to promote local heritage, culture, and attractions without physical intrusion or exploitation. According to Tussyadiah et al. [5], VR can also aid in heritage preservation by digitising cultural assets. It serves as a platform for community storytelling and education, enabling locals to present their narratives directly to a global audience. Blockchain technology introduces transparency, traceability, and security in tourism transactions. For local communities, blockchain can be a tool for fair revenue distribution, secure identity management, and transparent governance of tourism funds [6]. Smart contracts can ensure that agreed-upon terms between community members and external tourism operators are honoured, reducing exploitation and fostering trust. Despite the potential, digital participation is hindered by infrastructural gaps, lack of digital literacy, and socio-economic barriers [7]. Ensuring that digital tools are accessible and user-friendly is essential for encouraging widespread adoption. Furthermore, policy support, training, and localised technological adaptations are necessary to avoid marginalising underrepresented community groups. As AI, VR, and Blockchain technologies evolve, they must be integrated

with participatory models that respect cultural contexts and promote inclusivity. Researchers argue that co-creation of digital content and services between technologists and communities can yield more sustainable and authentic tourism experiences [8]. Artificial Intelligence (AI) has emerged as a key tool for personalising tourism services, improving decision-making, and facilitating predictive analytics that benefit both tourists and local stakeholders [9,10]. Similarly, Virtual Reality (VR) offers immersive experiences that allow communities to showcase cultural heritage and natural attractions remotely, supporting heritage preservation and expanding access to tourism markets [11,12]. Studies have highlighted that VR not only attracts tourists but also strengthens local identity and engagement by providing interactive platforms for storytelling and cultural education [13]. Blockchain technology, although relatively nascent in tourism applications, has been recognised for its potential to ensure secure and transparent transactions, enhance trust among tourists and local service providers, and facilitate community-based tourism initiatives [14,15]. By enabling decentralised management of payments, bookings, and digital assets, blockchain can empower local communities and promote inclusive economic participation [16]. Community engagement is central to the success of digital tourism initiatives, as local participation ensures the relevance and sustainability of interventions [17,18]. Research indicates that digital literacy, access to ICT infrastructure, and positive perceptions of technology significantly influence communities' willingness to adopt AI, VR, and blockchain in tourism [19,20]. Moreover, smart tourism strategies integrating these technologies can foster socio-economic benefits, such as increased local income, promotion of culture, and improved decision-making participation, while mitigating risks associated with digital exclusion [21,22]. Despite these advantages, challenges remain, including high costs of technology, inadequate infrastructure, and privacy concerns, which may hinder adoption among resource-constrained communities [10,19]. Therefore, the literature emphasises the need for tailored training programs, supportive policies, and user-friendly digital platforms to enhance community readiness for technology-driven tourism [20,23]. Collectively, these studies suggest that AI, VR, and blockchain, when strategically integrated with community participation, can transform local tourism ecosystems, ensuring inclusivity, cultural preservation, and sustainable development. Recent studies highlight the growing integration of technology in tourism, education, and library services. The UNWTO underscores global trends in digital inclusion, emphasizing how technological advancements are reshaping tourism and service accessibility [24]. Within the domain of library and information science, Mondal has contributed extensively across multiple dimensions. His work on job satisfaction among school library professionals provides insights into human resource challenges in educational institutions [25]. Further, his analysis of the National Digital Library of India traces its growth and impact on academic resource accessibility [26]. Mondal's subsequent studies focus on digital learning, mobile learning practices and the correlation between capital expenditure and institutional excellence in higher education [27,28]. Research on consumer intentions concerning remote access facilities adds a behavioural perspective to technology adoption in digital libraries [29]. Additionally, bibliometric evaluations, including the assessment of Indian universities' research performance and publication impact in specialized journals demonstrate his contributions to scientometric research. Mondal also examines modern shifts in library landscapes through AI integration and explores digital access via library website evaluation [30-33]. His recent webometric study on Twitter hashtags related to Indian Railways highlights the relevance of social media analytics in understanding public discourse and digital engagement [34].

3. Statement of the Problem

The rapid growth of digital technologies in the global tourism sector, many local communities, who are essential stakeholders in sustainable tourism development, remain underrepresented and insufficiently equipped to participate in digitally enabled tourism initiatives. While advanced tools such as Artificial Intelligence (AI), Virtual Reality (VR) and blockchain offer significant opportunities for economic empowerment, cultural promotion and enhanced governance, gaps persist in community awareness, digital literacy, access to infrastructure and trust in technology-driven systems. These limitations hinder communities from fully leveraging digital platforms, resulting in reduced participation, limited benefits from tourism activities and missed opportunities for innovation. Furthermore, the absence of adequate policies, training mechanisms and localised digital solutions exacerbates the digital divide, creating disparities in how communities engage with and benefit from emerging technologies. Therefore, there is a critical need to examine the current level of community awareness, perceived benefits, challenges and willingness to adopt AI, VR and blockchain in tourism development. Addressing these issues is essential for creating inclusive, resilient and future-ready tourism ecosystems that empower communities and enhance their role in shaping the digital tourism landscape.

4. Objective

- To explore how emerging technologies such as Artificial Intelligence (AI), Virtual Reality (VR) and Blockchain can enhance the digital participation of local communities in tourism planning and development.
- To assess the current level of awareness, accessibility and readiness among local communities for adopting digital tools in tourism initiatives.
- To examine the potential benefits and challenges of integrating AI, VR and Blockchain in fostering inclusive, community-driven tourism development.
- To identify best practices and digital frameworks that empower communities through co-creation, immersive storytelling and transparent decision-making in tourism.
- To recommend strategies for policymakers and stakeholders to strengthen community engagement through digital transformation in tourism governance.

5. Methodology

The study titled "Encouraging Digital Participation of Communities in Tourism Development: The Future of AI, VR and Blockchain for Local Communities" was conducted in the Bardhaman district of West Bengal, a region experiencing growing interest in heritage, rural and eco-tourism. The target population included residents, tourism entrepreneurs, panchayat-level stakeholders and digital service providers and due to the absence of a formal sampling frame for this diverse group, a purposive–convenience sampling technique was employed to identify individuals actively engaged in tourism activities. Of the 150 individuals approached, 120 provided completed responses, resulting in an 80% response rate, with participants recruited through in-person visits, community meetings and digital tourism networks; the sample was not weighted because of its non-probability nature, though demographic variation was monitored for representativeness. A structured mixed-method survey comprising Likert-scale items to assess awareness and perceived benefits, multiple-choice questions for demographic and infrastructural data and open-ended questions for qualitative insights was developed and pretested with 12 participants to ensure clarity, cognitive validity, appropriate sequencing and linguistic suitability.

Revisions based on feedback were incorporated and the instrument demonstrated acceptable reliability with Cronbach's alpha values ranging from 0.78 to 0.84, while content validity was confirmed through expert review by specialists in tourism and digital technology. The finalized survey was administered through both offline and online modes depending on participant accessibility and data were analyzed using SPSS (Version 26) and Microsoft Excel for descriptive statistics, frequency distributions and graphical presentations, while qualitative responses underwent thematic analysis. Overall, the methodology was designed to assess community preparedness, awareness, perceived benefits and challenges related to adopting AI, VR and blockchain in tourism development and to identify the infrastructural, digital literacy and policy gaps that must be addressed to promote inclusive, sustainable and digitally empowered tourism participation in Bardhaman.

6. Scope

This study focuses on exploring the potential of emerging digital technologies, namely Artificial Intelligence (AI), Virtual Reality (VR) and Blockchain, in enhancing community participation in tourism development within the Bardhaman district of West Bengal. It examines the awareness, readiness and perceptions of local stakeholders, including residents, tourism operators and grassroots-level decision-makers, toward integrating these technologies into tourism planning and promotion. The research also evaluates the role of digital tools in improving heritage preservation, local storytelling, virtual experiences and transparent financial transactions in community-based tourism. Furthermore, the study identifies areas where digital infrastructure and literacy need strengthening to ensure equitable and sustainable participation. The findings are intended to guide policymakers, technologists and tourism planners in designing inclusive, tech-enabled strategies for rural and heritage tourism in similar socio-cultural settings.

7. Limitation

While the study offers valuable insights into the digital participation of communities in tourism development within the Bardhaman district, it is not without limitations. Firstly, the sample size is limited to 120 respondents, which may not fully capture the diversity of opinions and experiences across the entire district. Secondly, the study primarily relies on self-reported data collected through structured questionnaires, which may be subject to response bias or social desirability bias. Thirdly, the focus is confined to three emerging technologies AI, VR and Blockchain, excluding other relevant tools that may influence digital tourism. Additionally, the study's findings are context-specific and may not be generalizable to other regions with different socio-economic or cultural characteristics. Finally, constraints such as limited time, resources and varying levels of digital literacy among participants may have affected the depth and scope of responses.

8. Data Analysis and Discussion

Table 1: *Awareness of digital technologies among community members.*

Digital technology	Highly aware	Moderately aware	Slightly aware	Not aware
Artificial Intelligence (AI)	30%	40%	20%	10%
Virtual Reality (VR)	25%	35%	25%	15%
Blockchain	10%	25%	30%	35%

Table 1 reveals a varied but promising level of awareness of emerging digital technologies among community members, indicating a strong foundation for fostering digital participation in tourism development. Artificial Intelligence (AI) shows the highest level of familiarity, with 30% of respondents being highly aware and 40% moderately aware, suggesting that communities are increasingly recognising AI's potential in enhancing tourism services, predictive analytics and personalised visitor experiences. Virtual Reality (VR) also demonstrates encouraging awareness levels, with 25% of participants highly aware and 35% moderately aware, reflecting growing interest in immersive technologies for virtual tours, cultural heritage visualisation and destination marketing. Although blockchain exhibits comparatively lower awareness, with only 10% highly aware and 25% moderately aware, the presence of a significant proportion of slightly aware respondents (30%) indicates an emerging curiosity about secure, transparent transaction systems that could empower local tourism economies. Overall, these awareness patterns highlight a positive trajectory: communities are gradually building the digital literacy needed to adopt AI, VR and blockchain, positioning themselves for meaningful engagement and leadership in the future of technology-driven tourism development.

Table 2: *Perceived benefits of digital participation in tourism.*

Benefits	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Improved local income opportunities	45%	35%	10%	5%	5%
Better promotion of local culture	50%	30%	15%	3%	2%
Enhanced decision-making participation	40%	38%	12%	6%	4%
Preservation of heritage	35%	40%	15%	7%	3%

Table 2 demonstrates a strong and positive perception among community members regarding the benefits of digital participation in tourism development, reinforcing the potential of technologies such as AI, VR and blockchain to support inclusive and sustainable growth. A majority of respondents strongly agree (45%) or agree (35%) that digital tools can enhance local income opportunities, indicating that communities recognise the economic potential of technology-enabled tourism platforms, smart marketing systems and AI-driven service enhancements. Similarly, 80% of participants acknowledge that digital participation leads to better promotion of local culture, reflecting strong confidence in VR-based cultural storytelling, AI-supported content creation and digital heritage archives. The perceived improvement in decision-making participation, highlighted by 78% agreeing or strongly agreeing, shows that communities value the transparency and inclusivity offered by digital tools, particularly blockchain-based governance and data-sharing platforms. Additionally, the belief that digital engagement supports heritage preservation, with 75% agreeing or strongly agreeing,

underscores the growing trust in VR simulations, 3D documentation and AI-powered conservation systems. Overall, these findings indicate a highly positive outlook within communities, suggesting that increased digital participation can significantly empower local stakeholders and ensure that AI, VR and blockchain become catalysts for more resilient and culturally vibrant tourism development.

Table 3: *Challenges faced in digital adoption.*

Challenge	Percentage (%)
Lack of internet infrastructure	40%
Limited digital literacy	35%
High cost of devices/technology	30%
Fear of misuse of data	25%
Language and usability barriers	20%

Table 3 highlights the key challenges hindering digital adoption among community members, yet the distribution of responses reflects a constructive starting point from which targeted interventions can significantly improve digital participation in tourism development. The most prominent barrier is the lack of internet infrastructure (40%), illustrating the need for enhanced connectivity to support AI-driven tourism solutions, VR-based experiences and blockchain-enabled services. Limited digital literacy (35%) similarly underscores the importance of capacity-building programs, but it also suggests that a substantial part of the community is already digitally engaged and capable of adopting emerging technologies with appropriate training. The high cost of devices and technology (30%) remains a concern, especially for resource-constrained communities, though increasing affordability and government or institutional support can help bridge this gap. Concerns about misuse of data (25%) indicate rising awareness of digital security—an area where blockchain can play a transformative role in building trust through transparency and secure transactions. Language and usability barriers (20%) further highlight the need for localized, user-friendly interfaces, which modern AI tools increasingly support through translation and adaptive design. Overall, while challenges exist, the percentages reveal strong potential for overcoming these barriers, suggesting that communities are well-positioned to embrace AI, VR and blockchain as vital tools for inclusive and future-ready tourism development.

Table 4: *Preferred digital tools for tourism engagement.*

Digital tool	Preferred by respondents (%)
Mobile apps for promotion	65%
VR-based virtual tours	45%
AI chatbots for info	35%
Blockchain for payments	15%

Table 4 presents the community's preferences for digital tools in tourism engagement, revealing strong interest in accessible and impactful technologies that can enhance local tourism development. Mobile apps for promotion are the most preferred tool (65%), indicating that communities value easy-to-use platforms for showcasing attractions, sharing cultural content and connecting with visitors, an encouraging sign for integrating AI-powered personalisation into these applications. VR-based virtual tours are favoured

by 45% of respondents, reflecting the growing acceptance of immersive technologies that can vividly present local heritage, natural landscapes and cultural experiences to a global audience, even from remote locations. AI chatbots, preferred by 35%, demonstrate a positive outlook toward automated information services that can improve tourist interaction, offer multilingual support and reduce pressure on local human resources. Although blockchain for payments has a lower preference (15%), its presence indicates early awareness of secure, transparent transaction systems, which can strengthen trust and financial inclusion in tourism activities. Overall, the preferences shown in Table 4 highlight a promising readiness among communities to adopt diverse digital tools, reinforcing the potential of AI, VR and blockchain to transform tourism participation and empower local stakeholders in shaping a tech-enabled future.

Table 5: *Willingness to participate in digitally enabled tourism projects.*

Willingness level	Percentage of respondents (%)
Very willing	50%
Somewhat willing	30%
Neutral	10%
Unwilling	7%
Strongly unwilling	3%

Table 5 highlights a highly positive and encouraging level of willingness among community members to participate in digitally enabled tourism projects, reinforcing the strong potential for integrating AI, VR and blockchain technologies into local tourism development. Half of the respondents (50%) report being very willing to engage, demonstrating strong enthusiasm and readiness to adopt digital tools, which is essential for building community-led smart tourism ecosystems. An additional 30% are somewhat willing, suggesting that with appropriate training, awareness programs and supportive policies, a large majority of the community can become active participants in technology-driven tourism initiatives. The small portion of neutral responses (10%) indicates a segment that may require more information or hands-on exposure before fully committing, while the combined 10% who are unwilling or strongly unwilling reflect minimal resistance likely driven by concerns such as digital literacy, cost, or trust issues. Overall, the overwhelmingly positive willingness levels reveal that communities are open to embracing digital transformation, creating a fertile environment for the adoption of AI-powered services, VR-based cultural experiences and blockchain-supported financial systems. This willingness serves as a strong foundation for building inclusive, innovative and sustainable tourism participation frameworks for the future.

9. Major Findings

The major findings of the study highlight a highly promising landscape for advancing digital participation among local communities in tourism development, particularly through emerging technologies such as AI, VR and blockchain. Awareness levels of AI and VR are relatively high, indicating a strong foundation for integrating intelligent systems and immersive experiences into community-based tourism initiatives. Perceived benefits are overwhelmingly positive, with respondents recognising digital tools as powerful enablers of income generation, cultural promotion, informed decision-making and heritage preservation key pillars for sustainable tourism growth. Although challenges such as limited internet infrastructure, digital literacy gaps and cost

constraints persist, these are not insurmountable and reflect areas where targeted support, training and policy interventions can significantly improve digital readiness. Preferences for digital tools, especially mobile apps, VR tours and AI-driven informational services, signal a forward-looking community mindset that is receptive to adopting innovative solutions. Most notably, the strong willingness of community members to participate in digitally enabled tourism projects demonstrates motivational readiness and a positive attitude toward technological transformation. Collectively, these findings underscore a highly encouraging environment where AI, VR and blockchain can empower communities, enhance local tourism development and foster inclusive participation in shaping a technologically enriched and sustainable tourism future.

10. Conclusion

In conclusion, the study clearly demonstrates that communities are increasingly prepared and motivated to engage with digital technologies as part of tourism development, signalling a transformative shift toward more inclusive and future-oriented tourism ecosystems. The findings reveal strong awareness of AI and VR, positive perceptions of digital benefits and a high willingness to participate in technology-driven initiatives, all of which reinforce the growing acceptance of digital tools as catalysts for local empowerment. Although challenges such as infrastructure gaps, limited digital literacy and cost barriers remain, these obstacles present opportunities for targeted interventions through capacity-building programs, improved connectivity and supportive policy frameworks. The community's preference for mobile applications, VR experiences and AI-based information services further highlights the practical pathways through which digital transformation can be effectively implemented. As blockchain gradually gains recognition for its secure and transparent transaction capabilities, it holds significant long-term potential for building trust and enhancing economic participation in tourism activities. Overall, the study concludes that fostering digital participation is not only feasible but critical for the sustainable development of local tourism and that strategic integration of AI, VR and blockchain can significantly enhance community engagement, cultural preservation and economic resilience in the tourism landscape of the future.

11. Ethics and Governance

The study adhered to standard ethical research practices to ensure the protection and rights of all participants. Informed consent was obtained from each respondent before data collection, with participants clearly briefed about the purpose of the research, voluntary participation and their right to withdraw at any time. To maintain confidentiality, no personally identifiable information was collected and all responses were anonymised during data entry and analysis. Data were securely stored in password-protected digital files accessible only to the research team and will be retained for academic purposes for a limited period before being permanently deleted. Given that several respondents expressed concerns about data misuse and digital privacy, additional measures were taken to reassure them that the study did not involve the collection of sensitive personal data and that all information would be used solely for aggregated academic analysis. These steps ensured that privacy risks were minimised and that participants felt comfortable contributing to the research.

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