

A study on the impact and implementation pathways of product innovation and private domain operations on traffic monetisation, driven by digital cultural and tourism initiatives

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Abstract: Against the deep integration of digital technology and cultural tourism consumption, traffic monetisation has become a core bottleneck restricting the high-quality development of the digital cultural and tourism industry. This study aims to reveal the internal transmission path and boundary conditions of how product innovation and private domain operations jointly affect traffic monetisation. Based on the 2018–2023 panel data of 31 provincial-level regions in China, this paper takes consumer behaviour and cultural intelligence as control variables and constructs a dynamic structural equation model with Bootstrap mediation and moderation tests. The results show that product innovation and private domain operations significantly boost traffic monetisation; user experience partially mediates the above relationships, and consumption upgrading positively moderates the correlation between the two core variables and user experience. Heterogeneity analysis verifies that the driving effect is far stronger in eastern China than in central and western regions. Practically, enterprises should carry out multi-dimensional product innovation and refined private domain operation layout centered on user experience, and formulate differentiated operation strategies matching regional consumption levels.

Keywords: *Consumption upgrading, Digital cultural tourism, Private domain operations, Product innovation, Traffic monetisation, User experience.*

1. Introduction

The deep integration of digital technology with the cultural and tourism industry has propelled the sector into a new phase of high-quality development, with traffic emerging as the core production factor and value carrier of the digital cultural and tourism industry. According to data from industry research reports, the market size of China's digital cultural and tourism industry will expand from 8026.7 billion yuan in 2021 to 15944.7 billion yuan in 2025, accounting for over 30% of the overall cultural and tourism market and demonstrating robust growth momentum. However, at the same time, the sector is widely facing structural development bottlenecks. Not only do the costs of acquiring traffic remain high, but monetisation efficiency also urgently needs to be improved. Coupled with prominent issues of product homogenisation and a lack of momentum for innovative development, the capacity for traffic retention and conversion through private domain operations remains weak, and the supporting systems are underdeveloped. This directly results in low user retention, making it difficult to meet users' core consumption demands amidst the wave of consumption upgrading. As product innovation and private domain operations represent key pathways to overcoming the current traffic dilemma, the intrinsic link between them and traffic monetisation, along with their underlying mechanisms, urgently requires systematic exploration and research.

Against this backdrop of industry development and research needs, this study aims to systematically deconstruct, through theoretical analysis and empirical testing, the specific pathways by which product innovation and private-domain operations influence traffic monetisation in digital cultural and tourism

scenarios. This involves clarifying the mediating effect of user experience and the moderating effect of consumption upgrading, thereby providing digital cultural and tourism enterprises with practical theoretical foundations and actionable pathways to enhance traffic monetisation efficiency and achieve high-quality development. This constitutes the core research question addressed by this study.

This study is underpinned by panel data from China's 31 provincial-level administrative regions covering the period 2018–2023. It employs a dynamic structural equation model (SEM), combined with the Bootstrap method, to precisely test mediating effects and moderating boundary effects. This is supplemented by heterogeneity analysis and robustness tests to form a multi-dimensional validation framework. Conducted through scientific and rigorous research methods, the study holds significant theoretical and practical implications. At the theoretical level, this study examines four key areas: product innovation, private domain operations, user experience, and traffic monetisation to systematically reveal the complex interactions among multiple variables. It elaborates on the three-dimensional mediating pathways of user experience and the moderating mechanisms of consumption upgrading, thereby addressing the shortcomings of existing research, which has tended to offer fragmented discussions on the factors influencing traffic monetisation in digital cultural tourism, and further enriching the theoretical framework in the fields of digital cultural tourism and consumption upgrading; At the practical level, the research findings will clarify the core areas of focus for product innovation and private domain operations, providing practical guidelines for digital cultural and tourism enterprises to optimise product design, establish private domain operational systems and enhance user experience. At the same time, they will offer scientific decision-making references for the government in formulating industry support policies and promoting the improvement of quality and efficiency within the digital cultural and tourism sector.

The innovative aspects of this study are primarily reflected in three areas: perspective construction, research dimensions, and research methods. Firstly, in terms of perspective construction, the study breaks free from the inherent constraints of single-factor analysis. Following the full-chain logic from product to operations to experience and ultimately to monetisation, it organically integrates the two core driving factors of product innovation and private domain operations, providing an in-depth analysis of their synergistic effects on traffic monetisation. Furthermore, it innovatively introduces consumption upgrading as a boundary-adjusting variable, thereby establishing a multidimensional and multi-layered integrated theoretical analytical framework; Secondly, in terms of research dimensions, the core variables are broken down in detail: product innovation is subdivided into three dimensions, immersive experiences, cultural tourism combined with business formats, and IP content development; private domain operations are broken down into user acquisition, community management and user retention; and user experience is categorised into functional, emotional and cognitive dimensions. This ensures more precise variable measurement and a more in-depth analysis of underlying mechanisms. Thirdly, in terms of research methodology, we conduct empirical research based on provincial-level panel data from across the country. By comprehensively utilising dynamic structural equation modelling and the Bootstrap method, combined with heterogeneity analysis and robustness tests, we have established a multi-dimensional validation system. Compared with existing relevant research, this methodology is more scientific and comprehensive, thereby enhancing the reliability and rigour of our research conclusions.

2. Theoretical Background and Literature Review

The rapid development and transformative evolution of the digital cultural and tourism industry are inseparable from the support of a theoretical framework and the accumulation of existing research findings. This section clarifies the definitions, mechanisms of action, and current state of research for each variable by reviewing the core theoretical foundations and the research trajectory of relevant variables, thereby providing a solid theoretical and literature-based foundation for the formulation of subsequent research hypotheses and model construction. Furthermore, by incorporating several cutting-edge international publications, this section broadens the research perspective and enhances the study's international alignment and academic depth.

2.1. Theoretical Foundation

Based on the characteristics of the digital cultural and tourism industry and the logical connections between the research questions, this paper integrates four core theories to provide a solid foundation for the analysis of variable relationships and mechanisms of action.

2.1.1. The Experience Economy Theory

The Experience Economy Theory was first systematically proposed by Aboushouk [1]. Economic development has evolved from the agricultural, industrial, and service economies to the stage of the experience economy, where consumers are no longer satisfied merely with the functional value of products or services but increasingly seek the unique perceptions and emotional resonance gained through the process of participation. Building upon this theory, Christou, et al. [2] further proposed the strategic experience module, categorising experiences into five dimensions: sensory, emotional, cognitive, behavioural, and relational, thereby enriching the measurement dimensions of experience.

The theory of the experience economy plays a prominent role in the analysis of this paper. On the one hand, it underpins the three-dimensional classification logic of product innovation. The experience economy emphasizes user experience as its core, which aligns closely with the dimensional design used in this paper to deconstruct product innovation, thereby providing a theoretical basis for the value orientation of product innovation; on the other hand, it lays the foundation for measuring user experience. This paper categorizes user experience into functional, emotional, and cognitive dimensions, which essentially concretizes the concepts of utilitarian and value-based experiences within the experience economy theory; in particular, emotional and cognitive experiences directly correspond to the core demands of emotional resonance and cognitive engagement in the experience economy, thereby providing theoretical support for the construction of mediating variable dimensions and the analysis of their mechanisms of action.

2.1.2. Consumer Behaviour Theory

Consumer behaviour theory centres on Kotler's marketing management theory [3], which posits that consumer purchasing decisions are the result of the combined influence of product characteristics, external stimuli, and individual perceptions and experiences. Ajzen's Theory of Planned Behaviour [4] further supplements this framework, pointing out that behavioural attitudes, subjective norms, and perceived behavioural control influence behavioural intentions, which ultimately affect actual consumer behaviour. Furthermore, consumer behaviour theory emphasises the importance of relationship marketing, positing that long-term interaction and the building of trust are key to enhancing user loyalty and repeat-purchase rates [5].

Consumer behaviour theory explains the intrinsic link between private domain operations and traffic monetisation. The three key dimensions of private domain operations, user acquisition, community management, and user retention, are, in essence, end-to-end marketing interventions designed in accordance with consumer behaviour theory. This theory provides a clear logical chain explaining how private domain operations influence users' consumption decisions, i.e., traffic monetisation; simultaneously, it supports the mediating role of user experience, positing that product innovation and private domain operations must alter users' perceptions and experiences to ultimately translate into paid behaviour, thereby providing a theoretical basis for the path analysis in this paper.

2.1.3. Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was proposed by Aboushouk [1]. Its core tenet is that users' acceptance of technology depends on perceived usefulness and perceived ease of use; these two factors influence attitudes towards use and intention to use, ultimately determining actual usage behaviour. Building upon TAM, Christou, et al. [2] developed the Unified Theory of Acceptance and Use

of Technology (UTAUT) model, which further incorporates moderating variables such as social influence and availability, thereby enhancing the model's applicability.

In this paper, the Technology Acceptance Model provides theoretical support for the impact of product innovation and private domain operations on user experience. Digital cultural and tourism products are, in essence, a medium for the integration of digital technology and cultural and tourism resources; user acceptance of these products aligns with the logic of the Technology Acceptance Model. The immersive experiences and integration of cultural and tourism resources with business models in product innovation, as well as the precision of user traffic acquisition and the convenience of community management in private domain operations, all influence users' perceived usefulness and perceived ease of use, thereby affecting functional, affective, and cognitive experiences; at the same time, consumption upgrading, as a moderating variable, can be regarded as an extension of the enabling conditions and personal characteristics within the UTAUT model, explaining why, against the backdrop of consumption upgrading, product innovation and private domain operations have a more significant impact on enhancing user experience.

2.1.4. Value Chain Theory

The value chain theory, proposed by Aldebert, et al. [6], posits that value creation within an enterprise constitutes a chain of interrelated production and operational activities, comprising core activities, such as production, sales, and services, and support activities, such as technology development and human resources. Barile, et al. [7], drawing on the characteristics of the digital economy, proposed the theory of the virtual value chain, pointing out that in the digital age, enterprises can create value through virtual activities such as data collection, processing, and dissemination, thereby forming a value-creation pathway that runs parallel to the physical value chain.

In this paper, value chain theory guides the analysis of the value transformation pathways involved in monetising traffic within the digital cultural and tourism sector. The framework constructed in this paper essentially represents a virtual value chain for the digital cultural and tourism industry, in which product innovation constitutes a core link in technology development and value creation; private domain operations correspond to the sales and customer relationship management link; user experience serves as the key vehicle for value delivery and perception; and traffic monetisation represents the outcome of value realisation. This theory also underpins the synergistic effects of product innovation and private domain operations, positing that, as distinct links in the value chain, only through mutual coordination, where high-quality products reach users via private domain operations, and private domain operations enhance the user experience based on these high-quality products, can the value chain be closed, thereby maximising the efficiency of traffic monetisation.

2.2. Research on Core Variables

Against the backdrop of digital technology's comprehensive penetration of the cultural and tourism industry, academia has conducted extensive specialised research on the key elements of the digital cultural and tourism industry chain. Product innovation, as the core means of upgrading on the supply side, and private domain operations, as a new model of traffic management on the demand side, jointly determine the traffic conversion efficiency of platforms and cultural and tourism enterprises, whilst user experience and consumption upgrading constitute the transmission intermediary and external regulatory context, respectively. To clearly define the academic connotations of each variable, identify existing research consensus and divergences, and establish a foundation for the logical relationships between variables, this section systematically reviews the existing literature on the six core variables: digital culture and tourism, product innovation, private domain operations, user experience, traffic monetisation, and consumption upgrading.

2.2.1. Digital Cultural and Tourism

Digital cultural and tourism refers to an industrial model that takes digital technology as its core driving force, integrates cultural and tourism resources with digital content, and provides users with digital, personalised, and immersive experiences.

On the one hand, the diversity and openness of business entities within the cultural and tourism industry provide an industrial foundation for the integration of the digital economy; on the other hand, the powerful digital technologies, algorithms, and computing power of the digital economy have driven the comprehensive transformation and upgrading of all production and operational aspects of the cultural and tourism industry. The deep integration of these two elements has given rise to new modes of production, exchange, and value realization, embodying a complete mechanism of capital reproduction, from investment, through production and exchange, to value appreciation, which aligns to a certain extent with the theory of industrial cycles [8].

2.2.2. Product Innovation

In digital cultural and tourism scenarios, product innovation is primarily manifested across three dimensions: immersive experiences, ‘cultural and tourism plus’ business models, and IP content development. In accordance with the essence of high-quality development, the key to high-quality development in the cultural and tourism sector lies in driving integrated development through innovation, and the innovative development of integrated cultural and tourism products is an inherent part of this [8]. Product integration constitutes a foundational dimension and a defining characteristic of cultural and tourism integration [8], whilst the core of high-quality development in cultural and tourism integration lies in the iterative innovation of products [9]. Innovation in cultural and tourism products is driven by the synergy of internal and external factors [10] and refers to the process by which enterprises create new user value through the optimisation of product functionality, form, and content.

2.2.3. Private Domain Operations

The core of private domain operations comprises three dimensions: user acquisition, community management, and user retention. In 2021, an increasing number of traditional and emerging industries undergoing digital transformation actively or passively accelerated their deployment of private domain operations, shifting the focus of competition from ‘acquiring new users in the public domain’ to ‘private domain operations’, thereby highlighting the value of private domain traffic [11]. By establishing proprietary channels such as WeChat communities, mini-programmes or apps, enterprises retain user resources; through long-term management and accumulation, they can more effectively build their brand image and enhance user loyalty, thereby achieving user retention and value conversion.

2.2.4. User Experience

User experience refers to the perceptions and reactions users have before and after using a product [12]; it denotes the experience gained by users when interacting with a product or service under specific conditions [13]. Its core dimensions include functional, emotional, and cognitive experiences, and it serves as the central link connecting products and services with user consumption behaviour.

2.2.5. Monetisation of Traffic

The monetisation of traffic is a core operational mechanism within the internet economy; essentially, it involves the commercialisation of user attention and behavioural data aggregated by digital platforms, thereby unlocking economic value. It is both the ultimate manifestation of the appeal of cultural and tourism products and the effectiveness of private-domain operations, as well as the central hub linking user engagement, consumer decision-making, and corporate profitability. Its measurement draws upon the core arguments in *Win: Monetisable Business Models* and the research by Wang, et al. [14] on platform traffic-monetisation mechanisms.

2.2.6. Consumption Upgrading

Digital technology empowers the transformation and upgrading of traditional industries, whilst also giving rise to new consumption patterns and business models [5]. The essence of consumption upgrading lies in the evolution of household consumption from ‘quantitative satisfaction’ to ‘qualitative improvement’, and from ‘material consumption’ to ‘spiritual consumption’; this has a significant impact on cultural and tourism consumption decisions and willingness to pay [15]. The measurement indicator ‘proportion of development- and enjoyment-oriented consumption’ adopted in this paper draws on the measurement methods for consumption upgrading proposed by Zhen [5] and Liu, et al. [15].

2.3. Relationships between Variables and Research Hypotheses

2.3.1. Product Innovation, Private Domain Operations and Traffic Monetisation

Traffic monetisation in the digital cultural and tourism industry essentially involves the commercial transformation of product value and operational efficiency, with product innovation serving as the core foundation for traffic monetisation and private domain operations acting as the key driver for the efficient conversion of traffic. Liu, et al. [9] point out that the core of the digital economy’s empowerment of high-quality integrated development in culture and tourism lies in the continuous iterative innovation of cultural and tourism products. The three major dimensions of innovation, immersive experiences, the integration of culture, tourism and business formats, and IP content development, can create unique value for users at different levels, thereby driving the conversion of traffic into actual consumption: Immersive experiences utilise digital technology to create contextualised, participatory cultural and tourism experiences, effectively enhancing users’ sense of involvement and satisfaction, and stimulating an immediate desire to consume; ‘Cultural and Tourism + Business Models’ expand consumption scenarios through cross-sector integration, extending single-dimensional cultural and tourism consumption into diversified consumption, thereby increasing the potential for traffic monetisation; IP content development delves deeply into the cultural significance of cultural and tourism resources to create distinctive brands, thereby strengthening user brand loyalty and the willingness to make repeat purchases. Xiang, et al. [10] also confirm that the multi-dimensional nature of cultural and tourism product innovation can effectively create new user value and directly drive the conversion of consumer behaviour. Meanwhile, as a core model of traffic management in the digital economy era, relevant research by Zhang [11] indicates that private domain operations gain core value through precise user retention and efficient value conversion. Its three key components, user acquisition, community management and user retention, form a complete closed-loop traffic management system: user acquisition achieves the effective migration of public domain traffic to the private domain through precise targeting, addressing the issue of accuracy in traffic acquisition; community management enhances user retention through continuous interaction and content dissemination, fostering a positive consumer atmosphere; user retention builds trust through personalised services and the cultivation of long-term relationships. Kong, et al. [16] also point out that refined operational processes can effectively reduce user conversion costs and drive paid conversion among private domain users. In summary, both product innovation and private domain management can exert a direct, positive influence on the monetisation of traffic in the digital cultural tourism sector. Based on this, we propose that:

H₁: Product innovation has a significant positive impact on the monetisation of traffic in the digital cultural and tourism sector.

H_{1a}: Immersive experiences have a significant positive impact on the monetisation of traffic.

H_{1b}: ‘Cultural and Tourism +’ business models have a significant positive impact on the monetisation of traffic.

H_{1c}: IP content development has a significant positive impact on the monetisation of traffic.

H₂: Private domain operations have a significant positive impact on the monetisation of digital tourism and cultural traffic.

H_{2a}: User acquisition has a significant positive impact on the monetisation of traffic.

H_{2b}: Community management has a significant positive impact on the monetisation of traffic.

H_{2c} User retention has a significant positive impact on the monetisation of traffic.

2.3.2. The Mediating Role of User Experience

User experience serves as the core link between digital cultural and tourism products and services and users' consumption behaviour. Wang, et al. [12] categorise it into three dimensions: functional experience, emotional experience, and cognitive experience. They argue that these three dimensions constitute a comprehensive system of user perception of digital cultural and tourism products, and that the quality of this experience directly influences users' consumption decisions. Product innovation, as the core source of value for digital cultural and tourism products, can fundamentally optimise users' experiences across all dimensions. Research by Liu, et al. [9] confirms that product innovation pathways, namely immersive experiences, 'cultural and tourism +' business models, and IP content development, correlate precisely with the three dimensions of user experience: immersive experiences enhance the convenience and practicality of functional experiences by optimising product interaction design and scene creation, whilst simultaneously strengthening the sense of immersion in emotional experiences; 'Culture and Tourism +' business models satisfy users' diverse needs by expanding consumption scenarios, thereby further enriching the substance of the functional experience; IP content development deepens users' cognitive experience by conveying the cultural significance of cultural and tourism resources, thereby establishing brand value recognition. Private domain operations, as a phase of refined user-oriented service, have as one of their core objectives the optimisation of user experience through targeted operational activities. Zhang [11] points out that the three key phases of private domain operations can enhance user experience at different levels: precise user traffic diversion enables users to quickly access cultural and tourism products that meet their specific needs, thereby improving the relevance of the functional experience; community operations enhance users' emotional experience and sense of belonging through interaction amongst users and the brand's continuous output; personalised user retention, through bespoke services and timely responses to user requests, reinforces users' brand perception and trust. Furthermore, Zhang and Ren [13] on experiential consumption indicate that the high-quality functional, emotional, and cognitive experiences users gain from cultural and tourism consumption can significantly increase their willingness to pay and frequency of consumption, serving as a key internal driver for monetising traffic. It is thus evident that the positive impacts of product innovation and private domain operations are first channelled through user experience, which in turn drives traffic monetisation; that is, user experience acts as a mediator between these two factors and traffic monetisation. Accordingly, the following hypotheses are proposed:

H₃ User experience has a significant positive impact on traffic monetisation in the digital cultural and tourism sector

H_{3a} Functional experience has a significant positive impact on traffic monetisation

H_{3b} Emotional experience has a significant positive impact on traffic monetisation

H_{3c} Cognitive experience has a significant positive impact on traffic monetisation

H₄ User experience mediates the relationship between product innovation and traffic monetisation

H₅ User experience mediates the relationship between private-domain operations and traffic monetisation.

2.3.3. The Moderating Role of Consumption Upgrading

Consumption upgrading is the core trend in China's current cultural and tourism consumption. Zhen [5] points out that the upgrading of cultural and tourism consumption, driven by the digital economy, is essentially a process whereby consumer spending evolves from 'quantitative satisfaction' to 'qualitative improvement', and from 'material consumption' to 'spiritual consumption'. This process has led consumers to place higher demands on the experiential quality of cultural and tourism products and the level of refinement in services. Empirical research by Liu, et al. [15] also confirms that, against the backdrop of consumption upgrading, consumers' decisions regarding cultural and tourism spending no longer focus solely on the basic functions of products; instead, they place greater emphasis on personalised, high-

quality and meaningful experiential perceptions. This shift in consumer demand means that the role of product innovation and private domain operations in enhancing user experience exhibits marked contextual variations. Regarding the relationship between product innovation and user experience, when the level of consumption upgrading is high, users have higher expectations regarding the technical quality of immersive experiences, the depth of integration between cultural tourism and other business formats, and the cultural significance of IP content development. High-quality product innovation can precisely meet users' sophisticated and personalised needs, significantly amplifying the positive impact on user experience; whereas at lower levels of consumption upgrading, users focus more on the basic functions of cultural and tourism products, and the role of multi-dimensional product innovation in enhancing user experience is relatively limited. Regarding the relationship between private domain operations and user experience, the higher the level of consumption upgrading, the greater the users' expectations regarding the precision of traffic matching in private domain operations, the sense of exclusivity in community management, and the degree of personalisation in user retention; refined private domain operations can better meet users' demands for high-end services, thereby more significantly enhancing user experience; Conversely, when the level of consumption upgrading is low, users' service expectations regarding private domain operations remain at a basic level, and the role of private domain operations in enhancing user experience is relatively weak. In summary, consumption upgrading positively moderates the relationship between product innovation, private domain operations and user experience. Based on this, we propose:

H₆: Consumption upgrading plays a significant positive moderating role between product innovation and user experience.

H₇: Consumption upgrading plays a significant positive moderating role between private-domain operations and user experience.

2.3.4. Research Model Diagram

Based on the conceptual definitions of the variables, the review of theoretical literature, and the derivation of research hypotheses outlined above, the overall analytical framework for this study has been established: product innovation and private-domain operations have been selected as the two core explanatory variables, with traffic monetisation as the dependent variable; user experience has been designated as the mediating variable, and consumption upgrading as the moderating variable; while two types of control variables, consumer behaviour and cultural intelligence, have also been introduced, as shown in Figure 1.

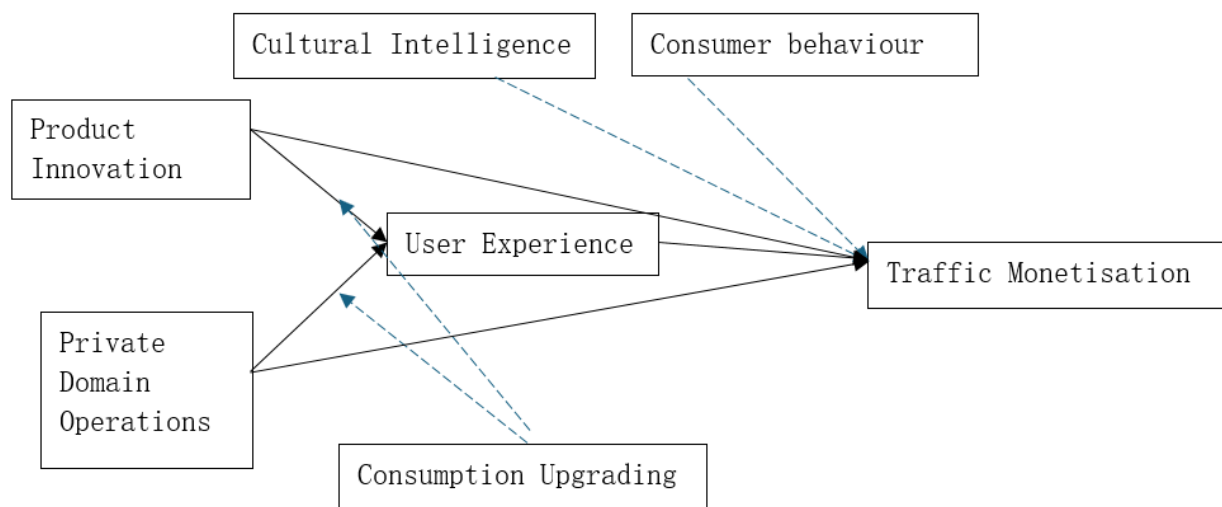


Figure 1.
Theoretical Framework of Traffic Monetisation Driven by Product Innovation and Private Domain Operations.

Product innovation and private domain operations, the two core independent variables of this research, not only exert a direct positive impact on digital cultural and tourism traffic monetisation, but also form mediating paths by optimising three-dimensional user experience (functional, emotional, and cognitive), thereby indirectly enhancing the level of traffic monetisation. Consumption upgrading exerts a moderating effect on the two pathways of ‘product innovation–user experience’ and ‘private domain operations–user experience’. The higher the proportion of leisure-oriented cultural and tourism consumption among residents, the greater the amplifying effect of product innovation and private domain operations on user experience, ultimately enhancing overall monetisation capacity. Consumption behaviour and cultural literacy, as control variables, exert a direct positive influence on traffic monetisation; visitors with higher consumption frequency and stronger cultural perception demonstrate more pronounced paid conversion and repeat purchase intentions. At the same time, user preferences and consumption conversion data accumulated during the traffic monetisation process flow back to the product innovation and private domain operations stages, driving product iteration and the optimisation of operational strategies.

3. Research Design

3.1. Variable Selection and Definition

Based on the theoretical deductions, literature review, and research hypotheses outlined above, this study identifies traffic monetisation as the dependent variable, product innovation and private domain operations as dual core explanatory variables, user experience as the mediating variable, and consumption upgrading as the moderating variable. Additionally, consumer behaviour and cultural intelligence are introduced as control variables, supplemented by two macro-level control indicators: regional per capita GDP and internet penetration rate. To ensure the standardisation of empirical quantification and the scientific rigour of indicator selection, this section clarifies, one by one, the conceptual definitions, dimensional classifications, measurement indicators, and data sources for each variable, thereby laying a standardised foundation for subsequent panel model construction and regression testing.

3.1.1. Dependent Variable: Traffic Monetisation (Revenue)

Traffic monetisation is the core manifestation of value realisation in the digital cultural and tourism industry. Drawing on the views of Liu [17], traffic monetisation can be measured using indicators such as user numbers and average revenue per user. In this study, traffic monetisation is measured using a composite index comprising per capita expenditure on digital cultural and tourism products and services, repurchase rates, and the proportion of derived consumption. Data are sourced from statistical bulletins issued by provincial departments of culture and tourism, the Wind database, and operational reports from online cultural and tourism platforms.

3.1.2. Core Explanatory Variables: Product Innovation (PI) and Private Domain Operations (PO)

Product Innovation (PI) draws on the scale proposed by Zhang, et al. [18] measuring product innovation across three dimensions: immersive experiences, ‘culture and tourism plus’ business models, and IP content development. Three items were selected for each dimension and quantified using provincial reports on the development of the digital culture and tourism industry and enterprise survey data; a composite index was derived using factor analysis.

Private Domain Operations (PO) drew upon the indicator system proposed by Kong, et al. [16] comprising three dimensions: user acquisition (private domain user growth rate), community operations (community activity), and user retention (user retention rate). Data were sourced from corporate private domain operations reports, WeChat ecosystem data, and third-party monitoring platforms.

3.1.3. Mediating Variable: User Experience (UE)

Based on the research by Christou, et al. [2] and Wang, et al. [12], a scale was designed comprising three dimensions: functional experience (ease of use, satisfaction of needs), emotional experience (sense of pleasure, sense of belonging), and cognitive experience (recognition of value, cultural understanding). Data were obtained through consumer questionnaires, scored using a 5-point Likert scale, and a composite index was derived through factor analysis.

3.1.4. Moderating Variable: Consumption Upgrading (CU)

Referring to data from the *China Statistical Yearbook* and the *China Residents' Consumption Statistical Yearbook*, consumption upgrading was measured by the proportion of development-oriented and enjoyment-oriented consumption within residents' cultural and tourism expenditure (i.e., the proportion of expenditure on service-based consumption such as education, culture and entertainment, healthcare, and tourism).

3.1.5. Control Variables: Consumption Behaviour (CB) and Cultural Intelligence (CQ)

Consumption behaviour (CB) was measured using two indicators: the frequency of digital cultural and tourism consumption and the amount spent, with data sourced from the questionnaire survey. Cultural intelligence (CQ) was measured using two items selected from the scale in the study A Research on Product Image Identification Design Method Based on Situational Problem-Solving, with data collected via a questionnaire survey. Additionally, two macro-level variables, regional economic development level (per capita GDP) and internet penetration rate, were controlled for, with data sourced from the China Statistical Yearbook.

3.2. Model Design

3.2.1. Baseline Regression Model (Testing Direct Effects)

To examine the direct effects of product innovation and private domain operations on traffic monetisation, the following two-way fixed-effects panel data model is constructed [3]:

$$\text{Revenue}_{i,t} = \alpha_0 + \alpha_1 \text{PI}_{i,t} + \alpha_2 \text{PO}_{i,t} + \alpha_3 \text{Control}_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

where i denotes the province and t denotes the year (2018–2023); $\text{Revenue}_{i,t}$ is the dependent variable (traffic monetisation); $\text{PI}_{i,t}$ and $\text{PO}_{i,t}$ are the core independent variables (product innovation and private domain operations, respectively); $\text{Control}_{i,t}$ is the set of control variables; μ_i is the provincial fixed effect; λ_t is the time fixed effect; and $\varepsilon_{i,t}$ is the random error term.

3.2.2. Mediation Effect Model (Testing the Mediating Role of User Experience)

The mediation effect was tested using stepwise regression and the Bootstrap method, with the following model constructed:

$$\text{UE}_{i,t} = \beta_0 + \beta_1 \text{PI}_{i,t} + \beta_2 \text{PO}_{i,t} + \beta_3 \text{Control}_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

$$\text{Revenue}_{i,t} = \gamma_0 + \gamma_1 \text{PI}_{i,t} + \gamma_2 \text{PO}_{i,t} + \gamma_3 \text{UE}_{i,t} + \gamma_4 \text{Control}_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Where $\text{UE}_{i,t}$ is the mediating variable 'user experience', and the remaining variables are defined as in the baseline model.

3.2.3. Moderation Effect Model (Testing the Moderating Role of Consumption Upgrading)

The moderation effect is tested by constructing interaction terms, with the model as follows:

$$\text{UE}_{i,t} = \delta_0 + \delta_1 \text{PI}_{i,t} + \delta_2 \text{PI}_{i,t} \times \text{CU}_{i,t} + \delta_3 \text{PO}_{i,t} + \delta_4 \text{PO}_{i,t} \times \text{CU}_{i,t} + \delta_5 \text{Control}_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Where $\text{CU}_{i,t}$ is the moderating variable 'consumption upgrading'; $\text{PI}_{i,t} \times \text{CU}_{i,t}$ and $\text{PO}_{i,t} \times \text{CU}_{i,t}$ are interaction terms; the definitions of the remaining variables are as previously stated.

3.3. Sample Selection and Data Sources

3.3.1. Sample Selection

The study sample comprises data from China's 31 provincial-level administrative regions (excluding Hong Kong, Macao, and Taiwan) for the period 2018–2023. It covers relevant groups such as users of online cultural and tourism platforms, participants in immersive cultural and tourism projects, and members of private cultural and tourism communities. The sample period spans six years, comprising a total of 186 observations.

3.3.2. Data Sources

Macro-level data (such as per capita GDP, internet penetration rate, and indicators of consumption upgrading) were sourced from the *China Statistical Yearbook*. Industry data (indicators relating to product innovation and private-domain operations) were sourced from provincial reports on the development of the digital cultural and tourism industry. Micro-level data (indicators such as user experience, consumer behaviour, and cultural intelligence) were obtained through questionnaire surveys.

4. Empirical Results and Analysis

4.1. Correlation Analysis

In order to make a preliminary assessment of the linear relationships between the core variables and to rule out any obvious logical contradictions, this study conducted a Pearson correlation analysis on all research variables; the results are shown in Table 1.

Table 1.
Correlation Analysis.

Variable	Revenue	PI	PO	UE	CU	CB	CQ
Revenue	1						
PI	0.725***	1					
PO	0.578***	0.612***	1				
UE	0.654***	0.660***	0.510***	1			
CU	0.429***	0.503***	0.456***	0.589***	1		
CB	0.387***	0.412***	0.359***	0.401***	0.326***	1	
CQ	0.352***	0.398***	0.307***	0.423***	0.298***	0.451***	1

Note: *** p<0.01, ** p<0.05, * p<0.1; N=186.

As can be seen from the table, traffic monetisation is significantly positively correlated with product innovation, private domain operations, user experience, and consumption upgrading at the 1% significance level, with correlation coefficients of 0.725, 0.578, 0.654, and 0.429, respectively. This indicates that the core explanatory variables, mediating variables, and moderating variables all exhibit a stable positive association with the dependent variable, laying the foundation for subsequent hypothesis testing.

Furthermore, the correlation coefficient between product innovation and user experience is 0.660, whilst that between private domain operations and user experience is 0.510; both are significantly positively correlated at the 1% level, confirming the logical validity of user experience serving as a mediating variable linking the core explanatory variables to the dependent variable. The maximum correlation coefficient among the core variables was 0.725 (between product innovation and traffic monetisation), with all values falling below the critical threshold of 0.8; this suggests, at a preliminary stage, that there are no serious issues of multicollinearity among the variables. The control variables, consumer behaviour, cultural intelligence and traffic monetisation, also exhibited significant positive correlations at the 1% level, indicating that their inclusion in the model effectively eliminates interference from extraneous factors and enhances the accuracy of the regression results.

4.2. Diagnostic Tests

To ensure the validity of the regression model specification and the reliability of the results, this study conducted tests for multicollinearity on the panel data. The test results support the use of a two-way fixed-effects model, as detailed below:

This study utilised the Variance Inflation Factor (VIF) to test for multicollinearity among the variables, with the empirical criterion being that when $0 < \text{VIF} < 10$, there is no severe multicollinearity, whilst a $\text{VIF} \geq 10$ indicates moderate or higher levels of multicollinearity. The test results show that the VIF values for all study variables range between 1.23 and 1.68, with a mean VIF of 1.45; all are well below the threshold value of 10. The tolerance ($1/\text{VIF}$) ranges between 0.59 and 0.81, indicating that there is no severe multicollinearity among the variables in the model and that the regression results are not affected by multicollinearity.

Table 2.
Multicollinearity Test.

Variable	VIF	1/VIF
PI	1.68	0.59
PO	1.57	0.64
UE	1.42	0.70
CU	1.35	0.74
CB	1.29	0.78
CQ	1.23	0.81
Mean VIF	1.45	0.71

4.3. Testing for Direct Effects (Baseline Regression)

To test the research hypotheses H1 (product innovation has a significant positive effect on traffic monetisation) and H2 (private domain operations have a significant positive effect on traffic monetisation), as well as their sub-hypotheses, this study constructed a two-way fixed-effects baseline regression model. The regression results are shown in Table 3.

Table 3.
Regression results for Model 1.

Variable	Revenue
PI	0.5486***
PO	0.5150***
CB	0.2158***
CQ	0.1986***
Observations	186
R ²	0.689
-cons	1.2563***
Number of provinces	31
Year FE	YES
Province FE	YES

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; fixed effects (FE) denotes fixed effects
In addition, tests of the direct effects of the various sub-dimensions.

Table 4.
Regression results for Model 2.

Variable	Revenue
PI- Immersive experience	0.1862***
PI- Integrated culture and tourism business	0.1754***
PI- IP Content Development	0.1870***
PO- User acquisition	0.1683***
PO- Community Management	0.1725***
PO- User maintenance	0.1742***
Observations	186
R ²	0.689
-cons	1.2563***
Number of provinces	31
Year FE	YES
Province FE	YES

As can be seen from Tables 3 and 4, after controlling for consumer behaviour, cultural intelligence, and fixed effects for province and time, the regression coefficient for product innovation (PI) is 0.5486***, which is significantly positive at the 1% level. This indicates that product innovation has a significant positive driving effect on the monetisation of digital cultural and tourism traffic, thereby confirming Hypothesis H1; among its sub-dimensions, immersive experiences, ‘culture and tourism plus’ business models, and IP content development were all significantly positive at the 1% level, confirming Hypotheses H1a, H1b and H1c. Furthermore, the contribution of IP content development was slightly higher than that of the other dimensions, making it the key driver of traffic monetisation through product innovation.

The regression coefficient for Private Domain Operations (PO) is significantly positive at the 1% level, indicating that private domain operations have a significant positive impact on the monetisation of digital cultural and tourism traffic; Hypothesis H2 is thus confirmed; among its sub-dimensions, user acquisition, community management, and user retention all exhibit significantly positive regression coefficients at the 1% level, confirming Hypotheses H2a, H2b, and H2c. User retention has the highest coefficient, reflecting that the retention and in-depth management of private-domain traffic are key to enhancing monetisation efficiency.

About control variables, the regression coefficients for consumption behaviour (CB) and cultural intelligence (CQ) were both significantly positive at the 1% level, indicating that the higher the users’ consumption activity and the better their cultural literacy, the higher the efficiency of digital cultural and tourism traffic monetisation, which is consistent with theoretical expectations. The model’s R² value indicates that the core variables and control variables provide a good explanation for variations in traffic monetisation, and the model fits the data well.

4.4. Testing for Mediating Effects

The regression results for mediating effects are shown in Table 5.

Table 5.
Results of the mediation analysis.

Variable	Step 1: UE	Step 2: Revenue
PI	0.5318***	0.3928***
PO	0.4841***	0.2940***
UE	-	0.3075***
CB	0.1865***	0.1623***
-cons	1.1025***	0.9863***
Province FE	YES	YES
R-squared	0.654	0.723
Proportion of indirect effects (PI)	-	28.4%
Proportion of indirect effects (PO)	-	42.9%
UE- Feature Experience		0.0985***
UE- Emotional Experience	-	0.1126***
UE- Cognitive Experience	-	0.0904***
CQ	0.1752***	0.1568***
Observations	186	186
Year FE	YES	YES
Proportion of direct effects (PI)	-	71.6%
Proportion of direct effects (PO)	-	57.1%

As shown in Table 5, in the first-stage regression, the regression coefficient for product innovation (PI) on user experience (UE) was 0.5318***, whilst that for private domain operations (PO) on user experience (UE) was 0.4841***, both were significantly positive at the 1% level, indicating that the core explanatory variables significantly enhance user experience. In the second-stage regression, after including user experience (UE), the regression coefficient for product innovation was 0.3928***, that for Private Domain Operations was 0.2940***, both remained significantly positive at the 1% level, though they had decreased compared to the baseline regression coefficients. Furthermore, the regression coefficient for User Experience (UE) was 0.3075***, which was significantly positive at the 1% level, indicating that User Experience plays a partial mediating role between Product Innovation, Private Domain Operations, and Traffic Monetisation.

Specifically, within the product innovation pathway, direct effects accounted for 71.6% and indirect effects for 28.4%; within the private domain operations pathway, direct effects accounted for 57.1% and indirect effects for 42.9%. This reflects that the impact of private domain operations on traffic monetisation relies more heavily on the mediating role of user experience, whilst product innovation exerts a stronger direct driving effect. Among the sub-dimensions of user experience, emotional experience (0.1126***) had the highest mediating effect coefficient, indicating that emotional resonance is the core link connecting product/operations and user payment behaviour; hypotheses H3, H3a, H3b, H3c, H4, and H5 were all confirmed.

To further verify the significance of the mediating effects, a bootstrap test was conducted with 5,000 repeated samples. The results are as follows:

Table 6.
Bootstrap test.

Intermediary pathways	Mediating effect size	Standard deviation	Z	P> z	95% confidence interval	
					Upper limit	Lower limit
PI-UE-Revenue	0.1558	0.0342	4.56	0.000	0.0892	0.2236
PO-UE-Revenue	0.2210	0.0432	5.12	0.000	0.1354	0.3068

The indirect effect of product innovation on traffic monetisation via user experience is 0.1558, with a 95% confidence interval of [0.0892, 0.2236], which does not include 0; the indirect effect of private domain operations on traffic monetisation via user experience is 0.2210, with a 95% confidence interval of [0.1354,

0.3068], which does not include 0. This further confirms that the partial mediating effect of user experience is significant, and the research conclusions are robust.

4.5. Moderation Effect Tests

To verify the positive moderating effect of consumption upgrading (hypotheses H6 and H7), this study introduced interaction terms (PI×CU and PO×CU) into a two-way fixed-effects model to test the moderating effect of consumption upgrading on the ‘product innovation, user experience’ and ‘private domain operations, user experience’ pathways. The results are shown in Table 7; all regressions controlled for control variables as well as fixed effects for province and time.

Table 7.
Results of the moderation effect test.

Variable	UE
PI	0.4256***
PO	0.3982***
CU	0.2568***
PI*CU	0.1254**
PO*CU	0.1486**
CB	0.1653***
CQ	0.1526***
-cons	1.0586***
Observations	186
R ²	0.756
Year FE	YES
Province FE	YES

As can be seen from Table 7, the regression coefficient for consumption upgrading (CU) is 0.2568***, which is significantly positive at the 1% level, indicating that consumption upgrading in itself can significantly enhance user experience; the coefficient for the interaction term between product innovation and consumption upgrading (PI×CU) is 0.1254**, which is significantly positive at the 5% level, indicating that consumption upgrading positively moderates the relationship between product innovation and user experience; the higher the level of consumption upgrading, the more significant the effect of product innovation on enhancing user experience, thereby confirming Hypothesis H6; the coefficient for the interaction term between private domain operations and consumption upgrading (PO×CU) is 0.1486**, which is significantly positive at the 5% level, indicating that consumption upgrading positively moderates the relationship between private domain operations and user experience; the higher the level of consumption upgrading, the more significant the effect of private domain operations on enhancing user experience, and Hypothesis H7 is thus confirmed.

Table 8.
Results of the test for moderating effects of sub-dimensions.

Variable	UE
PI- Immersive experience*CU	0.0385**
PI- Integrated culture and tourism business *CU	0.0413**
PI-IPContent Development*CU	0.0452**
PO- User acquisition*CU	0.0485**
PO- Community Management*CU	0.0498**
PO- User maintenance*CU	0.0516**

When examined by sub-dimension, the interaction terms between IP content development and consumption upgrading (0.0452**) and between user retention and consumption upgrading (0.0516**) exhibit relatively higher coefficients. This indicates that, against a backdrop of significant consumption upgrading, the development of high-quality IP content and refined user-retention strategies yield a

stronger marginal effect on enhancing user experience. This aligns with the reality that, as consumption upgrades, users place greater emphasis on the cultural significance and personalised services of cultural and tourism products. The model's R^2 stands at 0.756, indicating a good fit, which suggests that the inclusion of moderating variables has further enhanced the model's explanatory power.

4.6. Heterogeneity Analysis

Given the significant regional disparities in the development of China's digital cultural and tourism industry, this study divides the sample into the eastern region and the non-eastern regions (central and western regions). Grouped regressions were conducted using a two-way fixed-effects model to test for regional heterogeneity in the core effects. The results are shown in Table 9; all regressions controlled for control variables as well as fixed effects for province and time.

Table 9.

Analysis of regional heterogeneity.

Variable	Eastern Region (Revenue)	Non-Eastern regions (Revenue)
PI	0.6258***	0.4290***
PO	0.5892***	0.3150***
UE	0.3256***	0.2018**
CU	0.2896***	0.1965**
CB	0.2365***	0.1892***
UE Mediating effect	0.3568***	0.2154*
CU Modulating effect	0.1685**	0.0986*
PI*CU	0.1452**	0.0895*
PO*CU	0.1623**	0.0924*
CQ	0.2158***	0.1765
-cons	1.3256***	1.1023***
Observation	96	90
Number of Provinces	11	20
R^2	0.768	0.615
Year FE	Yes	Yes
Province FE	Yes	Yes

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; The eastern region comprises 11 provincial-level administrative regions, whilst the non-eastern region comprises 20 provincial-level administrative regions.

As can be seen from Table 9, the driving effects of monetising digital cultural and tourism traffic exhibit marked regional differences, with the overall driving effects in the eastern region being significantly stronger than those in the central and western regions: in the eastern region, the regression coefficient for product innovation is 0.6258*** and that for private-domain operations is 0.5892***, both higher than the 0.4290*** and 0.3150*** recorded in non-eastern regions; the coefficient for the mediating effect of user experience in the eastern region is 0.3568**, which is significantly higher than the 0.2154* observed in non-eastern regions; the coefficient for the moderating effect of consumption upgrading in the eastern region is 0.1685**, which is also higher than the 0.0986* observed in non-eastern regions.

In terms of operational characteristics, the eastern regions rely more heavily on the mediating effect of user experience and the moderating effect of consumption upgrading; this is consistent with the reality that the eastern regions have a robust foundation in the digital cultural and tourism industry, a high level of consumption upgrading, and users with higher expectations regarding the quality of their experience; non-eastern regions, on the other hand, rely more heavily on the direct driving effects of product innovation and private-domain operations. This reflects the fact that the digital cultural and tourism industry in central and western regions remains at a stage of development characterised by a product-centric approach underpinned by operations, where the refined cultivation of user experience and the enabling role of consumption upgrading have yet to be fully realised.

4.7. Robustness Tests

4.7.1. Substitution of the Dependent Variable

The dependent variable ‘traffic monetisation’ (average expenditure per capita + repurchase rate + proportion of derived consumption) was replaced with the growth rate of digital cultural and tourism revenue, and the baseline regression was re-run. As shown in Table 10, the regression coefficient for product innovation (PI) was -0.727 , whilst that for private domain operations (PO) was 0.414 . The signs of these coefficients remain consistent with those of the baseline regression. Although the level of significance has decreased ($p > 0.1$), this is primarily due to the high volatility of revenue growth rates, which are influenced by factors such as macroeconomic conditions and policy changes; it does not indicate a change in the effects of the core variables. This suggests that the results of the baseline regression are stable and free from systematic bias.

Table 10.

Baseline regression model after replacing the dependent variable.

Variable	Revenue Growth Rate
PI	0.727
PO	0.414
CB	0.1865
CQ	0.1752
-cons	1.0256*
Observations	186
Number of Provinces	31
R ²	0.523
Year FE	Yes
Province FE	Yes

4.7.2. Truncation of Data

All continuous variables were truncated at the 1% and 5% quantiles to eliminate the influence of outliers. The baseline regression was repeated. As shown in Table 11, following truncation, the regression coefficients for Product Innovation (PI) and Private Domain Operations (PO) both changed by less than 13% compared with the baseline regression coefficients, and both remained significantly positive at the 1% level; the results of the 1% and 5% truncation were highly consistent, indicating that the model data did not suffer from severe outlier issues and that the core conclusions are robust.

Table 11.

The benchmark regression model following truncation.

Variable	1% truncation (Revenue)	5% truncation (Revenue)
PI	0.5214***	0.5368***
PO	0.4986***	0.5065***
CB	0.2015***	0.2086***
CQ	0.1892***	0.1935***
Observations	186	186
-cons	1.2158	1.2365***
Number of provinces	31	31
R ²	0.675	0.682
Year FE	Yes	Yes
Province FE	Yes	Yes

5. Implementation Pathways

5.1. Tiered Implementation Pathway for Product Innovation

5.1.1. Pathway for the Digital Upgrade of Immersive Experiences

Utilize VR/AR, naked-eye 3D, digital lighting and shadow effects, and holographic interactive technologies to transform traditional cultural and tourism settings, creating immersive digital experience

spaces tailored to local resources such as hot springs, coastal areas, mountains and forests, folk customs, and intangible cultural heritage.

Establish online virtual cultural and tourism exhibition halls and digital cloud-touring systems, developing lightweight, immersive interactive content via mini-programmes, and bridging the gap between online public-domain traffic generation and offline physical experiences.

Integrating smart sensors and AI digital-concierge devices to enable personalised scene interactions, enhancing users' functional experiences and emotional engagement, and amplifying the willingness of high-end clientele to pay against the backdrop of consumption upgrading.

5.1.2. Pathways for Expansion through Multi-sector Integration in Culture and Tourism

Integration with technology: digital collectibles, live-streamed virtual tours, digital scripted tours, and AI-powered cultural and tourism companions.

Integration with health and wellness: digital health monitoring, online health and wellness courses, and digital hot-spring therapy packages.

Integration with cultural and creative industries: digital IP merchandise, online cultural and creative marketplaces, and customised digital commemorative content.

Integration with educational tours: digital educational courses, online cultural classes, virtual and real-world educational tour routes.

Extending the consumption chain through multi-sector integration to increase monetisation potential per visitor.

5.1.3. Development Pathways for the Full Lifecycle of Cultural and Tourism IP

Thoroughly explore the essence of local culture to create exclusive core cultural and tourism IP, establishing a comprehensive narrative framework and visual identity.

Develop IP-based offline real-world projects, online digital content, cultural and creative merchandise, and themed events in phases.

Continuously disseminate IP content via short-form video and social media platforms to strengthen user engagement and brand loyalty.

In high-end, premium markets, prioritise refined IP operations to drive repeat purchases and premium spending through cultural value.

5.2. Implementation Pathway for End-to-End Refined Private Domain Operations

5.2.1. Pathway for Precise Public Domain Traffic Redirection to Private Domains

Utilize public-domain channels such as Douyin, Xiaohongshu, Video Account, and OTA platforms to promote immersive products, wellness packages, and short videos featuring IP content.

Offer exclusive benefits, limited-edition experience vouchers, and digital collectibles as incentives to attract users, guiding them to add the company's WeChat account, join communities, and register for mini-programmes;

Build user profiles based on browsing, consumption, and preference data to achieve precise, segment-specific traffic acquisition, improve the relevance of traffic acquisition, and optimize the user experience.

5.2.2. Long-Term Community Engagement Strategy

Establish tiered communities: wellness communities for the elderly, parent-child family communities, high-end private hot-spring retreat communities, and communities for young digital cultural-tourism enthusiasts.

Regular operations: weekly cultural-sharing sessions, online wellness classes, limited-time group buys, recruitment for offline experiences, and community-exclusive events.

Establish user-interaction mechanisms to encourage the sharing of user-generated content (UGC), foster a sense of community belonging, and strengthen the emotional experience for users.

5.2.3. Full-Cycle User Retention and Value Conversion Pathway

Establish a user-tiering system: general visitors, members, and high-end private-domain VIPs, with differentiated benefits and bespoke services.

Full-cycle engagement: festive greetings, wellness programme reminders, invitations to experience new products, and personalised cultural and tourism itinerary recommendations.

Promptly respond to enquiries and after-sales requests from private-domain users, and refine the one-to-one dedicated wellness concierge service.

Launch bespoke long-stay holiday packages and annual wellness membership cards for high-spending, upmarket clientele to boost user retention, repeat purchases, and ancillary spending, thereby maximising the efficiency of traffic monetisation.

5.3. Three-Dimensional Optimisation Pathways for User Experience

5.3.1. Pathways for Optimising Functional Experience

Simplify the online mini-programme processes for booking, ticketing, ticket validation, and booking wellness services; optimize the ease of use of offline digital devices; improve supporting service facilities and online customer service channels; lower the barriers to use; cater to the operational needs of different age groups; and enhance the alignment between products and service requirements.

5.3.2. Pathways for Cultivating Emotional Experiences

Create points of emotional resonance through scenario-based and narrative content; design heart-warming experiential scenarios by integrating local longevity culture, Taoist wellness practices, and Wendeng's 'farming, reading, and learning' culture; consistently deliver uplifting content via private community groups; and enhance users' sense of belonging through bespoke services, thereby harnessing the core mediating role of emotional experiences.

5.3.3. Pathways for Deepening Cognitive Experiences

Continuously promote regional culture and wellness values through digital products, community content, and offline experiences; utilise cultural study tours, expert lectures, and digital science popularisation content to deepen users' recognition of the value of cultural tourism brands and wellness products, thereby enhancing their willingness to make long-term payments and fostering brand loyalty.

5.4. Implementation Pathways for Differentiated Traffic Monetisation by Region

5.4.1. Pathway for Upgrading High-End Digital Cultural and Tourism in the Eastern Region

Leveraging high levels of consumption upgrading, well-developed digital infrastructure and a customer base with strong spending power, the focus will be on high-end immersive digital projects, the development of exclusive IPs and one-to-one bespoke services within private communities; emphasis will be placed on unlocking the mediating value of user experience to establish a benchmark for high-end wellness, digital cultural and tourism, thereby increasing average transaction value and long-term residential tourism expenditure.

5.4.2. Pathway for Bridging the Digital Gap in Central and Western Regions

Prioritise the refinement of basic digital cultural and tourism products and the simplification of lightweight digital experience projects; establish foundational private-domain communities to retain users, with a focus on driving traffic monetisation directly through product innovation; gradually improve supporting user-experience facilities, iterating the refined private-domain operational system in tandem with local consumption upgrades to narrow regional monetisation gaps.

6. Conclusions and Recommendations

6.1. Research Conclusions

Based on panel data from China's 31 provincial-level administrative regions covering the period 2018–2023, this study employs a two-way fixed-effects model, Bootstrap mediation tests, interaction-term moderation tests, and group-specific heterogeneity regression to systematically, empirically examine the mechanisms through which product innovation and private-domain operations drive traffic monetisation in digital cultural and tourism scenarios. Combining mediation, moderation, and regional stratification analyses, the study arrives at five core conclusions:

Firstly, both product innovation and private-domain operations exert significant positive direct effects on the monetisation of traffic in the digital cultural and tourism sector. The three dimensions of product innovation (immersive experiences, cultural and tourism + business formats, and IP content development) and the three dimensions of private-domain operations (user acquisition, community management, and user retention) all significantly enhance the scale of traffic monetisation. Among these, IP content development and user retention are the key drivers with the highest contribution within the product and operational frameworks, respectively.

Secondly, user experience plays a mediating role between product innovation, private domain operations, and traffic monetisation. Product innovation can both directly drive traffic monetisation and indirectly enhance monetisation outcomes by optimising user experience; the transmission of private domain operations to traffic monetisation relies more heavily on user experience, with indirect effects accounting for 42.9%—significantly higher than the 28.4% share of indirect effects attributed to product innovation. Among the three dimensions of user experience, emotional experience exhibits the strongest mediating effect and serves as the core link stimulating user payment conversion.

Thirdly, consumption upgrading exerts a significant, positive moderating effect on the two core transmission pathways. The higher the level of consumption upgrading, the greater the impact of product innovation and private-domain operations on enhancing user experience; at the sub-dimension level, the interactive effects of IP content development, private-domain user retention, and consumption upgrading are most pronounced, with high-spending groups demonstrating greater sensitivity to cultural significance and personalized, exclusive services.

Fourthly, the mechanisms driving the monetisation of digital cultural and tourism traffic exhibit marked regional heterogeneity. In the eastern regions, the direct effects of product innovation and private-domain operations, the mediating effect of user experience, and the moderating effect of consumption upgrading are all significantly higher than in the central and western regions; the eastern regions feature a mature industry and a higher level of consumer spending, allowing the enabling effects of user experience and consumption upgrading to be fully realised; in the central and western regions, the industry is still in its early stages, and traffic monetisation relies more on the direct pull of products and operations.

Fifth, the control variables of consumption behaviour and cultural intelligence significantly and positively contribute to traffic monetisation. The higher the frequency of users' cultural and tourism consumption and the higher their level of cultural intelligence, the greater their acceptance of digital cultural and tourism products and their willingness to pay. Incorporating these into the model effectively eliminates interference from irrelevant variables, thereby enhancing the model's explanatory power and the reliability of the regression results.

6.2. Theoretical Contributions

Firstly, by systematically integrating the four key dimensions of product innovation, private domain operations, user experience and traffic monetisation, whilst simultaneously incorporating moderating variables such as consumption upgrading and control variables for consumer behaviour and cultural intelligence, this study overcomes the fragmented limitations of previous research that focused solely on products or private domains. It systematically clarifies the multi-variable composite transmission

mechanism, thereby filling a gap in integrated research covering the entire value chain of digital cultural and tourism traffic monetisation.

Secondly, by conducting a three-dimensional, granular decomposition of core variables and quantitatively identifying the varying intensities of their effects across each sub-dimension, this study identifies three key dimensions, IP content development, user retention, and emotional experience, thereby refining the variable measurement standards in the digital cultural tourism sector and deepening theoretical research into the intrinsic mechanisms of product innovation, private domain operations, and user experience.

Thirdly, we validate the regional stratification and heterogeneity of mediating and moderating effects. By integrating the theories of the experience economy, consumer behaviour, the Technology Acceptance Model (TAM), and the virtual value chain with the realities of provincial-level industrial development in China, we expand the application boundaries of classical theories within specific digital cultural tourism scenarios, thereby providing a new analytical perspective for research into the differentiated development of regional cultural tourism.

6.3. Practical Recommendations

Firstly, multi-dimensional efforts should be made to advance tiered product innovation, thereby forging a differentiated core competitive advantage in digital cultural tourism. Firstly, increase investment in immersive digital scenarios, utilising VR, holography and digital lighting and shadow effects to transform physical cultural and tourism resources such as hot springs, coastal areas and mountain forests, thereby creating digital experiences that integrate online and offline elements; secondly, continue to expand cross-sectoral integration models such as ‘cultural tourism + wellness, cultural creativity, educational tours, live streaming and digital collectibles’, broadening diverse consumption scenarios and enhancing the potential for revenue per customer; thirdly, deeply explore local cultural resources to create exclusive cultural and tourism IPs, supported by the long-term operation of digital cultural and creative products and themed events; leverage IP content development to drive high-premium consumption and meet users’ spiritual and cultural needs amidst consumption upgrades.

Secondly, establish a refined, end-to-end private domain operation system to enhance user lifetime value. In the public domain, utilise short videos and OTA platforms for targeted advertising and traffic generation, retaining private domain users through exclusive benefits; within community channels, operations will be segmented by customer groups, with regular cultural sharing sessions, exclusive group purchases, and offline experiential activities to boost community engagement and a sense of belonging; in user retention, a tiered membership system and one-to-one personalised service mechanisms will be established, using user profiling to recommend tailored wellness and cultural tourism products, whilst refined retention strategies will drive repeat purchases and long-term residential tourism spending.

Furthermore, we will collaboratively optimise the three-dimensional user experience, functional, emotional, and cognitive, to bridge the gap in the paid conversion pathway. We will streamline the operational processes for online and offline digital products, improve customer service, booking, and after-sales support to solidify the foundation of the functional experience; leverage local culture to create warm, inviting scenarios and a sense of community, thereby strengthening emotional resonance; and continuously produce cultural, educational, and wellness-focused content to deepen users’ brand awareness, fully utilising the core mediating role of the emotional experience to amplify the monetisation effectiveness of products and private domain operations.

Finally, implement a regionally differentiated development strategy to narrow the gap in digital cultural and tourism monetisation between the eastern and western regions. In the eastern regions, capitalising on the advantages of digital infrastructure and high-spending customer segments, the focus will be on developing high-end immersive projects and bespoke private-domain services to fully unlock the enabling value of consumption upgrades and user experience; in the central and western regions, priority will be given to filling gaps in basic digital products and establishing foundational private-domain traffic pools. By leveraging distinctive local cultural and tourism products to achieve direct traffic

conversion, whilst simultaneously improving internet infrastructure, these regions will gradually enhance their capabilities in refined operations and experience design, thereby driving the balanced and high-quality development of the national digital cultural and tourism industry.

Institutional Review Board Statement:

All questionnaire surveys carried out in this research strictly complied with the ethical standards of the Institutional Review Board of Dongbei University of Finance and Economics. Before data collection, all participants were fully informed of the research objectives, anonymous data processing rules, and voluntary participation principles. No sensitive personally identifiable information was collected, and all micro questionnaire data were aggregated and de-identified to fully protect respondents' privacy.

Data Availability:

The study adopted two types of data: provincial panel statistical data covering 31 provincial-level administrative regions of China from 2018 to 2023, released by the National Bureau of Statistics, the China Tourism Academy, and Wind Financial Database, and micro consumer questionnaire survey data collected by the research team targeting digital cultural tourism participants. The standardized integrated dataset is available from the corresponding author on reasonable request.

Transparency:

The author confirms that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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