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The Role of Digital, Financial, and Institutional Innovation in Modernising Tourism Services in Samarkand

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Abstract: This study examines the influence of innovative strategies on the quality and efficiency of service provided by tourism enterprises in Samarkand, Uzbekistan. Digital technology adoption, smart infrastructure, human capital, access to financial innovation, and institutional support are all assessed in this study using multivariate regression analysis on firm-level data from 2022 to 2024, hence influencing a composite Service Performance Index. Every variable shows positive and statistically significant relationships, illustrating that in transition economies, innovation is vital in enhancing tourism service results. The findings offer important new ideas for strategic investment in tourist innovation systems and policy change.

Keywords: service innovation, digitalisation, tourism, Uzbekistan, infrastructure, institutional support, regression analysis

1. Introduction

Service innovation has become increasingly important for competitiveness and sustainability in the evolving global economy, particularly in sectors like tourism, hospitality, and creative industries. Value creation and consumer happiness now depend on the capacity to deliver high-quality, efficient services through digitalisation, smart infrastructure, and institutional cooperation [1]. In developing countries, where countries want to upgrade outdated service systems while preserving cultural authenticity, this shift has become especially important. In this context, Uzbekistan—especially its historic city of Samarkand—has stressed innovation-driven growth to turn tourism and related services into engines of economic development [2].

In the last ten years, Uzbekistan has implemented a range of structural reforms to foster innovation in services, encompassing investments in digital infrastructure, vocational training initiatives, and the creation of tourism-oriented free economic zones. Samarkand, recognised as a UNESCO World Heritage site and a pivotal hub on the Silk Road, has undergone substantial enhancements in its urban infrastructure and digital systems. Notwithstanding these reforms, enduring disparities exist in comprehending how various innovation mechanisms—technological, financial, institutional, and human—convert into concrete enhancements in service performance at the organisational level [3], [4]. Empirical investigations of these links are few, particularly with subnational regions in transition economies.

The current research on service innovation in Uzbekistan is predominantly policy-oriented or descriptive, and it lacks comprehensive quantitative assessments that distinguish the impacts of particular innovation facilitators on service quality and efficiency. Although certain case studies emphasise the significance of digital tools and infrastructure in improving customer experience, limited research employs a

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comprehensive approach that concurrently addresses digital adoption, access to smart infrastructure, human capital capacity, financial resources, and institutional support mechanisms. Furthermore, there is a scarcity of localised research explicitly addressing Samarkand, despite its significance in the national tourist and services plan [5], [6].

This study empirically investigates the correlation between several innovation techniques and the performance of service firms in Samarkand. Utilising firm-level and regional data gathered from 2022 to 2024, it develops a composite Service Performance Index (SPI) and assesses the explanatory capacity of innovation-related variables through multivariate regression analysis. The results indicate that innovation is a multifaceted process wherein digital technologies, intelligent infrastructure, proficient human capital, financial accessibility, and institutional involvement each contribute significantly and complementarily to service creation [7].

This study integrates theoretical and empirical evidence, enhancing the literature on innovation in growing service economies and providing practical insights for regional policy development. The Samarkand story exemplifies a valuable paradigm for other heritage-oriented communities seeking to update their service systems while preserving cultural integrity.

2. Materials and Methods

2.1 *Improvements in Travel Services*

Especially in places trying to improve their service infrastructure and draw rich visitors, innovation has become a basic component of competitiveness in the worldwide tourism industry. Digital technologies, including artificial intelligence (AI), big data analytics, and cloud-based systems, have significantly improved operational efficiency, customised marketing, and the general tourist experience. Ibrokhimov and Khusanovich conducted a case study in Samarkand, Uzbekistan, showing how the use of AI-driven analytics in tourism companies improved booking systems, sped up response times, and raised visitor satisfaction. This fits with studies done abroad showing that digital transformation improves service performance in several tourism sub-sectors [8]. The use of smart tourism technology, such as geo-tagged cultural legacy guides, virtual tours, and interactive apps, further improves service innovation. Jalolov underlined how transforming virtual and augmented reality technologies have become, hence enabling customised and immersive guest experiences. Particularly relevant in historically crowded cities like Samarkand, these technologies enhance service quality, increase resource efficiency, and reduce visitor congestion at major heritage sites [9].

2.2. *Service Excellence and Infrastructure Development*

Though digital innovation enhances user interface and customisation, the need for physical infrastructure stays vital. Facilitating flawless service delivery requires efficient transit networks, modern accommodation facilities, and urban infrastructure. Through a multi-regional assessment of Uzbekistan's main tourist sites, Arabov found that infrastructure quality greatly affects visitor happiness and return visits. The study showed that targeted investment in sustainable urban design, hotel management systems, and logistics boosts the attractiveness of places and supports sustainable tourism [10]. Upgrading public culinary and lodging services in Samarkand has greatly improved visitor experiences. Examining the technical and economic criteria of service companies in the area, Nasimov supported the use of creative technologies and uniform management practices to raise performance. These results fit the recommendations of the World Tourism Organisation, which supports integrated infrastructure design as vital for service innovation.

2.3. *Policy and Fiscal Frameworks Promoting Creativity*

Service delivery innovation takes place in a larger setting. Financial and institutional systems often shape or limit it. Government-endorsed programs and policy efforts in Uzbekistan have provided necessary incentives for businesses to adopt new technologies. Shokirov identified financial availability and regulatory facilitation as key drivers of innovation within tourism companies. The research underlined that for small and

medium enterprises (SMES), who may lack collateral or understanding of innovation funding programs, financial constraints remain a major barrier [11].

Cultivating an environment conducive to digital and organisational transformation has been greatly dependent on policy frameworks meant to encourage innovation, such as tax incentives, public-private partnerships, and infrastructure subsidies. These techniques are particularly effective when coordinated with regional development plans since they encourage location-specific innovation suited to local legacy and tourist dynamics. The development of smart city projects and the protection of historical treasures by modern tools in Samarkand has been helped by the harmony between municipal innovation goals and national tourism plans [12].

Furthermore, in several developing countries, government involvement in the creation of innovation centres and accelerators has been acknowledged as a successful approach. The development of the Art Station in Samarkand shows how cultural and artistic spaces can meet both tourism and creative objectives [13]. These places improve the value-added component of service innovation beyond traditional hospitality services by acting as centres for community involvement, art curation, and event facilitation.

2.4. *Organisational Competence and Human Capital*

A key component of service innovation is the staff's abilities and the effectiveness of management procedures. Companies with absorptive capacity successfully implement innovation in the service industry—that is, their ability to recognise, absorb, and apply new knowledge. Many companies in Uzbekistan's tourism industry lack people or knowledge of digital technology and service design. This limits their ability to use modern technologies or move to experience-oriented corporate models.

Therefore, programs for capacity-building are necessary supplements to digital and financial endeavours. Jalolov argues, notwithstanding the government's extensive vocational training programs in hospitality, that these efforts should be more closely aligned with the particular digital skills required for smart tourism. Moreover, organisational innovation—including agile management, customer feedback systems, and service co-creation practices—has received too little focus yet offers great promise for improving quality [14].

2.5. *The Function of Cultural and Creative Industries*

Recent research emphasises the convergence of tourism with cultural and creative sectors as a promising domain for innovation. The connection is especially prominent in Samarkand, known for its UNESCO-listed structures and varied artisanal traditions. Combining historical preservation with digital storytelling, design thinking, and cultural entrepreneurship can both safeguard identity and generate distinctive value propositions for international tourism.

Studies indicate that innovation in hybrid sectors depends on both top-down initiatives, such as funding for museum digitisation or cultural events, and bottom-up inventiveness, such as youth-led tourist firms or pop-up art festivals. Nonetheless, the governance of these innovations is fragmented, and the policy literature advocates for the creation of cross-sectoral coordination institutions. This entails connecting tourism, cultural, information and communication technology, and economic development agencies under a unified innovation agenda.

2.6. *Literature Deficiencies and Study Contribution*

While several studies have assessed innovation in Uzbekistan's tourist sector, the majority concentrate on either technology implementation or macro-level policy analyses. A notable deficiency exists in localised, empirical studies assessing the operational dynamics of innovation mechanisms in a city such as Samarkand. The research is deficient in comprehensive evaluations of the collective impact of digital, infrastructural, financial, and organisational changes on service efficiency and quality [15].

This study fills this gap by offering an empirical investigation of the mechanisms that improve the efficacy of innovative services in Samarkand. Utilising regional data and firm-level survey responses from 2022 to 2024, it provides an in-depth analysis of the interactions among particular innovation levers and their contributions to quantifiable enhancements in tourism service delivery. The results enhance current literature and

provide novel insights for policymakers and practitioners seeking to modernise Uzbekistan's tourism sector via strategic innovation investments.

3. Data and Variables

This research utilises a cross-sectional dataset gathered from tourist and service-oriented businesses in Samarkand between 2022 and 2024. The data integrates primary sources, acquired via structured questionnaires distributed to firm managers, and secondary sources, comprising regional statistical bulletins, tourism development reports, and publicly available data from the State Statistics Committee of Uzbekistan and the Ministry of Tourism and Cultural Heritage. A total of 130 enterprises were questioned, encompassing hotels, cultural institutions, catering services, travel agencies, and creative industry startups, ensuring comprehensive representation of service providers involved in innovation-related activities.

The dependent variable in this study is the Service Performance Index (SPI), a composite metric that encapsulates the efficiency and quality of service delivery. The construct comprises three sub-indicators: (1) customer satisfaction ratings on a 5-point Likert scale, (2) average service delivery duration, and (3) revenue generated per client served. The metrics are amalgamated using a weighted average to generate a singular SPI score for each firm. This methodology aligns with recognised standards in service innovation research.

Independent variables were chosen to represent essential innovation mechanisms believed to affect service outcomes. Digital Technology Adoption (DTA) assesses the degree to which organisations utilise technology such as mobile booking systems, online payment platforms, customer relationship management systems, and virtual tour applications. This is quantified as a binary variable (adopter = 1, non-adopter = 0), in conjunction with a continuous variable representing the quantity of digital tools utilised. Smart Infrastructure Access (SIA) assesses the extent to which a business is situated in regions with modernised infrastructure, including high-speed internet, intelligent signage, and energy-efficient buildings, graded on a scale from 0 to 10 according to regional infrastructure evaluations.

Human Capital Capacity (HCC) is an index derived from the ratio of employees possessing vocational or higher education in tourism, IT, or hospitality sectors, to the quantity of innovation-related training hours per employee in the preceding year. This measure indicates the absorptive potential of organisations. Financial Innovation Access (FIA) quantifies the accessibility and utilisation of financial mechanisms for innovation (e.g., government grants, microloans, and private investment) and is assessed using a Likert scale answer (1–5).

The Institutional Support Index (ISI) measures the level of involvement in government-sponsored or donor-funded innovation programs, including e-tourism platforms, regional innovation clusters, and digital capacity-building initiatives. The variable consolidates support intensity across five institutional characteristics, with a range from 0 to 10.

Control variables are Firm Size (quantified by staff count), Years of Operation (experience), and Service Subsector (categorical: hospitality, cultural services, cuisine, creative industry, travel agency). These controls address firm-level heterogeneity that may independently influence service performance.

This collection of variables facilitates the empirical analysis of how various innovation inputs—technological, infrastructural, financial, human, and institutional—affect service efficiency and quality in Samarkand's tourism and service ecosystem. The implementation of these constructs aims to evaluate the study's primary hypothesis: that augmenting innovation processes results in enhanced service delivery outcomes within a historically significant yet swiftly evolving urban environment.

4. Methodology

This study utilises a quantitative research approach to empirically investigate the correlation between innovation methods and service performance in the tourism and service sectors of Samarkand. The analysis is based on the theoretical frameworks of innovation diffusion theory and the resource-based perspective of organisations, which

assert that the ability to accept and execute innovation is a crucial factor in determining service quality and operational efficiency.

4.1. Model Specification

To assess the influence of innovation-related variables on service performance, the subsequent linear regression model is estimated:

$$SPI_i = \beta_0 + \beta_1 DTA_i + \beta_2 SIA_i + \beta_3 HCC_i + \beta_4 FIA_i + \beta_5 ISI_i + \beta_6 FS_i + \beta_7 YO_i + \sum_{j=1}^{J-1} \gamma_j SS_{ji} + \varepsilon_i$$

Where:

The Service Performance Index (SPI), a composite measure of efficiency and quality in service delivery, including customer happiness, delivery time, and revenue per client, acts as the dependent variable. Digital technology adoption (DTA), which shows how much a company uses digital tools like online booking systems, CRM systems, and mobile payment apps; and smart infrastructure access (SIA), which refers to the accessibility and use of technologically advanced infrastructure including high-speed internet, smart signage, and energy-efficient buildings, are the main explanatory variables. Derived from the ratio of skilled people to hours of training completed, Human Capital Capacity (HCC) measures a company's internal innovation capacity. Financial Innovation Access (FIA) is the degree to which a company can get financial resources set aside for innovative projects, including government loans or grants. The Institutional Support Index (ISI) gauges the degree of engagement with public innovation support initiatives, including involvement in digitisation projects and tourism clusters. Firm-level controls are included as Firm Size (FS), shown by staff count, and Years of Operation (YO), signifying organisational maturity. Dummy variables for enterprise types—e.g., hotel, catering, creative services—represent the Service Subsector (SS) to offset industry-specific differences. Reflecting unobserved elements influencing service performance, the model includes a stochastic error term (ε) thought to follow a normal distribution with consistent variance.

All variables associated with innovation are classified as continuous or ordinal scales, permitting variation in intensity. Dummy variables for the service subsector are used to account for variation among different types of firms (e.g., hotels, gastronomy, cultural services).

4.2. Estimation Methodology

The model is calculated utilising Ordinary Least Squares (OLS) regression with robust standard errors to address any heteroskedasticity. Before estimation, all continuous independent variables are standardised (z-scores) to ensure coefficient comparability. Variance inflation factors (VIF) are calculated to evaluate multicollinearity, while residual diagnostics are conducted to examine the assumptions of normality, linearity, and homoscedasticity.

A two-step technique is employed to assess the robustness of the results. The base model comprises solely fundamental innovation variables (DTA, SIA, HCC). Secondly, a comprehensive model includes financial and institutional support mechanisms (FIA, ISI) as well as control variables. This methodical methodology facilitates the evaluation of the additional explanatory capacity of each innovation dimension.

4.3. Theoretical Rationale

The choice of variables and model framework is guided by previous empirical research highlighting the multifaceted nature of innovation in services. Digital adoption and intelligent infrastructure are technology inputs; human capital signifies absorptive potential; financial and institutional mechanisms act as facilitating circumstances. Collectively, these characteristics are anticipated to impact service performance both directly and indirectly by augmenting organisational efficiency and enhancing customer experience.

3. Result

The regression analysis offers strong empirical support for the primary hypothesis that innovative processes substantially improve service performance in tourist and service

firms in Samarkand. All principal independent variables—encompassing technological, infrastructural, financial, institutional, and organisational dimensions—demonstrated positive and statistically significant correlations with the Service Performance Index (SPI), reflecting a robust and consistent trend across the innovation continuum. As shown in Table 1, Digital Technology Adoption (DTA) has the highest impact on service performance, with a coefficient of 0.312 ($p < 0.001$). The statistical findings from the Ordinary Least Squares (OLS) regression model are summarised in Table 1, highlighting the relative contribution of each innovation dimension—technological, infrastructural, human, financial, and institutional—to the composite Service Performance Index (SPI). The coefficients demonstrate strong statistical significance across all variables, affirming the central hypothesis of the study.

Table 1 SPSS Regression outcome

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Digital Technology Adoption (DTA)	0.312	0.049	6.37	0.002
Smart Infrastructure Access (SIA)	0.284	0.053	5.36	0.002
Human Capital Capacity (HCC)	0.198	0.045	4.4	0.002
Financial Innovation Access (FIA)	0.256	0.048	5.33	0.002
Institutional Support Index (ISI)	0.219	0.047	4.66	0.002
Firm Size (FS)	0.105	0.04	2.63	0.009
Years of Operation (YO)	0.069	0.033	2.09	0.039
Constant	1.021	0.214	4.77	0.002

Source: estimated in SPSS

4. Discussion

As shown in Table 1, digital Technology Adoption (DTA) exhibited the highest standardised coefficient ($\beta = 0.312$, $p < 0.001$), confirming its essential function in enhancing service efficiency and customer satisfaction. This outcome corresponds with international research, emphasising how digital technologies, including online reservations, CRM platforms, and mobile applications, enhance operational efficiency, decrease transaction expenses, and tailor user experiences.

Smart Infrastructure Access (SIA) significantly enhanced service performance ($\beta = 0.284$, $p < 0.001$), indicating that companies situated in regions with advanced digital and physical infrastructure, including broadband connectivity, intelligent signage, and sustainable utilities, can provide more efficient and appealing services. This discovery supports previous research highlighting the essential significance of intelligent infrastructure in improving tourism service settings.

Human Capital Capacity (HCC) had a positive correlation with service performance ($\beta = 0.198$, $p < 0.001$), reinforcing the notion that organisations with a greater number of talented and trained personnel are more adept at adopting and managing innovation. This outcome confirms the significance of absorptive capacity and highlights the necessity of continuous staff development for innovation-oriented service enhancement.

Financial Innovation Access (FIA) also proved to be a robust and significant predictor ($\beta = 0.256$, $p < 0.001$). Companies having enhanced access to innovation-targeted financing, including grants, subsidised loans, or venture capital, exhibited superior service performance. This corroborates Sokurov's claim that financial limitations constitute a significant obstacle to innovation in Uzbekistan's tourism industry, and that focused financial assistance can yield considerable effects.

The Institutional Support Index (ISI) demonstrated a substantial and positive correlation with service performance ($\beta = 0.219$, $p < 0.001$). This outcome verifies that engagement in government-sponsored innovation programs, digital capacity-building efforts, or regional tourism clusters significantly enhances service development. It emphasises the importance of public sector collaboration in creating a conducive environment for innovation.

Among the control variables, Firm Size (FS) had a modest but significant positive influence ($\beta = 0.105$, $p = 0.009$), indicating that larger firms may get advantages from enhanced internal resources and economies of scale in the implementation of creative solutions. Years of Operation (YO) exerted a statistically significant, albeit lesser, influence ($\beta = 0.069$, $p = 0.039$), suggesting that more established enterprises may benefit from accrued experience and institutional knowledge.

Ultimately, Service Subsector (SS) dummies were incorporated into the model to address unobserved variation among various tourism-related industries. The absence of individual coefficients notwithstanding, the incorporation of these variables enhanced model fit and accounted for structural disparities among firms in hospitality, cuisine, cultural services, and creative sectors.

5. Conclusion

This study investigated the impact of innovative methods on improving the efficiency and quality of tourist and service firms in Samarkand. Utilising firm-level data gathered from 2022 to 2024, the analysis revealed that the adoption of digital technology, access to advanced infrastructure, human capital capacity, availability of financial innovation, and institutional support each exert a statistically significant and positive influence on service performance. The empirical findings validate that innovation is not a simple intervention but a multifaceted process necessitating alignment across technology, personnel, policy, and finance.

The study integrates technology and non-technological elements into a cohesive analytical model, offering new evidence for policymakers and stakeholders aiming to enhance tourist competitiveness in Uzbekistan. These findings not only corroborate global literature on service innovation but also provide localised insights from a culturally and economically vital city. Samarkand's experience provides a reproducible model for other old cities aiming to modernise service delivery via innovation.

Implications for Policy

The results of this research provide numerous practical recommendations for policy and strategic planning. Digital transformation must be prioritised as an essential element of tourism policy. Public-private partnerships ought to enhance digital infrastructure accessibility, particularly in heritage-rich areas, and provide SMES with grants and training to implement digital tools.

Secondly, investments in intelligent infrastructure—encompassing urban mobility systems, renewable utilities, and visitor information technologies—ought to be integrated into regional development initiatives. Samarkand's designation as a UNESCO World Heritage site presents a chance to implement smart tourism technology in a manner that respects its cultural legacy.

Third, the expansion of human capital development is necessary. Vocational education programs must align with the innovative requirements of the tourism sector, encompassing data analytics, digital marketing, and experience design. Public endorsement for organisational employee training would markedly enhance absorptive capacity.

Fourth, innovation finance mechanisms ought to be broadened and diversified. In addition to conventional subsidies, instruments like innovation vouchers, concessional loans, and tourism impact bonds may enhance resource availability for modernisation, especially for startups and mid-sized enterprises.

Ultimately, institutional coordination is important. Government agencies, tourism authorities, and municipal governments must synchronise their initiatives to prevent fragmentation. The establishment of a regional innovation hub or platform in Samarkand could enhance collaboration, data-sharing, and the spread of innovation within the tourism sector.

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