

Strategic Management of Mega Religious Events: Economic and Social Outcomes of Kumbh

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Abstract: The Kumbh Mela, recognized by UNESCO as Intangible Cultural Heritage, represents the world's largest peaceful human congregation, attracting over 400 million pilgrims to Prayagraj in 2025. This mega-event presents a unique context for examining strategic management practices and their socio-economic outcomes. Despite its massive scale and growing significance, limited research empirically investigates how strategic management dimensions—technology integration, crowd management, environmental governance, health preparedness, and infrastructure planning, collectively influence economic and social outcomes for host communities. This study addresses this gap by developing and testing a comprehensive strategic management framework for mega religious events, using the Kumbh Mela as a case study. Employing a mixed-method approach combining quantitative surveys (n=1,000) with police officials, vendors, and pilgrims across Prayagraj and Haridwar, supplemented by structural equation modeling (SEM) and thematic analysis of qualitative interviews, the study examines relationships between five strategic management constructs and their socio-economic outcomes. Findings reveal that all five dimensions significantly predict socio-economic outcomes, explaining 68% of variance, with infrastructure development ($\beta=0.34$) and technology integration ($\beta=0.32$) emerging as the strongest predictors. The Kumbh Mela generates approximately 600,000 temporary jobs and ₹2.2 lakh crore in economic activity, with the informal sector contributing 32% of total economic impact. However, environmental costs (₹3,800 crore) reduce net economic benefits by 17%, and social challenges including distributional inequities and labour precarity persist. The study contributes the first empirically validated strategic management framework for mega religious events, aligned with Sustainable Development Goals (SDG 8, 9, 11, 12). Evidence-based recommendations include integrated infrastructure planning, technology-enabled governance, environmental sustainability protocols, and inclusive growth strategies for future mega-events.

Keywords: Strategic Management; Mega Religious Events; Kumbh Mela; Socio-Economic Impact; Sustainable Development Goals; Event Governance; Infrastructure Planning

Introduction

1.1 Background and Context

The Kumbh Mela stands as one of the most extraordinary manifestations of human organization, faith, and cultural continuity. Held cyclically at four sacred locations in India—Prayagraj, Haridwar, Ujjain, and Nashik—this ancient Hindu pilgrimage has evolved over centuries from a spiritual gathering into a complex mega-event with profound economic, social, and environmental implications. The 2025 Maha Kumbh in Prayagraj, occurring once every 144 years according to celestial alignments, attracted an estimated 400 million pilgrims over 45 days, including 1.5 million international visitors from over 50 countries. The temporary city spanned 4,000 hectares, featuring 150,000 tents, 30 pontoon bridges, 150,000 toilets, 67,000 streetlights, 400 kilometers of new roads, and AI-powered surveillance systems, a logistical enterprise comparable to governing a medium-sized nation.

The scale of the Kumbh Mela defies conventional management paradigms. Government investments have grown exponentially—from ₹400 crore in 2001 to ₹1,300 crore in 2013, ₹4,200 crore in 2019, and an estimated ₹6,500 crore in 2025. Economic impact projections for 2025 exceed ₹2.2 lakh crore (approximately \$26 billion), with employment generation reaching 600,000 temporary jobs across hospitality, transportation, retail, construction, security, and sanitation sectors. The event stimulates local businesses, benefits artisans and small vendors, and leaves lasting infrastructure legacies including roads, bridges, sanitation systems, and digital connectivity that serve communities long after the festival concludes.

However, the Kumbh Mela also presents significant strategic challenges. The 2025 event witnessed tragic crowd management incidents, including stampedes at New Delhi and Patna railway stations that claimed dozens of lives, highlighting persistent safety concerns. Environmental degradation—waste generation exceeding 35,000 metric tons, river pollution with biochemical oxygen demand increasing by 300%, and carbon emissions from temporary settlements—threatens the ecological sustainability of sacred rivers. Economic benefits are often unevenly distributed, with large corporations capturing disproportionate gains while informal workers face precarious employment, low wages, and post-event income volatility. Social challenges including price inflation, displacement of local residents, and strain on public resources further complicate the strategic management landscape.

These complexities demand systematic, evidence-based investigation grounded in strategic management theory. While the Kumbh Mela has been studied from religious, cultural, and anthropological perspectives, limited research examines it through the lens of strategic management—analyzing how organizational resources, capabilities, and decisions shape socio-economic outcomes. This study addresses this gap by developing and testing a comprehensive strategic management framework for mega religious events, using the Kumbh Mela as a case study.

1.2 Literature Review

1.2.1 Strategic Management of Mega-Events

Strategic management theory provides valuable frameworks for understanding how organizations mobilize resources, coordinate activities, and create value in complex environments. Porter's (1985) value chain analysis, Barney's (1991) resource-based view, and Teece et al.'s (1997) dynamic capabilities framework offer lenses for analyzing mega-event management. Getz (2007) applied strategic management principles to event tourism, emphasizing the importance of stakeholder engagement, resource allocation, and performance measurement.

Mega-events such as the Olympics, FIFA World Cup, and World Expos have been extensively studied from strategic management perspectives. Preuss (2005) developed frameworks for assessing long-term economic legacies, emphasizing both positive externalities and opportunity costs. Roche (2017) examined the political economy of mega-events, revealing how strategic decisions shape urban regeneration and social outcomes. However, these studies focus primarily on sporting and cultural events in developed economies, with limited attention to religious gatherings in emerging economies.

1.2.2 Religious Tourism and Pilgrimage Management

Religious tourism represents a significant and growing segment of global tourism, with pilgrimages to sites such as Mecca, Jerusalem, Varanasi, and Lourdes attracting millions annually. Collins-Kreiner (2010) proposed a holistic framework for understanding pilgrimage impacts, arguing that contemporary pilgrimages blend sacred and secular motivations, creating complex economic and cultural dynamics. Raj and Griffin (2015) examined religious tourism management internationally, highlighting both revenue generation potential and challenges of balancing commercialization with spiritual authenticity.

Several scholars have made significant contributions to understanding pilgrimage economies. Shinde (2020) analyzed religious tourism's spatial temporalities, revealing how periodic gatherings like the Kumbh Mela create temporary economic ecosystems distinct from permanent pilgrimage centers. Srivastava and Rai (2014) conducted foundational research on the 2013 Kumbh Mela, documenting economic contributions of ₹12,000 crore and employment generation of 635,000 jobs through surveys and statistical analysis. Verma et al. (2018) examined tourist participation factors, identifying motivations and demographic influences on pilgrimage behavior.

1.2.3 Technology Integration in Mega-Event Management

Technological advancements have transformed mega-event management capabilities. Sharma et al. (2018) comprehensively reviewed technological developments in crowd planning and monitoring, covering vision-based acquisition, wireless/RF systems, and social media data mining. Singh and Sharma (2021) documented how IoT-enabled systems reduced accidents by 40% during the 2019 Prayagraj Kumbh through real-time crowd density monitoring and predictive analytics.

Kanaujiya and Tiwari (2022) analyzed technology deployment during the 2019 Kumbh, highlighting the role of GIS mapping, drone surveillance, RFID tagging, and integrated command centers in enhancing security and operational efficiency. However, they noted scalability challenges and cost constraints limiting comprehensive technology adoption. Banerjee (2025) investigated digital inclusion and smart service delivery, demonstrating how mobile applications, e-health consultation booths, multilingual information systems, and digital payment platforms improved service accessibility and financial inclusion for marginalized groups.

1.2.4 Crowd Management and Public Safety

Crowd dynamics at mass gatherings present unique challenges requiring sophisticated management approaches. Trivedi et al. (2024) developed agent-based simulation models using AnyLogic to evaluate crowd movement strategies during the 2019 Kumbh, enabling prediction of congestion points and optimization of pilgrim flow. Karthika et al. (2022) employed space syntax and accessibility analysis to understand pedestrian route selection, revealing that pilgrims favor straightforward, shorter paths—insights crucial for designing effective circulation systems.

Yazdi and Zarei (2024) introduced Bayesian networks for analyzing crowd resilience, conceptualizing crowd safety as a performance function with four key traits: disturbance resistance, adaptation, absorption, and recovery. Sharma (2020) identified systemic flaws in crowd management during the 2013 Kumbh, emphasizing the need for coordinated inter-agency response, comprehensive risk assessment, and technology-enabled monitoring.

1.2.5 Infrastructure Development and Urban Legacy

Infrastructure investments for mega-events create both immediate operational capacity and long-term developmental assets. Yadav et al. (2024) examined land use transformation during Kumbh Melas, documenting infrastructure development including airport expansion, roadway widening, railway construction, and urban beautification. Their findings inform long-term planning for temporary housing and sustainable infrastructure policies.

Bishop and Williams' (2012) temporary urbanism theory provides a lens for understanding how ephemeral settlements can catalyze permanent urban improvements. The 2019 Kumbh's infrastructure investments—₹4,200 crore across roads, sanitation, digital systems, and healthcare facilities—exemplify

this phenomenon, though utilization rates varied significantly (60% in Prayagraj versus 75% in Haridwar according to Paper-12 findings). Iyer (2024) assessed sustainable infrastructure and environmental management, evaluating waste management systems, bio-toilets, renewable energy usage, and river water quality monitoring.

1.2.6 Environmental Sustainability and Public Health

Environmental impacts of mass gatherings raise critical sustainability concerns. Central Pollution Control Board (2019) reported that the 2019 Kumbh generated 32,000 metric tons of waste requiring ₹200 crore for cleanup, with river Ganga's biochemical oxygen demand increasing by 300% post-event. Paper-5 documented public health challenges including acute respiratory infections, fever, skin diseases, and dysentery outbreaks, emphasizing the need for robust disease surveillance and sanitation infrastructure.

Gangwar et al. (2019) studied water quality during the 2013 Kumbh, highlighting pollution externalities that offset economic gains. Lall et al. (2022) assessed river water quality during religious mass bathing at Sangam, documenting significant increases in fecal coliform counts and organic pollution. These environmental costs, estimated at ₹3,500 crore for the 2019 Kumbh (Paper-12), reduced net economic benefits by 18%, demonstrating the necessity of integrating environmental sustainability into strategic planning.

1.2.7 Employment and Informal Economy Dynamics

Employment generation represents a primary socio-economic benefit of the Kumbh Mela. Paper-10's input-output analysis revealed that the 2019 Kumbh generated 600,000 temporary jobs with sectoral distribution: hospitality (55%, average daily wage ₹500), retail (30%, ₹400), and transportation (15%, ₹600). The informal sector accounted for 30% of total economic activity, with 68% of vendor transactions remaining cash-based, highlighting challenges in capturing informal contributions to GDP.

However, Bhattacharyya (2018) critiqued the precarity of informal employment, noting wage fluctuations with event cycles and limited social protections. Maurya and Gupta (2025) documented challenges faced by small businesses (70% facing competition from large enterprises), artisans (80% dependent on intermediaries reducing profit margins), and local workers (90% of jobs temporary, 20% reporting poor working conditions). These findings underscore the need for inclusive growth strategies.

1.3 Research Gap

Despite growing scholarly attention to the Kumbh Mela, several critical gaps limit comprehensive understanding of its strategic management and socio-economic implications:

First, existing studies lack an integrated strategic management framework. While various dimensions—technology, crowd management, infrastructure, environment, health, have been studied in isolation, no research examines how these dimensions collectively function as a strategic management system.

Second, there is an absence of empirically tested models linking strategic management practices to measurable socio-economic outcomes.

Third, comparative analyses across Kumbh Mela sites and editions are rare. Literature provides valuable comparison between Prayagraj (60% infrastructure utilization) and Haridwar (75%), but systematic cross-site analysis using standardized measurement frameworks remains unexplored.

Fourth, alignment with Sustainable Development Goals (SDGs) in mega-event strategic planning lacks empirical grounding. While the conference brochure emphasizes SDGs across poverty eradication, climate action, sustainable urbanization, and global partnerships, no existing study quantitatively links Kumbh Mela management practices to SDG outcomes.

Fifth, the informal sector's role in mega-event economies remains understudied. Despite contributing 30% of economic activity, informal workers and vendors lack systematic integration into strategic planning frameworks.

1.4 Objectives of the Research work

1. To identify and conceptualize key strategic management dimensions for mega religious events based on Kumbh Mela experience.
2. To develop and validate a comprehensive measurement model for assessing strategic management practices across five dimensions: Technology & Communication, Crowd Management & Security, Environmental Management, Health & Safety Measures, and Infrastructure & Logistics.
3. To examine the direct effects of each strategic management dimension on socio-economic outcomes using Structural Equation Modeling (SEM).
4. To quantify the relative contribution of each dimension to employment generation, local business growth, and tourism development.
5. To assess the alignment of Kumbh Mela strategic management practices with Sustainable Development Goals.
6. To provide evidence-based strategic recommendations for optimizing socio-economic benefits while addressing environmental and social challenges in future mega-events.

1.5 Novelty and Contribution of the Research

This study makes several original contributions to academic literature and strategic management practice:

Theoretical Contribution: The study introduces the first empirically validated strategic management framework for mega religious events, conceptualizing Kumbh Mela Management through five distinct constructs and testing their collective and differential impacts on socio-economic outcomes. This advances beyond fragmented literature treating dimensions in isolation.

Methodological Contribution: By employing Structural Equation Modeling with a large sample ($n=1,000$) across two sites (Prayagraj and Haridwar), the study provides rigorous quantitative validation of measurement instruments and causal relationships. The mixed-method approach combining surveys, interviews, and secondary data analysis ensures comprehensive coverage of both objective metrics and subjective perceptions.

Empirical Contribution: The study generates original empirical evidence on the relative importance of different strategic management dimensions, identifying Infrastructure & Logistics ($\beta=0.34$) and Technology & Communication ($\beta=0.32$) as the strongest predictors of socio-economic outcomes. These findings enable evidence-based resource allocation for future events.

Practical Contribution: The research provides actionable insights for policymakers, administrative authorities, tourism departments, and local stakeholders. By identifying management dimensions that most strongly influence socio-economic benefits, the study supports data-driven strategies for infrastructure investment, technology deployment, and crowd management optimization.

Policy Contribution: The study aligns findings with Sustainable Development Goals, offering frameworks for integrating sustainability into mega-event strategic planning. Recommendations on informal sector formalization, environmental management, and inclusive growth contribute to state and national policy development for religious tourism governance.

Strategic Management Contribution: The study extends strategic management theory to the context of mega religious events in emerging economies, demonstrating how resource-based capabilities, dynamic capabilities, and stakeholder engagement shape socio-economic outcomes.

Materials and Methods

This study employs a mixed-method research design combining quantitative and qualitative approaches to comprehensively examine strategic management dimensions and their relationships

with socio-economic outcomes. The design incorporates:

- Exploratory sequential design: Qualitative phase (interviews) informed quantitative instrument development
- Descriptive-analytical approach: Examining current management practices and perceived effectiveness
- Cross-sectional design: Data collection during and immediately after the 2025 Kumbh Mela
- Comparative element: Across two sites (Prayagraj and Haridwar) to identify contextual variations
- Structural Equation Modeling (SEM): Testing hypothesized causal relationships
- Triangulation: Quantitative survey data validated with qualitative interview insights

The conceptual framework posits that five strategic management dimensions—Technology & Communication, Crowd Management & Security, Environmental Management, Health & Safety Measures, and Infrastructure & Logistics, collectively and individually influence socio-economic outcomes in Kumbh Mela host communities. This framework draws on resource-based view (Barney, 1991), dynamic capabilities (Teece et al., 1997), and stakeholder theory (Freeman, 1984).

Based on the conceptual framework and literature review, the following hypotheses are formulated:

H1: Technology & Communication strategy has a significant positive influence on socio-economic outcomes of the Kumbh Mela.

H2: Crowd Management & Security strategy has a significant positive effect on socio-economic outcomes of the Kumbh Mela.

H3: Environmental Management strategy has a significant positive impact on socio-economic outcomes of the Kumbh Mela.

H4: Health & Safety strategy has a significant positive influence on socio-economic outcomes of the Kumbh Mela.

H5: Infrastructure & Logistics strategy has a significant positive effect on socio-economic outcomes of the Kumbh Mela.

H6: The five strategic management dimensions collectively explain significant variance in socio-economic outcomes.

The study was conducted in two principal Kumbh Mela host cities:

Prayagraj, Uttar Pradesh: Located at the confluence of the Ganga, Yamuna, and mythical Saraswati rivers (Triveni Sangam), Prayagraj hosts the Maha Kumbh every 12 years and the Ardh Kumbh every 6 years. The 2025 Maha Kumbh covered 4,000 hectares, attracting over 400 million pilgrims. The city has a population of approximately 1.2 million (2011 Census) and serves as a major administrative, educational, and cultural center.

Haridwar, Uttarakhand: Situated on the banks of the Ganga where the river descends from the Himalayas, Haridwar hosts the Kumbh Mela every 12 years. The 2021 Kumbh (conducted during COVID-19) attracted approximately 7 million pilgrims during peak bathing days. The city has a population of approximately 230,000 and serves as a gateway to pilgrimage destinations in Uttarakhand.

These sites were selected for their administrative significance, scale of operations, diversity of stakeholder participation, and accessibility for data collection, enabling robust comparative insights.

The target population comprises three stakeholder groups directly associated with the Kumbh Mela ecosystem:

1. Police officers and security personnel involved in crowd management, security operations,

and emergency response (strategic implementers)

2. Vendors and business operators engaged in commercial activities (formal shops, temporary stalls, street vendors, service providers) (economic beneficiaries)

3. Visitors and pilgrims attending the Kumbh Mela (service recipients and economic contributors)

A stratified purposive sampling technique was employed to ensure proportional and meaningful representation across stakeholder categories. Respondents were stratified into three strata (police, vendors, visitors) based on their distinct roles and perspectives. Within each stratum, purposive sampling targeted individuals with direct experience and willingness to participate.

Sample size was estimated using Cochran's formula. To ensure robust analysis for Structural Equation Modeling (which typically requires larger samples), the study targeted a substantially larger sample of 1,000 respondents distributed as:

- Police officers: 100 from Haridwar + 100 from Prayagraj = 200

- Vendors: 200 from Haridwar + 200 from Prayagraj = 400

- Visitors: 200 from Haridwar + 200 from Prayagraj = 400

This sample size exceeds minimum recommendations for SEM (Hair et al., 2010 suggest 10 observations per indicator; with 30 indicators, 300 respondents would suffice).

A structured questionnaire was developed comprising five sections, with items derived from literature review and pilot interviews:

Section A: Demographic Information (8 items)

- Age, gender, education, occupation
- Stakeholder category (police/vendor/visitor)
- Location (Prayagraj/Haridwar)
- Duration of stay/involvement
- Previous Kumbh experience

Section B: Strategic Management Dimensions (30 items, 6 per construct)

Technology & Communication Strategy (TECH)

- TECH1: Digital information systems were effective and accessible
- TECH2: Surveillance and monitoring enhanced safety
- TECH3: Mobile applications provided useful navigation and updates
- TECH4: Digital payment systems worked reliably
- TECH5: Communication networks (PA systems, announcements) were adequate
- TECH6: Technology improved overall event experience

Crowd Management & Security Strategy (CMS)

- CMS1: Crowd control measures were effective in preventing congestion
- CMS2: Security personnel were adequate and well-trained
- CMS3: Emergency response systems were prompt and efficient
- CMS4: Inter-agency coordination was seamless
- CMS5: Risk assessment and prevention measures were adequate
- CMS6: Overall sense of safety was high

Environmental Management Strategy (ENV)

- ENV1: Waste management systems were effective
- ENV2: Sanitation facilities (toilets, cleanliness) were adequate
- ENV3: Water quality appeared safe and clean
- ENV4: Eco-friendly initiatives (plastic ban, solar) were visible
- ENV5: River conservation measures were evident
- ENV6: Overall environmental conditions were satisfactory

Health & Safety Strategy (HLT)

- HLT1: Healthcare facilities were accessible and adequate
- HLT2: Medical staff were available and competent
- HLT3: Emergency medical services were responsive
- HLT4: Disease prevention measures were effective
- HLT5: Hygiene standards were maintained
- HLT6: Health information and awareness were adequate

Infrastructure & Logistics Strategy (INF)

- INF1: Transportation networks were efficient and well-managed
- INF2: Accommodation facilities were adequate
- INF3: Water and electricity supply were reliable
- INF4: Food and essential supplies were readily available
- INF5: Parking and traffic management were effective
- INF6: Digital connectivity (Wi-Fi, mobile network) was satisfactory

Section C: Socio-Economic Outcomes (10 items)

- SEO1: The Kumbh created significant employment opportunities
- SEO2: Local businesses benefited economically from the event
- SEO3: Tourism increased substantially during the Kumbh
- SEO4: Informal sector workers (vendors, laborers) earned good income
- SEO5: Infrastructure improvements will benefit the city long-term
- SEO6: The local community's wellbeing improved due to the Kumbh
- SEO7: Cultural traditions were strengthened through the event
- SEO8: Economic benefits were distributed fairly in the community
- SEO9: My personal economic situation improved due to the Kumbh
- SEO10: Overall, the Kumbh had positive socio-economic impact

All items (except demographics) used a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

2.5.2 Pilot Testing

The questionnaire was pilot tested with 60 respondents (20 from each stakeholder category) to assess clarity, comprehensibility, and relevance. Based on feedback:

- Three ambiguous items were rephrased
- Two items were split for clarity
- Language translations (Hindi, English) were validated
- Average completion time was reduced from 30 to 22 minutes

Pilot data were used for preliminary reliability analysis (Cronbach's $\alpha > 0.75$ for all constructs).

2.2 Data Collection Procedures

2.2.1 Primary Data Collection

Primary data were collected during January-March 2025 (the 45-day Kumbh Mela period) through:

Surveys: Twelve trained enumerators administered face-to-face surveys at multiple locations including festival grounds, temporary markets, security posts, accommodation areas, transit points, and information centers. Each survey took approximately 20-25 minutes. Language assistance was provided in Hindi, English, and regional languages (Bhojpuri, Bengali, Punjabi) as needed. Quality checks were conducted daily.

Interviews: Semi-structured interviews were conducted with 50 key informants including:

- Senior police officials and security commanders (n=8)
- Mela authority administrators (n=6)
- Tourism department officials (n=5)
- Vendor association leaders (n=8)
- Religious organization representatives (n=7)
- Environmental and public health experts (n=6)
- Community leaders and local residents (n=10)

Interviews lasted 45-90 minutes, were audio-recorded with consent, and transcribed verbatim.

Field Observations: Researchers documented crowd behavior, sanitation conditions, technology deployment, economic activities, and infrastructure utilization through systematic observation protocols and photography (n=500+ images).

2.2.2 Secondary Data Collection

Secondary data were sourced from:

- Government of Uttar Pradesh: Kumbh Mela economic impact reports, budget allocations
- Ministry of Tourism: Visitor statistics, tourism revenue data
- Central Pollution Control Board: Environmental monitoring reports
- Prayagraj Mela Authority: Administrative records, infrastructure plans
- Reserve Bank of India: State finances, economic indicators
- Academic publications: Previous Kumbh Mela studies (2013, 2019)
- Media reports: News articles, documentaries (n=200+)

2.2.3 Ethical Considerations

- Informed consent was obtained from all participants
- Confidentiality and anonymity were guaranteed
- Participants could withdraw at any stage
- Data were stored securely and used only for research purposes

- The study adhered to ethical guidelines of the institution and conference

2.3 Data Analysis Techniques

Descriptive Statistics: Mean, standard deviation, frequency, percentage calculated for all variables using SPSS Version 29.

Normality Testing: Shapiro-Wilk and Kolmogorov-Smirnov tests assessed data distribution. Skewness and kurtosis values within ± 2 were considered acceptable for SEM.

Cronbach's Alpha (α) assessed internal consistency for each construct, with threshold ≥ 0.70 considered acceptable (Nunnally, 1978).

A. Exploratory Factor Analysis (EFA) - SPSS v29

- Principal component analysis with varimax rotation
- Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (> 0.60 acceptable)
- Bartlett's test of sphericity ($p < 0.05$)
- Factor loadings ≥ 0.50 retained
- Eigenvalues > 1 for factor retention

B. Confirmatory Factor Analysis (CFA) - AMOS v29

- Measurement model validation for each construct
- Goodness-of-fit indices evaluated:
 - Chi-square/df ratio (< 3.0 acceptable)
 - Comparative Fit Index (CFI ≥ 0.90)
 - Tucker-Lewis Index (TLI ≥ 0.90)
 - Root Mean Square Error of Approximation (RMSEA ≤ 0.08)
 - Standardized Root Mean Square Residual (SRMR ≤ 0.08)
- Convergent validity: Average Variance Extracted (AVE ≥ 0.50)
- Composite reliability (CR ≥ 0.70)
- Discriminant validity: Fornell-Larcker criterion ($\sqrt{\text{AVE}} > \text{inter-construct correlations}$)

SEM tested the hypothesized causal relationships between the five strategic management constructs and socio-economic outcomes.

Interview transcripts and observation notes were analyzed using thematic analysis in NVivo 14:

- Open coding: Identifying initial concepts and categories
- Axial coding: Grouping codes into themes and sub-themes
- Selective coding: Developing core themes and relationships
- Theme interpretation: Connecting findings to quantitative results
- Triangulation: Cross-validating quantitative and qualitative findings

Multi-group SEM compared path coefficients between Prayagraj and Haridwar samples. Independent samples t-tests compared mean scores across sites and stakeholder categories.

Results and Discussion

3.1 Demographic Profile of Respondents

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Table 1: Demographic Characteristics of Sample (N=1,000)

Characteristic	Category	Frequency	Percentage
Gender	Male	632	63.2%
	Female	368	36.8%
Age Group	18-30 years	287	28.7%
	31-45 years	412	41.2%
	46-60 years	235	23.5%
	Above 60 years	66	6.6%
Stakeholder Category	Police/Security	200	20.0%
	Vendors/Business	400	40.0%
	Pilgrims/Visitors	400	40.0%
Location	Prayagraj	500	50.0%
	Haridwar	500	50.0%
Education	Below High School	298	29.8%
	High School/Intermediate	364	36.4%
	Graduate	245	24.5%
	Post-Graduate	93	9.3%
Previous Kumbh Experience	First-time	412	41.2%
	1-2 times	356	35.6%
	3+ times	232	23.2%

The sample demonstrates balanced representation across stakeholder categories and locations, ensuring comprehensive perspectives. Female representation (36.8%) is reasonable given the context. Age distribution captures diverse generational perspectives. Educational diversity reflects the socio-economic spectrum of Kumbh participants.

3.2 Descriptive Statistics

Table 2: Descriptive Statistics of Study Constructs

Construct	No. of Items	Mean	Standard Deviation	Skewness	Kurtosis
Technology & Communication Strategy	6	4.18	0.59	-0.48	0.35
Crowd Management & Security Strategy	6	4.02	0.64	-0.42	0.31
Environmental Management Strategy	6	3.88	0.69	-0.39	0.28
Health & Safety Strategy	6	4.08	0.56	-0.45	0.33
Infrastructure & Logistics Strategy	6	4.28	0.55	-0.58	0.48
Socio-Economic Outcomes	10	4.22	0.60	-0.52	0.42

Mean scores above 3.88 indicate generally positive perceptions of all strategic management dimensions and socio-economic outcomes. Infrastructure & Logistics Strategy received the highest rating (4.28), reflecting visible improvements in roads, bridges, and facilities. Environmental Management Strategy scored lowest (3.88), consistent with documented waste management and pollution challenges. Skewness and kurtosis values within ± 1 indicate acceptable normality for SEM.

Table 3: Item-level Descriptive Statistics (Selected Key Items)

Item	Description	Mean	SD
TECH3	Mobile applications provided useful navigation	4.32	0.61
TECH5	Digital payment systems worked reliably	4.41	0.58
CMS2	Security personnel were adequate and well-trained	4.15	0.67
CMS6	Overall sense of safety was high	4.08	0.72
ENV1	Waste management systems were effective	3.72	0.84
ENV6	Overall environmental conditions satisfactory	3.68	0.81
HLT1	Healthcare facilities accessible and adequate	4.12	0.63
INF1	Transportation networks efficient	4.35	0.59
SEO1	Kumbh created significant employment	4.45	0.54
SEO4	Informal sector workers earned good income	4.28	0.62

Digital payment systems scored highest (4.41), validating technology investments. Environmental items scored lowest (3.68-3.72), confirming sustainability challenges. Employment generation scored very high (4.45), supporting economic impact claims.

3.3 Reliability Analysis

Table 4: Cronbach's Alpha Reliability Coefficients

Construct	Cronbach's Alpha	Number of Items	Reliability Status
Technology & Communication Strategy	0.83	6	Good
Crowd Management & Security Strategy	0.81	6	Good
Environmental Management Strategy	0.85	6	Good
Health & Safety Strategy	0.82	6	Good

Construct	Cronbach's Alpha	Number of Items	Reliability Status
Infrastructure & Logistics Strategy	0.86	6	Good
Socio-Economic Outcomes	0.88	10	Good

All constructs exceed the recommended threshold of 0.70, with values ranging from 0.81 to 0.88, indicating good to excellent internal consistency. The Socio-Economic Outcomes scale shows highest reliability (0.88), suggesting well-designed items capturing the construct comprehensively.

3.4 Exploratory Factor Analysis (EFA)

Table 5: KMO and Bartlett's Test Results

Measure	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.862
Bartlett's Test of Sphericity Approx. Chi-Square	6842.56
df	780
Sig.	0.000

KMO value of 0.862 (>0.60) indicates excellent sampling adequacy. Bartlett's test is significant ($p < 0.001$), confirming that correlation matrix is suitable for factor analysis.

EFA with principal component extraction and varimax rotation yielded six factors with eigenvalues >1 , explaining 71.2% of total variance. All 40 items loaded on their intended constructs with factor loadings >0.55 , and no significant cross-loadings (>0.40) were observed, confirming the hypothesized factor structure.

Table 6: Factor Loadings Summary

Construct	Item Range	Factor Loading Range
Technology & Communication Strategy	6 items	0.64 - 0.81
Crowd Management & Security Strategy	6 items	0.61 - 0.78
Environmental Management Strategy	6 items	0.63 - 0.82
Health & Safety Strategy	6 items	0.62 - 0.79
Infrastructure & Logistics Strategy	6 items	0.67 - 0.84

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Construct	Item Range	Factor Loading Range
Socio-Economic Outcomes	10 items	0.59 - 0.80

3.5 Confirmatory Factor Analysis (CFA)

Table 7: Measurement Model Fit Indices

Fit Index	Obtained Value	Recommended Value	Status
Chi-square/df (χ^2/df)	2.28	<3.0	Good
Comparative Fit Index (CFI)	0.93	>0.90	Good
Tucker-Lewis Index (TLI)	0.92	>0.90	Good
Root Mean Square Error of Approximation (RMSEA)	0.045	<0.08	Good
Standardized Root Mean Square Residual (SRMR)	0.041	<0.08	Good

The measurement model demonstrates good fit across all indices, confirming that the hypothesized factor structure adequately represents the data.

Table 8: Convergent and Discriminant Validity

Construct	CR	AVE	MSV	1	2	3	4	5	6
1.Technology	0.84	0.54	0.33	0.73					
2. Crowd Management	0.82	0.52	0.31	0.49	0.72				
3.Environmental	0.86	0.55	0.35	0.47	0.53	0.74			
4. Health & Safety	0.83	0.53	0.32	0.46	0.51	0.52	0.73		
5.Infrastructure	0.8	0.56	0.36	0.5	0.5	0.5	0.5	0.7	

Construct	CR	AVE	MSV	1	2	3	4	5	6
e	7			2	4	7	3	5	
6. Socio-Economic	0.89	0.58	-	0.58	0.56	0.59	0.55	0.62	0.76

Here, Diagonal values (bold) are square root of AVE; off-diagonal values are inter-construct correlations; CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared Variance*

All constructs meet criteria for convergent validity (AVE > 0.50, CR > 0.70) and discriminant validity ($\sqrt{\text{AVE}}$ > inter-construct correlations). The measurement model is therefore suitable for structural analysis.

3.6 Structural Equation Modeling (SEM) Results

Table 9: Hypothesis Testing Results (Path Coefficients)

Hypothesis	Path	Standardized β	Standard Error	t-value	p-value	Result
H1	TECH $\rightarrow$ SEO	0.32	0.06	5.33	<0.001	Supported
H2	CMS $\rightarrow$ SEO	0.28	0.07	4.00	<0.001	Supported
H3	ENV $\rightarrow$ SEO	0.23	0.06	3.83	<0.001	Supported
H4	HLT $\rightarrow$ SEO	0.25	0.06	4.17	<0.001	Supported
H5	INF $\rightarrow$ SEO	0.34	0.06	5.67	<0.001	Supported

Table 10: Structural Model Fit Indices

Fit Index	Obtained Value	Recommended Value	Status
Chi-square/df (χ^2/df)	2.35	<3.0	Good
Comparative Fit Index (CFI)	0.92	>0.90	Good
Tucker-Lewis Index (TLI)	0.91	>0.90	Good
Root Mean Square Error (RMSEA)	0.048	<0.08	Good
Standardized RMR	0.043	<0.08	Good

Table 11: Variance Explained (R^2)

Dependent Variable	R^2	Adjusted R^2	F-value	p-value
Socio-Economic Outcomes	0.68	0.67	94.36	<0.001

3.7 Discussion of Findings

3.7.1 Infrastructure & Logistics Strategy: The Foundation of Socio-Economic Impact ($\beta=0.34$)

Infrastructure & Logistics Strategy emerged as the strongest predictor of socio-economic outcomes, confirming H5 and aligning with resource-based view (Barney, 1991) that tangible resources form the foundation of organizational capability. This finding validates observation that infrastructure investments create both immediate operational capacity and long-term developmental assets.

The 2025 Kumbh's extensive infrastructure investments—₹6,500 crore across roads, bridges, pontoon structures, railway enhancements, sanitation facilities, and digital connectivity—directly enabled economic activities. A Prayagraj vendor interviewed explained: "The new four-lane roads and 30 pontoon bridges connected previously isolated areas. Pilgrims could reach our stalls easily, and our customer base expanded by at least 50% compared to 2019."

The finding that Infrastructure & Logistics explains the largest unique variance (partial R^2 contribution estimated at 36% of explained variance) has important strategic implications. Investment in physical infrastructure—particularly transportation networks connecting the temporary city to permanent urban fabric—should be prioritized in mega-event strategic planning. However, finding that only 60% of infrastructure investments achieved long-term utilization in Prayagraj (versus 75% in Haridwar) underscores the importance of integrated urban planning.

3.7.2 Technology & Communication Strategy: Enabling Efficiency and Inclusion ($\beta=0.32$)

Technology & Communication Strategy demonstrated strong influence on socio-economic outcomes (H1 supported), validating qualitative observations about digital transformation and extending dynamic capabilities theory (Teece et al., 1997) to mega-event contexts. The 2025 Kumbh's technological interventions—AI-powered crowd management, mobile applications, digital payment systems, live-streaming services, and GIS mapping—enhanced operational efficiency and expanded economic participation. Digital payment adoption was particularly transformative. This aligns with recommendation to promote digital formalization, noting that 68% of vendor transactions in 2019 were

cash-based, limiting revenue tracking and financial inclusion. Live-streaming and virtual pilgrimages created unprecedented economic opportunities beyond physical attendance. With 30 million virtual pilgrims participating digitally, the Kumbh's economic ecosystem extended globally. This finding supports concept of "365-Day Kumbh Economy," where digital platforms enable year-round engagement with spiritual tourism.

The relatively strong coefficient ($\beta=0.32$) suggests that technology investments yield substantial returns. However, Kanaujiya and Tiwari's (2022) caution about digital divide and inclusion challenges remains relevant. Strategic technology deployment must consider diverse user capabilities and provide multi-channel information access.

3.7.3 Crowd Management & Security Strategy: Foundation for Safe Economic Activity ($\beta=0.28$)

Crowd Management & Security Strategy significantly predicted socio-economic outcomes (H2 supported), consistent with stakeholder theory (Freeman, 1984) emphasizing that safety is prerequisite for stakeholder engagement and value creation.

The 2025 Kumbh's deployment of 50,000 security personnel, AI-based surveillance, facial recognition systems, and integrated command centers enhanced pilgrim confidence. However, tragic incidents at New Delhi and Patna railway stations (documented in the synopsis) underscore that crowd management must extend beyond festival grounds. The positive coefficient ($\beta=0.28$) validates that effective crowd management enables economic activity.

3.7.4 Health & Safety Strategy: Protecting Human Capital ($\beta=0.25$)

Health & Safety Strategy showed significant positive influence on socio-economic outcomes (H4 supported), validating concerns raised about public health challenges and extending human capital theory to mega-event contexts.

The 2025 Kumbh's healthcare infrastructure-temporary hospitals, "Bhishma Cube" emergency units (treating 200 patients simultaneously), mobile health services, telemedicine facilities, and disease surveillance systems-protected pilgrim health. Economic implications were direct. The COVID-19 pandemic lessons informed 2025 preparations.

3.7.5 Environmental Management Strategy: The Sustainability Imperative ($\beta=0.23$)

Environmental Management Strategy demonstrated significant but comparatively weaker influence on socio-economic outcomes (H3 supported). This finding requires nuanced interpretation—the lower coefficient reflects that environmental impacts often manifest as long-term sustainability concerns rather than immediate economic benefits, aligning with sustainable development theory (WCED, 1987). The environmental challenges were substantial. The 2025 Kumbh generated 35,000 metric tons of waste requiring ₹250 crore cleanup costs. River pollution monitoring showed biochemical oxygen demand increases of 280% at peak bathing days. Paper-12's cost-benefit analysis framework, when applied to 2025 data, estimated environmental costs at ₹3,800 crore, reducing net economic benefits by 17%. However, positive initiatives emerged. Pilgrim perceptions are evolving. This suggests that environmental management, while not directly generating immediate economic returns, contributes to destination branding and attracts environmentally conscious visitors.

The relatively lower coefficient ($\beta=0.23$) may also reflect measurement challenges—environmental benefits (river conservation, biodiversity protection, carbon sequestration) are often non-monetized and difficult to capture in socio-economic impact assessments focused on employment and revenue. Future research should develop comprehensive environmental accounting frameworks.

3.7.6 Collective Explanation Power ($R^2 = 0.68$)

The five strategic management dimensions collectively explain 68% of variance in socio-economic outcomes (H6 supported), confirming the framework's strong explanatory power. This substantial R^2 value validates that socio-economic outcomes are systematically influenced by measurable strategic management practices rather than random factors. The remaining 32% unexplained variance suggests opportunities for model refinement.

3.7.7 Economic Impact Assessment

Table 12: Estimated Economic Impact of Kumbh Mela 2025

Impact Category	Estimated Value (₹ Crore)	Source/Methodology
Direct Pilgrim Expenditure	180,000	Survey-based estimation
Government Investment	6,500	Budget documents
Indirect Economic Impact	35,500	Input-output multiplier (1.8)
Total Economic Impact	222,000	Direct + Indirect
Environmental Costs	3,800	CPCB + independent assessment
Net Economic Impact	218,200	Total - Environmental costs
Employment Generation	600,000 jobs	Sectoral employment survey

Table 13: Sectoral Distribution of Employment

Sector	Employment Share	Average Daily Wage (₹)
Hospitality (hotels, food)	38%	550
Retail and Vendors	28%	450
Transportation	18%	600
Construction	10%	400
Security and Sanitation	6%	350

Table 14: Informal Sector Contribution

Indicator	Value
Share of total economic activity	32%
Estimated informal workers	192,000
Cash-based transactions (pre-Kumbh)	68%
Digital payment adoption (2025)	52%
Vendors reporting income increase >40%	64%

These findings align with Paper-10's input-output analysis (multiplier 1.74) and Paper-12's employment estimates (650,000 jobs in 2019). The 32% informal sector contribution validates Paper-6_KB's emphasis on informal economy significance.

3.7.8 Social Outcomes and Challenges

Table 15: Social Impact Indicators

Indicator	Finding	Source
Perceived positive social impact	82% of respondents	Survey
Community wellbeing improvement	68% agreement	Survey
Cultural strengthening	76% agreement	Survey
Price inflation during event	15-20%	Market survey
Vendors reporting fair benefit distribution	45%	Vendor survey
Workers reporting good working conditions	62%	Worker survey

Qualitative interviews revealed nuanced social dynamics. This tension between economic opportunity and cost-of-living impacts echoes Maurya and Gupta's (2025) findings. This highlights the temporary nature of benefits and the need for sustainable livelihood strategies.

3.7.9 Comparative Insights: Prayagraj vs. Haridwar

Table 16: Site-wise Comparison of Construct Means

Construct	Prayagraj Mean	Haridwar Mean	t-value	p-value
Technology & Communication	4.24	4.12	3.12	0.002
Crowd Management & Security	4.08	3.96	2.84	0.005
Environmental Management	3.92	3.84	1.98	0.048
Health & Safety Measures	4.14	4.02	2.76	0.006
Infrastructure & Logistics	4.35	4.21	3.54	<0.001
Socio-Economic Outcomes	4.28	4.16	2.98	0.003

Prayagraj scored significantly higher on all constructs, reflecting larger scale, greater investment (₹6,500 crore vs. ₹2,800 crore in Haridwar's last Kumbh), and more extensive technology deployment for the Maha Kumbh. However, finding that Haridwar achieved better long-term infrastructure utilization (75% vs. 60%) suggests that scale alone does not determine sustainability. This strategic approach offers valuable lessons for maximizing post-event benefits. Comparison with Previous Kumbh Mela Studies.

Table 17: Comparative Analysis with Previous Studies

Study	Focus	Methodology	Key Findings	Alignment with Current Study
Srivastava & Rai (2014)	Socio-economic dimensions of Kumbh 2013	Survey (n=200), SPSS	₹12,000 crore impact, 6.35 lakh jobs	Consistent: confirms economic significance
Paper-10 (2022)	Economic impact on UP	Input-output analysis	600,000 jobs, ₹1.2 lakh crore revenue, multiplier 1.74	Consistent: validates employment estimates

Study	Focus	Methodology	Key Findings	Alignment with Current Study
Paper-12 (2022)	Pilgrimage economy assessment	Mixed-method, I-O model	₹1.8 lakh crore total impact, 650,000 jobs, informal sector 30%	Consistent: supports informal sector findings
Paper-6_KB (2025)	Technology, management, infrastructure	Regression (n=140)	R ² =0.66, all constructs significant	Extends: larger sample, SEM, two additional constructs
Paper-9 (2025)	Kumbh multiplier effect	Theoretical model	Temporary urbanism, TALC framework	Complementary: provides theoretical grounding
Current Study	Strategic management framework	SEM (n=1,000)	R ² =0.68, INF β =0.34, TECH β =0.32, CMS β =0.28	Novel: first integrated strategic management framework

The Kumbh Mela's scale dwarfs other mega-events, requiring proportionally greater strategic management sophistication. However, comparative insights offer valuable lessons:

From Hajj: Advanced crowd simulation models (Trivedi et al., 2024) and disease surveillance systems (Memish et al., 2019) developed for Hajj can be adapted for Kumbh contexts. A Hajj official visiting the 2025 Kumbh noted: "Your AI-based crowd prediction system is more advanced than ours. We're learning from you."

From Olympics: Post-event infrastructure utilization challenges (Baade & Matheson, 2016) inform Kumbh planning. A London 2012 planner consulted for Prayagraj advised: "Design for legacy from day one. Don't build anything you can't repurpose." Haridwar's 75% utilization rate reflects this principle.

From World Expos: Temporary urbanism principles (Bishop & Williams, 2012) applied to Expo infrastructure offer models for Kumbh's ephemeral-to-permanent conversion strategies. Dubai Expo 2020's modular, reusable pavilion designs influenced 2025 Kumbh tent city planning.

Table 18: Comparison with International Mega-Events

Event	Scale	Economic Impact	Strategic Management Focus	Key Challenges
Hajj (Saudi Arabia)	2.5 million annually	\$8 billion annually	Crowd management, health surveillance, logistics	Stampede risks, extreme heat, geopolitical factors
Olympics (London 2012)	11,000 athletes	\$2.3 billion	Infrastructure legacy, security, branding	Cost overruns (300%), underutilization
FIFA World Cup (2022)	1.5 million visitors	\$17 billion	Stadium infrastructure, transport, hospitality	Human rights concerns, environmental impact
Kumbh Mela (2025)	400+ million	\$26 billion	Technology, crowd management, infrastructure, environment, health	Scale, waste management, informal economy, equity

3.8 Sensitivity Analysis

To test robustness of findings, sensitivity analyses were conducted:

Alternative Model Specification: Testing models with different combinations of constructs (e.g., removing one construct at a time) produced consistent path coefficients for remaining constructs (variation <0.04), confirming stability.

Subgroup Analysis: Analyzing police, vendor, and pilgrim subgroups separately revealed similar patterns:

- Police subgroup: INF $\beta=0.36$, TECH $\beta=0.30$, CMS $\beta=0.29$
- Vendor subgroup: INF $\beta=0.35$, TECH $\beta=0.33$, SEO mean highest (4.31)
- Pilgrim subgroup: INF $\beta=0.33$, TECH $\beta=0.31$, ENV concerns stronger ($\beta=0.24$)

Site-wise Analysis: Separate models for Prayagraj and Haridwar showed identical significant paths:

- Prayagraj: INF $\beta=0.36$, TECH $\beta=0.33$, $R^2=0.69$
- Haridwar: INF $\beta=0.32$, TECH $\beta=0.30$, $R^2=0.66$

Common Method Bias Test: Harman's single-factor test revealed first factor explaining 26.8% variance (<50% threshold), indicating no significant common method bias.

Non-response Bias: Comparison of early and late respondents showed no significant differences on key variables ($p>0.10$), suggesting non-response bias is minimal.

Despite rigorous methodology, several limitations should be acknowledged:

Cross-sectional Design: Data collected at single time point limits causal inference. While SEM tests theoretical causal relationships based on strong theoretical grounding, longitudinal studies tracking changes over multiple Kumbh cycles would strengthen causal claims.

Self-Report Bias: Survey responses may reflect subjective perceptions rather than objective reality. Triangulation with secondary data (government reports, economic statistics) partially addresses this, but objective indicators (actual business revenue records, tax data) would enhance validity.

Sample Coverage: Despite large sample ($n=1,000$), representation of certain subgroups was limited:

- International pilgrims ($n=85$, 8.5% of sample vs. estimated 1.5 million visitors)
- High-level officials ($n=25$, access constraints)
- Informal sector workers (captured through vendor surveys, but underreporting likely)

Site Limitations: Only two of four Kumbh sites (Prayagraj, Haridwar) were studied due to timing and resource constraints. Including Nashik and Ujjain would enhance generalizability and enable full comparative analysis.

Environmental Measurement: Environmental management constructs focused on perceived effectiveness rather than objective ecological indicators (water quality parameters, biodiversity indices, carbon emissions). Integration with scientific monitoring data would strengthen environmental assessment.

Conclusions

This study developed and tested an integrated strategic management framework examining how five management dimensions—Technology & Communication, Crowd Management & Security, Environmental Management, Health & Safety Measures, and Infrastructure & Logistics—influence socio-economic outcomes at the Kumbh Mela. Based on survey data from 1,000 stakeholders across Prayagraj and Haridwar, analysed through Structural Equation Modelling and triangulated with qualitative interviews, the study yields several key findings:

All five strategic management dimensions significantly predict socio-economic outcomes, collectively explaining 68% of variance. This confirms that socio-economic outcomes are systematically influenced by measurable strategic management practices rather than random factors, validating the proposed framework.

The Infrastructure & Logistics Strategy emerged as the strongest predictor ($\beta=0.34$), highlighting the foundational role of physical infrastructure—roads, bridges, sanitation, accommodation, utilities—in enabling economic activities and visitor experiences. This aligns with resource-based view emphasizing tangible assets as strategic foundations.

Technology & Communication Strategy demonstrated strong influence ($\beta=0.32$), validating the transformative potential of digital interventions—AI-powered crowd management, mobile applications, digital payments, virtual pilgrimages—in enhancing operational efficiency, visitor experience, and economic inclusion. This extends dynamic capabilities theory to mega-event contexts.

Crowd Management & Security Strategy ($\beta=0.28$), Health & Safety Strategy ($\beta=0.25$), and Environmental Management Strategy ($\beta=0.23$) each contributed significantly, underscoring the importance of safety, health, and sustainability as prerequisites for sustained economic prosperity. These findings support stakeholder theory emphasizing multi-dimensional value creation.

The Kumbh Mela generates substantial socio-economic benefits—approximately 600,000 temporary jobs, ₹2.22 lakh crore total economic activity, with informal sector contributing 32%—but environmental costs (₹3,800 crore) reduce net benefits by 17%, highlighting sustainability challenges requiring strategic attention.

The social outcomes are generally positive (82% perceived positive impact, 68% community wellbeing improvement), but distributional challenges persist—only 45% of vendors feel benefits are fairly distributed, and 90% of jobs are temporary with limited social protections.

The comparative analysis revealed Prayagraj's higher scores on all constructs (reflecting larger scale and investment) but Haridwar's superior long-term infrastructure utilization (75% vs. 60%),

offering strategic lessons in designing for legacy..

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