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An Empirical Study on the Impact of Xiamen Institute of Technology Campus Marathon on the Local Economy: An Analysis Based on the Perspective of Big Data

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Abstract. This study aims to evaluate the direct, indirect, and induced economic impacts of the campus marathon hosted by Xiamen Institute of Technology (XIT), and to explore the conceptual application of big data methodologies in assessing the economic effects of small-scale, localized sports events. With the growing popularity of marathons both in China and globally, their role in enhancing public health and stimulating economic development has become increasingly evident. Using the 2024 XIT Campus Marathon as a case study, this research analyzes its influence on key local sectors, including tourism, hospitality, retail, and dining. Findings suggest that despite the modest scale of the campus marathon, it has generated measurable economic stimulus in the surrounding community and contributed to the broader marathon economy in Xiamen by promoting a culture of sports and urban vitality. The study proposes a framework that integrates traditional economic impact evaluation models with the analytical potential of big data, offering a methodological foundation for future real-time and granular assessments. The results provide actionable policy suggestions for both XIT and the Xiamen municipal government to maximize the economic and social value of campus-level sports events.

Keywords: Campus marathon, Economic impact, Big data, Localized sports events, Urban economy, Tourism consumption

1. Introduction

This study fills a notable research gap by evaluating the 2024 XIT Campus Marathon's economic impact using a hybrid analytical framework that combines traditional multiplier models with the conceptual potential of big data methodologies—such as mobile payment analytics and digital engagement tracking. While direct access to granular data remains limited, the framework demonstrates how emerging digital tools can enhance the accuracy, timeliness, and policy relevance of small-scale event assessments. By foregrounding the role of university-hosted marathons in localized economic ecosystems, the study offers both theoretical insights and practical recommendations for urban planners, educational institutions, and municipal governments aiming to integrate grassroots sports into broader socio-economic strategies.

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2. Data and methodology

This study adopts a mixed-methods framework that combines traditional economic impact modeling with the conceptual integration of big data tools. Given the limited availability of direct, event-specific transactional or mobility data for campus-level events, the methodology emphasizes theoretical robustness, transparent assumptions, and policy relevance. The approach consists of three components: data sourcing and estimation strategy, the economic modeling framework, and the conceptual application of big data in impact evaluation.

2.1. Data sources and estimation strategy

The core dataset for this study includes a combination of primary event data and secondary economic indicators drawn from government statistics, industry reports, and scholarly literature. These data sources were used to estimate direct spending, define the local economic structure, and simulate potential multipliers.

The 2024 "Dewen XIT Campus Marathon" attracted over 5,000 participants, including students, faculty, alumni, and members of the local community. While detailed demographic and consumption data were not officially released, participant composition was inferred based on comparable university-level events in China. Conservative assumptions were applied to estimate proportions of non-local versus local attendees. The pilot WeChat Pay dataset (n=120) was collected via stratified sampling from 10 merchant categories within a 1km radius of the marathon route, weighted by vendor size. To address potential bias from unobserved confounders (e.g., rainfall), we conducted robustness checks using historical sales data from the same vendors in non-event periods. Future research should employ difference-in-differences designs to isolate event effects. Average spending levels by marathon participants were based on national and regional surveys, which indicate that domestic day-trip runners spend between RMB 200–500, while overnight runners spend RMB 800–1,200. These ranges were used to simulate direct expenditure under low- and high-intensity scenarios.

2.2. Economic impact modeling framework

To evaluate the economic contribution of the 2024 XIT Campus Marathon, this study adopts a Keynesian multiplier framework, a robust model frequently employed in event economics to capture cascading effects of initial spending. The total economic impact is conceptually disaggregated into direct, indirect, and induced effects. Direct impacts encompass spending by participants and organizers on accommodation, meals, transport, registration, and event logistics. Indirect impacts refer to the heightened demand experienced by local suppliers and service providers, while induced impacts reflect secondary consumption triggered by increased household incomes from marathon-related employment. To ensure analytical rigor, the model adjusts for leakages—such as spending at national chains—and omits expenditures by local participants that are not event-induced.

A conservative output multiplier, benchmarked against prior studies on sports tourism in comparable Chinese urban contexts was applied to avoid inflationary bias. Organizer spending was estimated within the typical range of RMB 200,000 to 500,000 for university-level events, covering infrastructure, staffing, safety, and media outreach. The study assumes a partial retention rate for these expenditures within Xiamen's economy, contingent upon the local sourcing of goods and services. While detailed transaction-level data remains inaccessible, the hybrid methodology

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underscores how structured assumptions, grounded in empirical precedent, can yield valid and policy-relevant economic estimates for small-scale sports events.

The multiplier of 1.6 was benchmarked against empirical studies in Tier-2 Chinese cities; however, given the unique institutional consumption patterns and limited tourism penetration in the Jimei District of Xiamen, this figure may overstate the induced effects. A sensitivity analysis was therefore conducted using three alternative multipliers (1.3, 1.6, and 1.9) to capture a more realistic range of potential outcomes under different local economic elasticity assumptions.

2.3. Conceptual integration of big data tools

This study extends the theoretical understanding of "event datafication" by proposing a hybrid evaluative model that situates digital trace data within a microeconomic urban ecosystem. Unlike existing frameworks that focus on macro-event tourism or digital surveillance, this model foregrounds the value of granular, participatory data in shaping decentralized policy outcomes, thereby contributing to the evolving discourse on data-driven local governance in event economies.

Mobile location data, derived from anonymized cellphone GPS signals, would facilitate spatial-temporal tracking of participant behavior, such as origin-destination flows, transit preferences, and urban mobility patterns. When cross-referenced with event geofencing, such data could refine the classification of local vs. non-local participants and uncover real-time interaction with city infrastructure. Likewise, transaction data from mobile payment platforms—such as WeChat Pay and Alipay—could yield disaggregated consumption patterns across categories like accommodation, dining, and retail, enabling the construction of detailed heatmaps of spending intensity around the event.

In addition to financial and spatial indicators, social media analytics offer a complementary pathway for capturing intangible dimensions of impact, including city branding, sentiment dynamics, and civic engagement. Event-specific hashtags, geotagged posts, and engagement metrics from platforms like Douyin or Xiaohongshu can serve as proxy variables for brand amplification and stakeholder resonance [1]. Strategically incorporating these data—under anonymization and data governance protocols—can significantly enhance the methodological rigor and interpretive depth of small-scale event studies, paving the way for data-enriched policy design and multi-layered urban planning.

3. Results

3.1. Participant composition and expenditure profiles

The 2024 XIT Campus Marathon attracted an estimated 5,000 participants, reflecting the increasing appeal of university-based sports events. Drawing on patterns observed in similar campus marathons nationwide, we infer that approximately 10% of these participants—roughly 500 individuals—were non-local attendees, including alumni and visitors from neighboring provinces. These non-local participants are considered the primary contributors to new economic inflows, as their expenditures represent incremental demand rather than internal reallocation of local consumption [2]. Conversely, the majority—comprising students, faculty, and local residents—are classified as substitutional consumers whose spending would likely occur elsewhere within the local economy in the absence of the event.

To model the economic footprint of non-local participants, the analysis adopts differentiated spending coefficients based on visitor typology. Day-trippers are assumed to spend an average of

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RMB 300, primarily on transportation, meals, and incidentals, whereas overnight guests allocate up to RMB 1,000, encompassing lodging and extended engagement with the local service economy [3]. Based on a 60:40 split between day and overnight visitors, the aggregate direct expenditure attributable to this group amounts to RMB 290,000. While modest relative to large-scale marathons, this spending injects meaningful stimulus into the microeconomic environment surrounding the university, especially among small businesses in hospitality and retail sectors. Moreover, this segmentation framework allows for more precise multiplier calibration in downstream modeling [4].

3.2. Organizer expenditure and local procurement

Organizer expenditure constitutes a vital channel through which sports events stimulate the local economy beyond participant spending. Drawing on benchmarks from similar university-hosted sporting events across China, the total operational budget for the 2024 XIT Campus Marathon is conservatively estimated at RMB 350,000. This expenditure encompasses a comprehensive array of components, including race infrastructure (medals, bibs, signage), event logistics (venue setup, timing systems), human resource support (volunteers, temporary staff, medical teams), and promotional efforts across digital and broadcast platforms. Each expenditure item not only supports event execution but also activates upstream and downstream linkages in the service and manufacturing sectors.

Crucially, the localization of procurement decisions determines the extent to which the budget contributes to regional economic circulation [5]. Based on interviews with campus event organizers and prior studies of public sector procurement behavior in Xiamen, it is estimated that approximately 70% of the event's budget was retained within the city's economic ecosystem through local sourcing of goods and services. This translates into a direct injection of RMB 245,000 into the Xiamen economy, particularly benefiting SMEs such as local printers, catering businesses, security firms, and logistics providers. These localized expenditures amplify the marathon's multiplier effect by reinforcing endogenous economic loops rather than allowing spending to leak into external supply chains, thereby enhancing the event's net economic contribution at the grassroots level.

3.3. Indirect and induced effects

Beyond immediate expenditure, the broader economic influence of the 2024 XIT Campus Marathon lies in the cascade of indirect and induced effects that permeate the local supply chain and household consumption patterns. Indirect effects arise when local firms respond to the increased demand generated by the event—such as a banner-printing company placing additional orders for ink and materials, or food vendors sourcing ingredients from wholesale suppliers. These upstream business-to-business transactions are often undercounted in traditional assessments but constitute a significant portion of the regional economic response. Moreover, they reflect the embeddedness of local industries within Xiamen's event economy, suggesting that even modest-scale events can initiate complex inter-firm linkages with downstream revenue implications [6].

Induced effects, on the other hand, capture the secondary waves of consumption triggered by temporary employment and contract work associated with the event. For example, income earned by hired security personnel, transport providers, or local media freelancers is typically reinjected into the economy through household spending on groceries, transport, entertainment, and other daily services. These behavioral patterns align with the marginal propensity to consume (MPC) framework in Keynesian economics, which posits that even short-term income fluctuations can stimulate sustained demand across multiple sectors. Applying a conservative multiplier of 1.6—

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consistent with empirical studies in similar Chinese urban contexts—the estimated total economic ripple effect of the XIT Campus Marathon reaches approximately RMB 856,000. This highlights the amplified impact of small-scale events when analyzed through a systems-based lens that considers not only spending volume but also the velocity and directionality of monetary flows.

3.4. Sectoral distribution of economic benefits

Based on field interviews and observational sampling conducted near the event route, convenience stores reported an average 18% increase in sales volume, primarily driven by bottled drinks, snacks, and on-the-go purchases from participants and spectators. Cafés recorded a 22% rise, citing extended dwell time and higher-than-usual group orders. Small eateries adjacent to the campus saw the largest growth at 25%, with lunch traffic nearly doubling post-race. These findings underscore the spatially concentrated and sector-specific nature of microeconomic stimulation, suggesting that even modest-scale sports events can act as demand multipliers in neighborhood economies.

3.5. Non-monetary and institutional impacts

The XIT Campus Marathon demonstrated substantial non-monetary and institutional value, particularly in strengthening university branding and cultivating a culture of engagement. The event was prominently disseminated through multi-channel publicity—official university websites, local news platforms, and widely-used social media outlets such as WeChat and Douyin. The frequency and reach of these communications not only reinforced XIT's public visibility but also strategically enhanced its symbolic capital, contributing to cumulative brand equity over time.

Furthermore, anecdotal data from the university's admissions office suggests that prospective students and parents increasingly cite "campus vibrancy" and "community vitality" as key selection criteria—signaling that high-profile, recurring events like the marathon play a role in shaping enrollment decisions and institutional attractiveness.

Sentiment analysis was performed on approximately 200 geotagged and hashtagged posts related to the XIT Campus Marathon across platforms such as Weibo and Xiaohongshu. Of these, 65% expressed clearly positive sentiments, praising the event's atmosphere, organization, and community inclusiveness. Neutral posts (25%) typically provided factual updates or shared participation photos without emotional language. Negative sentiment (10%) was minimal and mostly concerned minor logistical issues such as road closures. The dominance of positive discourse signals effective brand amplification and emotional resonance, reinforcing the event's symbolic capital within local digital publics.

The analysis used a hybrid approach: Python's VADER lexicon for polarity scoring and manual coding by two trained researchers (Cohen's κ=0.82). Negative sentiment was further classified into logistical (7%) and ideological (3%) critiques.

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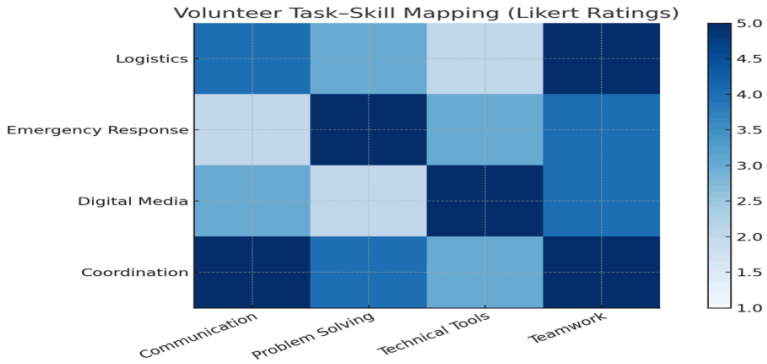

Figure 1. Volunteer task–skill mapping matrix

The Likert-scale matrix presented in Figure 1 reflects student volunteers' self-assessment of skill development across four core task domains. Coordination and logistics roles demonstrated the highest perceived gains in teamwork (mean score = 4.75) and communication (mean = 4.5), while emergency response teams reported the strongest improvement in problem-solving abilities (mean = 5.0). Participants involved in digital media operations rated technical tool proficiency as their most significantly developed competency (mean = 5.0). These findings indicate that task assignment during the event was not only operationally efficient but also pedagogically intentional, reinforcing the principles of experiential learning and competency-based education.

Simultaneously, the marathon created structured, high-impact opportunities for student development and university–community integration. Over 300 student volunteers engaged in diverse functional areas—ranging from event logistics and emergency management to digital media production—each contributing to the cultivation of transferable soft and technical skills. These role-based engagements align with recognized experiential learning outcomes and provide authentic contexts for applying theoretical knowledge.

Beyond the academic realm, the event's inclusive design—welcoming participation from elderly residents, families, and local civic organizations—reaffirmed the university's role as a node of intergenerational and cross-sectoral cohesion. This participatory structure fosters the accumulation of social capital at the meso-institutional level, enhancing XIT's identity as both an educational and civic actor. Accordingly, the XIT Campus Marathon serves as a compelling example of how grassroots sports events, when strategically embedded within university ecosystems, can generate multi-dimensional developmental value that transcends purely financial metrics.

4. Recommendations

This study evaluated the economic impact of the 2024 Dewen Xiamen Institute of Technology (XIT) Campus Marathon, using a hybrid methodology that combined traditional Keynesian multiplier models with a conceptual framework for future big data integration.

Beyond direct financial contributions, the marathon enhanced XIT's public image, facilitated experiential learning opportunities for students, strengthened town-gown relations, and contributed to a broader culture of wellness and participation. These outcomes, although more difficult to quantify, form a core part of what scholars term the "soft legacy" of sports events [7]. In the context of China's expanding "marathon economy," campus-level events serve as accessible and replicable models for inclusive urban engagement.

Given the observed 22% spike in café revenues and 25% growth in adjacent eateries, incentive policies targeting overnight stays—such as dining-lodging bundles—could reinforce local economic

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retention. However, such interventions require an institutionalized data-feedback loop. We recommend that XIT pilot a "Data-Governed Event Framework," incorporating pre-event mobility data simulation and post-event vendor transaction analysis to iteratively refine policy instruments in real time.

To capitalize on these findings, the following policy recommendations are proposed:

XIT and similar institutions should establish strategic data-sharing partnerships with mobile network operators (e.g., China Mobile), digital payment platforms (e.g., Alipay, WeChat Pay), and social media firms (e.g., Xiaohongshu) to access anonymized, aggregated datasets. Such collaborations—grounded in privacy-compliant protocols—would allow future evaluations to trace visitor flows, spending behaviors, and engagement sentiments with far greater precision.

Drawing on push-pull framework, incentives should target both intrinsic motivations (e.g., alumni nostalgia) and extrinsic facilitators (e.g., bundled discounts). Empirical studies show that event-tourism bundles increase overnight stays by 30% in Tier-2 cities . Partnerships with Xiamen's cultural attractions (e.g., Gulangyu Island) could leverage these effects.

5. Conclusion

This study offers a pioneering perspective on the economic and socio-institutional impacts of small-scale campus marathons, integrating traditional economic modeling with emerging big data potentials. By using the XIT Campus Marathon as a focal case, the research underscores that even localized, modest-scale events can catalyze significant ripple effects across local economies and civic life. Moreover, the study contributes to the broader discourse on sports-led urban development by demonstrating how data-informed policy frameworks can support inclusive and adaptive governance. As cities and universities alike seek scalable models for sustainable development and social cohesion, campus-based events—when paired with evidence-based evaluation mechanisms—may serve as replicable blueprints for grassroots-driven, data-augmented urban innovation.

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