

Application Practice of Smart Campus Activity Management Systems in Higher Education Institutions

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ABSTRACT

This paper aims to deconstruct the application logic and bottleneck constraints of innovative venue activity management systems in higher education institutions, while exploring pathways for enhancing their effectiveness. The introduction of intelligent management systems serves as a core structural driver for universities to overcome resource mismatches and service inefficiencies inherent in traditional operational models, respond to smart campus development demands, and ultimately achieve modernization of internal governance. In practice, the system's effectiveness faces widespread structural impediments: information silos disrupt management loops, entrenched governance habits deeply inhibit digital processes, and mechanisms for data-driven precision decision-making and service iteration remain weak. To address these challenges, this paper proposes a three-pronged collaborative optimization framework: First, prioritize building an integrated platform enabling cross-domain convergence and interoperable data to break down operational silos; second, focus on driving management process reengineering and institutional system realignment through systematic deployment; and third, establish a mechanism for dynamic resource allocation based on multi-source data sensing, enabling elastic adjustment and proactive demand response.

KEYWORDS

Higher education institutions; Smart facilities; Management systems

1 Introduction

Modernizing university governance systems has become a key dimension for measuring comprehensive institutional capacity in transforming toward high-quality development in higher education. As vital conduits for teaching, research, cultural dissemination, and student activities, the resource allocation efficiency of facilities directly reflects the overall operational quality of universities. Traditional management models, characterized by manual approvals, paper-based records, and departmental silos, reveal structural flaws—including information bottlenecks, process delays, and resource misallocation—when confronting the dynamic growth and increasing complexity of facility demands. This state inflates hidden management costs, diminishes the sense of fulfilment among faculty and students, and creates fundamental tension with the modern university's pursuit of open collaboration and efficient governance. The development of smart campuses, driven by the deep integration of digital technologies into education, fundamentally involves restructuring service delivery, resource allocation, and decision-making mechanisms through data circulation and intelligent technologies. Facilities, characterised by high spatial standardisation and strong digital adaptability, naturally emerge as strategic nodes for smart transformation. However, technological integration does not automatically enhance governance efficiency; its effectiveness is constrained by organizational cultural inertia, the suitability of management structures, and user behavioural habits.

2 The Smart Venue Management System is Essential for Modernizing University Governance Capabilities

2.1 Inefficiencies and Resource Misallocation in Traditional Venue Management Models

The operational core of traditional university venue management is rooted in information silos and manual, intervention-driven, non-standard processes. Its fundamental flaw lies in: venue availability and scheduling being exclusively controlled by a handful of administrators, while faculty and students—as the demand side—suffer from severe information asymmetry and power imbalance. Reservation processes require multiple manual steps—such as phone calls, emails, or form submissions—leading to high-frequency communication overhead and cumulative operational errors risks, significantly increasing ineffective reservation rates. A more profound contradiction lies in insufficient objective data anchors in resource allocation mechanisms. Decisions devolve into experiential discretion or mechanical first-come-first-served principles, causing structural misallocation of temporal and spatial resources: popular venues experience frequent conflicts due to overconcentrated bookings. At the same time, peripheral spaces remain chronically vacant due to information accessibility failures. This disconnect between resource supply and demand, coupled with operational inefficiency, not only constitutes a persistent loss of university public assets but also fundamentally erodes the spatial usage rights of faculty and students, creating institutionalized barriers to service quality improvement.

2.2 Objective Requirements for Digital Facility Management in the Context of Smart Campus Development

Innovative campus development fundamentally involves the comprehensive integration of campus information

systems and data flow restructuring. As a high-frequency public service scenario, venue management has evolved from an optional feature to a foundational requirement for maintaining the integrity and operational fluidity of the innovative ecosystem. The core paradigm of modern smart campuses lies in providing a unified authentication service chain across all domains. Faculty and students should seamlessly access full-scenario services—from class schedule queries and library book borrowing to venue reservations—through a single terminal ^[1]. If facility systems remain disconnected from this digital service framework, it will directly disrupt the closed-loop ecosystem of campus-wide services, undermining the effectiveness of innovative campus development. More strategically, dynamic facility data constitutes critical nodes in mapping campus user behaviour patterns. When integrated into the university-wide data intelligence hub, this data provides an irreplaceable foundation for precise demand tracing, resource topology optimization, and teaching and activity effectiveness assessment. Venue digitization thus becomes the strategic fulcrum supporting the iterative evolution of innovative campus systems.

2.3 Smart Management Systems: The Core Lever for Enhancing Venue Utilisation and Service Experience

Innovative venue management systems deconstruct traditional management challenges through technological integration, serving as the core mechanism for achieving synergistic leaps in resource efficiency and service experience. Resource Dimension: A digital platform built on transparency rules enables real-time visibility of facility status across all user interfaces, eliminating information asymmetry. Its automated scheduling engine and conflict resolution algorithms prevent entropy growth from manual intervention, while data-driven discovery and strategic reallocation of idle periods boost space turnover efficiency. A reservation-driven electromechanical linkage control mechanism achieves precise energy supply matching, reducing operational costs. On the service dimension: The system offloads transactional workloads from faculty and students, supporting full-time mobile self-service for reservations, inquiries, and cancellations. A reservation traceability system, intelligent approval triggers, and embedded digital payments collectively form an efficient, transparent service loop. This user-centric service architecture not only enhances accessibility and stakeholder satisfaction but also drives a more profound transformation of organizational service paradigms toward modern governance, becoming a tangible manifestation of enhanced governance efficiency in higher education institutions.

3 Practical Challenges in Implementing Smart Campus Facility Management Systems

3.1 Data Silos Resulting in Incomplete Closed-Loop Management

Innovative campus facility systems often operate as isolated units, lacking seamless data exchange and process integration with core campus information systems. This creates systemic barriers to data interoperability, leading to structural deficiencies in management loops and value dissipation. Comprehensive facility management requires covering the entire lifecycle: event approvals, venue reservations, identity/permission configurations, equipment requests, on-site verification, energy consumption control, and post-use evaluations. However, system silos prevent automatically synchronizing user identity data from successful reservations to access control systems, forcing administrators to initiate secondary verification procedures manually. Similarly, electronic equipment and environmental control systems lose their automated response capabilities ^[2]. Post-event, usage data and feedback fail to flow back into management systems, rendering resource allocation optimization mechanisms ineffective. This persistent fragmentation of end-to-end processes degrades system functionality to mere reservation registration tools, preventing the establishment of a dynamic, data-driven closed-loop optimization system.

3.2 Constraints on System Performance from Traditional Management Process Inertia

Technological iteration often precedes organizational change, causing innovative system applications to encounter deep-seated blockages from existing management workflows. Most universities have not undertaken corresponding offline process reengineering, mechanically replicating hierarchical approval systems onto digital interfaces. This creates a dilemma where online processes replace offline workflows without resolving efficiency bottlenecks. Typical manifestations include: student activity venue applications still requiring passage through multiple digital approval nodes—counsellor approval, departmental Youth League Committee review, and venue centre final approval—replicating administrative redundancy and traditional models. More notably, some administrators, driven by path dependency or trust deficits, require applicants to submit additional paper documentation after online submission, transforming digital systems into incremental administrative burdens. Entrenched within organizational structures, such operational patterns severely constrain the inherent potential of intelligent systems to streamline processes and unlock efficiency. This traps technological value within rigid institutional frameworks, preventing the systems from achieving the operational quality and efficiency gains they were designed to deliver.

3.3 Weak Data-Driven Decision Support and Service Optimisation Capabilities

The vast operational data accumulated by innovative venue management systems should be a core resource for planning and service asset optimisation. However, current data analysis practices exhibit a pronounced tendency toward superficiality. Managers often limit themselves to fundamental statistical indicators like venue reservation saturation and spatiotemporal occupancy parameters, merely fulfilling periodic reporting requirements. They generally lack the systematic capability to deconstruct data's inherent correlations and identify potential risks^[3]. The critical issues lie in: usage data from academic departments and student organizations failing to translate into behavioural demand maps for group activities, thereby losing the basis for decision-making on functional space renovations; and dynamic parameters like venue cancellation rates lacking attribution analysis and strategic response mechanisms, thus failing to drive iterative improvements in reservation rules. This dual deficiency in data insight and predictive decision-making traps management in a perpetual state of transactional responses, preventing advancement to data-driven, precision governance.

4 Pathways for Deep Application and Efficiency Enhancement of Smart Campus Facility Activity Management Systems

4.1 Building an Integrated Management Platform for Interconnected Business Data

To overcome data silos, the positioning of innovative facility systems must be redefined—transforming them from isolated tools into core components of campus IT architecture. The goal is establishing an integrated management platform enabling cross-system business data connectivity. The core implementation plan must leverage a unified data middleware platform or a standardized application programming interface (API) ecosystem to establish deep coupling channels between venue systems and campus infrastructure. These channels should connect identity authentication hubs, academic management modules, student affairs systems, electronic payment terminals, and logistics operation monitoring systems. Once the platform is established, it should achieve the following paradigm-level process reengineering: When faculty initiate ad-hoc teaching space change requests through the academic system, it automatically triggers intelligent venue resource matching and global locking mechanisms. Upon digital confirmation of student activity reservations, participant rosters are instantly synchronized to access control systems to generate dynamic permissions, dispatching automated environmental maintenance and security service instructions to logistics support modules. This seamless integration of cross-domain workflows transforms fragmented management nodes into a closed-loop organic system, ultimately breaking through end-point barriers in full-process management and driving an order-of-magnitude breakthrough in management efficiency.

4.2 Business Process Reengineering and Management System Transformation Based on System Applications

The full potential of technological implementation requires parallel innovation in management systems. Universities should leverage the deep deployment of innovative venue systems as a turning point to systematically reconstruct existing management processes and institutional frameworks. The primary step involves mapping end-to-end business process topology diagrams, conducting necessity validation and entropy reduction optimization^[4] for online and offline nodes. Establish a tiered authorization model based on risk matrices and transaction priority principles to address redundant approval tiers: routine low-risk space requests transition to rule-driven automated review or single-tier approval; only activities exceeding thresholds retain limited multi-tier review channels. Simultaneously, a prohibition on dual-track operations should be enacted to establish legal exclusivity for digital processes. This framework necessitates a comprehensive revision of institutional texts, embedding digital workflow topology, authority-responsibility allocation matrices, service benchmark ranges, and incentive-constraint mechanisms into the fundamental operational laws of the organization. This top-level institutional reconstruction project dismantles the institutional shackles of traditional governance inertia, establishing a robust institutional foundation for the efficacy leap of the innovative system.

4.3 Establish a Data-Analytics-Based Dynamic Allocation and Service Improvement Mechanism for Venue Resources

Universities must establish institutionalized closed-loop data governance mechanisms to transform system data into substantive management intelligence. The primary step involves forming a collaborative analysis consortium comprising facility managers, IT specialists, and student representatives, with clearly defined functional boundaries and collaboration protocols. This company periodically drives multidimensional in-depth research to distil specialised diagnostic reports, focusing on core metrics such as space utilisation efficiency, user activity density, activity spectrum patterns, temporal flow dynamics, and service satisfaction. These reports should serve as binding decision benchmarks for resource optimization: - When vacancy rates in specific spaces/time slots persistently rise abnormally, trigger time-based pricing

interventions or targeted departmental space allocation to activate idle assets. - If user clusters report network signal attenuation exceeding critical thresholds, immediately initiate emergency infrastructure reinforcement projects ^[5]. By establishing a spiral optimization cycle encompassing data capture, pattern analysis, strategic intervention, and effectiveness validation, venue management can achieve a fundamental paradigm shift from transactional maintenance to predictive precision governance.

5 Conclusion

The deep application of innovative venue management systems in higher education institutions represents a structural iteration of management paradigms rather than a mere technological upgrade. This necessitates that universities position venue management as a core hub unit within the innovative campus governance framework, systematically constructing a platform operation system that integrates multi-business data and enables full-process collaborative integration. This process simultaneously tests institutional innovation capabilities, urgently requiring organisational restructuring triggered by technology adoption to reshape management processes and profoundly optimise supporting systems. Its ultimate efficacy stems from the formation of data-driven decision-making, decision execution, and performance evaluation. It propels the innovative system to evolve from a basic information tool into an engine for transforming governance capability. Ultimately, the strategic leap in venue resource efficiency and user experience relies on a support system where technological innovation, process reconstruction, and cultural adaptation evolve synergistically.

About the Author

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