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Original Article

Preserving Cultural Narratives: The Revitalization of Heritage Mandapams as Urban Catalysts in Kanchipuram through an Heritage-Led Urban Regeneration Model

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Abstract *- Kanchipuram, one of South India's most significant temple towns, contains a complex yet largely unregulated network of ritual Mandapams associated with its major temples. While conservation efforts have historically prioritised monumental temple complexes, many Mandapams dispersed across the urban fabric remain institutionally fragmented, legally ambiguous, physically dilapidated, and underutilised. Despite the presence of historic Mandapams with established spatial, ritual, symbolic, and cultural legitimacy, new temporary and permanent pavilions continue to be constructed along pilgrimage routes to accommodate festivals and tourism, revealing a critical contradiction. To address this, the present research develops an analytically weighted model to create a priority order of Mandapams for regeneration based on heritage value and catalytic potential within Kanchipuram's ritual economy. Thirty-four Mandapams were initially identified and georeferenced through a mobile GIS - based reconnaissance survey. Guided by Vinayak Bharne's ritual scape framework, the study focused on meso-ritualscape areas beyond temple precincts associated with the Ekambaranathar Temple. Processional route mapping identified 15 Mandapams, of which 12 were selected through ethnographic validation, confirming active ritual use. These were documented using Polycam-based 3D scanning and manual measurement. Sixty parameters relevant to heritage-led urban regeneration were consolidated into 19 indicators under the Safeguard and Catalyst domains through thematic clustering. The relative weight of indicators was derived using a frequency-salience technique based on the literature and expert survey analysis. A multicriteria decision-making framework employing binary scoring and weighted-sum analysis generated a priority ranking of the Heritage mandapams. This Heritage-led urban regeneration model enables targeted, phased conservation, efficient resource allocation, and catalytic regeneration, and is transferable to other historic heritage towns where dispersed clusters of heritage structures support cultural continuity and local economies.*

Keywords *- Kanchipuram, Ritual Mandapams, Heritage conservation, Urban regeneration, Urban Catalysts.*

1. Introduction

Historic towns often exhibit a rich mixture of social, cultural, architectural, and historical heritage values [1]. Urbanization threatens many heritage towns possessed of unique aesthetic, architectural, cultural, and historical significance [2]. Kanchipuram is a heritage city in Tamil Nadu with a number of temples and traditional settlements, and was the capital of the Pallava Kingdom [3]. It is also one of the seven important holy cities of India (Ayodhya, Mathura, Haridwar, Varanasi, Kanchipuram, Ujjain, and Dwarka) [4]. Well known for its multitude of values and Dravidian Architectural style reflected in the temples, the city today has witnessed a tremendous degree of change from the original character due to urbanization and metropolitan influence. The unique character and the renowned heritage structures, which were the identity of the city for decades, have been losing their sheen and continue to be neglected.

The Historic city of Kanchipuram in Tamil Nadu, India, holds various heritage structures, including religious structures such as temple complexes, temple tanks, megalithic cists and cairns, tombs, sculptures, inscriptions, and paintings [5]. Stein, Emma Natalya, has listed and chronologically documented the temples of Kanchipuram and has specified four heritage Mandapams/pavilions in the historic core of the city, which are now sealed-wall structures housing shops and street-side shrines, with walls nearly completely covered with paint and billboard advertisements [6]. Preserving historical environments through legal restrictions, the introduction of

new permanent architectural forms in old urban areas is limited. However, to ensure the sustainability of urban heritage while addressing the current needs of inhabitants, temporary pavilions play a crucial role at present. These pavilions serve as catalysts for urban place-making, responding to the demand for public events and festivals, and fostering community-driven projects [7, 8]. Although there is a growing need for temporary structures in urban development to create vibrant spaces and enhance social interaction, it is essential to consider reusing existing structures, particularly heritage buildings that encapsulate the essence and style of the context. This enables a good mix between the historical value and the urban placemaking projects.

The existence of a global recognition with regard to the significant economic, cultural, and societal values that can be accrued by the preservation of historical buildings is worth recognizing. As a direct consequence of this fact, the adaptive reuse of such buildings is perceived as an inspiring chance to produce sustainable societal, environmental, and economic values. The significance of the preservation of historical buildings not only for their intrinsic value but also for their use as a strategic tool for creating beneficial effects for society, the environment, and the economy has been emphasized by various authors [9, 10].

A number of possible transformations arising from a functional change that responds to the needs of today give adaptive reuse an important role in the revival and regeneration process of degraded areas. This allows the maintenance of architectural objects that hold importance to the local community, fostering the integrity and historical continuity of the city by restoring the objects' functional and economic value as well [11]. Adaptation need not relate to changing the function of a building, and with the Burra Charter, adaptation has been defined as any process where a place is modified for its continuing or any intended use but without its original character changed [12].

Adaptive reuse does not always require a new function; the already existing function might be intensified and revitalized. Such an approach does not merely retain the historical character of the structure but also significantly contributes to urban development. The historic structures also have the ability to transform a place by playing an urban catalyst role, developing good catalytic effects within the setting.

As such, some of the heritage structures can be developed to meet the needed functions with the objective of preserving the identity and promoting interaction among people [13]. Urban catalysts are the strategies relating to the redevelopment of cities. They are made up of projects designed to direct the development of the cities and act as an indicator that the projects are successful, especially when implemented while reviving the structures that form the heritage of the cities and act as an agent that injects life into the location [14]. The conservation efforts of institutions in major historic temple towns in India primarily protect temple complexes, yet their activities do not extend to the associated pavilions/mandapams, which remain economically vital but face both administrative and operational challenges. The freestanding ritual pavilions, which function as sacred spaces for urban areas, now face multiple threats, including encroachment and privatization, and they also experience insensitive modifications and material degradation.

Heritage conservation research in India focuses primarily on three areas, which include monument preservation and adaptive reuse of major historical sites and tourism-driven regeneration practices. The three multi-criteria assessment methods, AHP, ANP, and TOPSIS, serve as common tools for both infrastructure design and heritage assessment, yet these approaches rely on stakeholder opinions for weight determination while they fail to use ritual-network assessment as a criterion. The Historic Urban Landscape framework developed by UNESCO supports comprehensive value-based management, yet it lacks a practical system to rank different ritual sites or does not provide an assessment framework for heritage structures.

The existing research about Kanchipuram temples shows their historical development through time; however, there is no established system that can evaluate the heritage value of mandapams associated with temples according to their protection needs and their ability to recover. The lack of a system to determine preservation priorities leads to random conservation choices that waste available resources.

The study introduces a new research concept and a hybrid model for creating a priority order of Heritage structures for phased conservation in heritage-led urban regeneration projects. The research studies mandapams through their connection to the Meso-Ritualscape network, which shows how these structures connect to both their physical surroundings and their ceremonial uses throughout the city.

The study presents a safeguard-catalyst evaluation framework that uses two distinct evaluation methods to assess the structural protection of heritage sites and their potential to support urban development, which enables better conservation planning of heritage sites through their relationship to urban development patterns. This research establishes indicator weights through a systematic frequency-salience assessment of academic literature, which improves the research process by making it easier to follow and duplicate the findings. International frameworks like the Heritage Impact Assessment model and Historic Urban Landscape approach support complete heritage management practices, but they lack the capacity to create priority systems for scattered ceremonial Heritage sites.

The research establishes a new scientific contribution that transforms theoretical heritage concepts into a functional evidence-based ranking system that supports detailed conservation planning and regeneration efforts for historic temple towns. The study combines ritualscape theory with heritage prioritization discourse through its theoretical framework. The study presents a new method that derives frequency-salience weights through its assessment of safeguards and catalysts. The model offers a step-by-step conservation plan, which the authors of the study use to preserve the mandapams located along the Ekambaranathar temple processional path.

The novelty of the present research stems from the development of a reproducible framework, which combines the theories of ritual geography and heritage prioritization. Although existing multi-criteria decision-making techniques such as the Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), and TOPSIS heavily rely on the subjective comparison and decision-making of stakeholders, the present research attempts to mitigate such limitations with the development of the literature-derived frequency-salience weighting system and strengthen it with an expert survey. Moreover, the present research proposes the development of a two-domain evaluation model that considers the Safeguard indicators for evaluating the structural integrity, risks, and conservation requirements of heritage sites, and the Catalyst indicators, which measure the potential of heritage sites to activate urban regeneration and socio-economic development.

The integration of the ritualscape theory, literature-derived weighting system, and binary scoring model with the Weighted Sum Model (WSM) offers the novelty of the present research, which proposes the development of a prioritization framework particularly suited for the dispersed ritual infrastructure, such as the mandapams located in temple townscapes, but can also be adopted for other historic towns with multiple heritage structures.

International heritage planning guidelines such as the Heritage Impact Assessment (HIA), which is promoted by ICOMOS, and the Historic Urban Landscape (HUL), which is advocated by UNESCO, are significant guidelines for integrating heritage conservation into the larger process of urban regeneration. Nevertheless, most such guidelines are qualitative and do not provide concrete mechanisms for prioritizing individual heritage assets during regeneration. Similarly, most multiple criteria decision analysis used for heritage regeneration is based on limited sets of indicators and/or do not involve systematic parameter development using literature and experts' survey analysis. This research makes significant contributions to the subject by proposing a hybrid indicator-based evaluation model for integrating literature-based parameters, expert validation, and multiple criteria decision analysis for successful heritage-led urban regeneration. This heritage-led hybrid model is significant because it helps to identify individual heritage assets with the highest catalytic potential for regeneration using a systematic approach, thereby operationalizing it for successful urban regeneration in temple towns such as Kanchipuram, and can be adopted by other historic heritage towns.

1.1. Research Gap

- Lack of Measurable success indicators in HERITAGE-LED Urban Regeneration. (No standardised, transferable indicator-based evaluation framework) [15].
- Fragmentation between Conservation & Regeneration Discourse [16].
- Absence of MICRO-SCALE Heritage catalysts studies in Temple Town [17].

1.2. Research Questions

- How can built-heritage structures be systematically evaluated as urban catalysts within the Heritage-led urban regeneration framework?
- Can a hybrid weighted-indicator model integrating literature-derived parameters & expert judgement provide a reliable framework for prioritizing heritage conservation interventions?
- How effectively can the proposed model prioritize the conservation of mandapams associated with the Ekambaranathar temple in Kanchipuram, and how adaptable is it to other heritage urban contexts?

1.3. Research Hypothesis

H1: Built Heritage structures possessing favourable physical, spatial, cultural, socio-economic, and functional characteristics have the potential to act as measurable urban catalysts contributing to successful urban regeneration.

H2: A Hybrid weighted-indicator framework integrating literature-derived frequency salience weighting & expert judgement can produce a reliable prioritisation system for Heritage-led urban regeneration interventions.

H3: Application of the proposed evaluation framework enables effective prioritisation of mandapams associated with Ekambaranathar temple in Kanchipuram and its adaptability for use in other Heritage contexts.

2. Materials and Methods

This study develops a decision-making heritage-led urban regeneration hybrid model to prioritize heritage mandapams as urban catalysts supporting urban regeneration in Kanchipuram. A set of 60 parameters was systematically derived and then consolidated into 19 safeguard and catalyst indicators, with weights established using frequency-salience analysis, expert validation, and Multi-Criteria Decision Making (MCDM) analysis.

The framework was applied and tested on 12 mandapams along the processional route of Ekambaranathar Temple in Kanchipuram, generating a phased priority order for conservation within an urban regeneration strategy.

2.1. Phase 1: Spatial Reconnaissance and Heritage Inventory

The first phase established a spatial baseline for Mandapams in Kanchipuram. A mobile GIS-based reconnaissance survey was carried out through systematic walkover documentation across the town [18].

Using Map Plus, 34 mandapams were georeferenced with latitude - longitude coordinates, creating a spatial heritage inventory. This phase converted dispersed ritual structures into a mappable urban dataset, enabling subsequent spatial, ritual, and planning analysis.

2.2. Phase 2: Ritualscape Framework and Study Boundary Definition

To locate Mandapams within their functional ritual system, this research adopts Vinayak Bharne's micro, meso, and macro ritualscape framework [19]. The study was restricted to the meso-ritualscape - ritual spaces outside temple walls but within the town associated with the Ekambaranathar Temple, identified as Kanchipuram's principal pilgrimage and ritual anchor based on historical significance and maximum tourism footfall [20, 21]. Processional routes of the Ekambaranathar Temple were mapped. 15 mandapams located along these routes were assessed as active ritual networks [22].

2.3. Phase 3: Sample Selection - Heritage Mandapams

From the 15 mandapams, 12 were selected based on ethnographic validation through interviews with priests, temple functionaries, and local users [23, 24]. Only mandapams where the utsavar deity is ritually placed and worshipped were included, ensuring that the analytical sample represented living ritual infrastructure.

Through GIS-based reconnaissance, the initial inventory found 34 heritage mandapams that existed throughout Kanchipuram. The study selected 12 mandapams for their analytical sample after they established specific purposive sampling criteria, which required that only mandapams used as ritual halt points for the utsavar deity and ritual activities be included. The sample selection guarantees an active meso-ritual infrastructure that exists as functional elements rather than studying route markers, which serve no active purpose. The non-probabilistic sampling method achieves its goal to represent the actual ritual sites that exist throughout the Ekambaranathar processional corridor.

2.4. Phase 4: Physical and Digital Documentation

Each of the 12 mandapams was documented using a combination of Manual measurement and Polycam 3D scanning application [25]. This produced records of spatial dimensions, structural configuration, and physical condition, enabling a systematic basis for evaluating the conservation and adaptive reuse potential of mandapams.

2.5. Phase 5: Indicator Consolidation

The previously established set of 60 heritage urban-catalyst parameters was refined using qualitative content analysis through a process of thematic consolidation and redundancy clustering [26, 27]. Conceptually overlapping and repetitive variables were merged to produce a manageable framework of 19 indicators, grouped under Safeguard and Catalyst domains, while preserving the analytical intent of the original parameter set. This is based on UNESCO's Historic Urban Landscape strategy of handling complex heritage attributes by means of a holistic thought process based on a broad spectrum vision of heritage value and Feilden & Jokilehto's argument that systems of evaluation need to remain functional and not be redundant [28, 29]. The indicators were specifically reorganised under two domains, Safeguard and Catalyst, because this reflects the dual function of heritage in historic cities; ensuring structural and environmental protection while enabling socio-cultural and economic activation [30, 31].

Thematic clustering matrix development enabled systematic integration of overlapping parameters through system design. The original 60 parameters were grouped in a way that took into account conceptual similarity, redundancy mapping, and domain alignment. The parameters had functional objectives in common, which included structural integrity and material stability, and crack vulnerability protection using unified safeguard indicators. The clustering of parameters was achieved in two ways by design, which maintained the analytical objectives and created conceptual links between elements.

The structural condition assessment was carried out through consultation with practicing structural engineers experienced in historic masonry structures. Based primarily on visual inspection, the engineers evaluated the integrity of the granite construction system by identifying indicators such as loose or displaced stones, major cracks, stone misalignment, and the active or stable nature of structural distress, along with the current level of maintenance. These observations informed a preliminary understanding of the structural stability of the mandapams and their immediate conservation needs within the assessment framework.

Table 1. Thematic clustering matrix for consolidation of initial parameters into operational indicators. source: authors

Cluster Theme	Original Parameters Identified in Literature	Final Indicator Code	Indicator Description	Domain
Structural Stability	Structural cracks, column tilting, roof displacement, and foundation settlement	S1	Structural Stability and Damage Condition	Safeguard
Architectural Authenticity	Retention of original materials, historical fabric integrity, and architectural authenticity	S2	Architectural Integrity and Authentic Fabric Retention	Safeguard
Public Safety Risk	Structural hazards, unsafe roof slabs, and falling stone fragments	S3	Immediate Safety and Hazard Risk	Safeguard
Maintenance History	Conservation works, repair documentation, and previous restoration	S4	Maintenance and Documentation Status	Safeguard
Ownership & Governance	Legal ownership, custodianship clarity, and management responsibility	S5	Ownership and Custodianship Clarity	Safeguard
Emergency Response	Fire safety access, emergency evacuation routes	S6	Emergency Access and Disaster Response Readiness	Safeguard
Environmental Risk	Encroachment, pollution exposure, and vegetation growth	S7	Environmental Risk and Encroachment Pressure	Safeguard
Regulatory Protection	Heritage listing status, monitoring frameworks	S8	Regulatory Protection and Institutional Monitoring	Safeguard
Security Conditions	Physical protection, surveillance, vandalism risk	S9	Heritage Asset Security and Protection	Safeguard
Cultural Significance	Ritual use, festival association, sacred value	C1	Cultural and Ritual Significance	Catalyst
Community Interaction	Community participation, social activities	C2	Community Engagement and Current Use	Catalyst
Adaptability	Flexible space use, adaptive reuse potential	C3	Spatial Adaptability for Heritage Reuse	Catalyst
Tourism Potential	Visitor attraction, heritage tourism value	C4	Tourism and Economic Activation Potential	Catalyst
Urban Connectivity	Visibility, accessibility, street integration	C5	Urban Integration and Accessibility	Catalyst
Sustainability Measures	Climate adaptation, environmental performance	C6	Sustainable Heritage Adaptation Potential	Catalyst
Placemaking	Urban identity, cultural memory	C7	Placemaking and Identity Revival	Catalyst
Visitor Experience	Interpretation panels, cultural storytelling	C8	Visitor Interpretation and Experience	Catalyst
Policy Alignment	Alignment with heritage programs and government schemes	C9	Policy and Institutional Alignment	Catalyst
User Amenities	Lighting, seating, safety perception	C10	Visitor Amenities and Safety Perception	Catalyst

2.6. Phase 6: Indicator Weighting

The first step in establishing importance levels for all 19 indicators required applying a frequency-salience weighting method, which the study used to assess 100 peer-reviewed heritage and regeneration studies according to their cross-analysis results [32, 33]. The study established primary status for indicators, which served as central arguments, whereas they designated supporting factors as secondary elements; thus, they created a normalized weight system that relied on worldwide heritage-based regeneration principles instead of personal evaluation methods. The study used qualitative content analysis of existing literature to develop improved weight measurement following this initial phase.

The study examined Safeguard and Catalyst indicators through 50 reference studies because this method meets guidance, which states that 40 to 60 sources should be reviewed to reach thematic saturation [34]. The study selected an equal sampling method, which is confirmed by [35], because they believe that equal amounts of evidence will reduce weighting bias during evaluations of similar categories. The study established a matrix that linked indicators to their corresponding sources through coding of insights from each paper.

The study assigned preliminary weight to their study because of its primary literature presence and secondary presence across the dataset [36, 37]. The resulting hierarchy provides an evidence-based assessment of indicator importance. An expert survey method (Delphi method), along with the Kanchipuram town and mandapams' specific context, determined expert weight for each indicator. The final relative weight was determined through averaging the literature and expert survey results.

2.7. Phase 7: Application on sample Mandapams - MCDM Analysis

The information system used its multicriteria decision-making framework to assess 12 mandapams according to 19 criteria, which were evaluated through binary scoring that assigned a value of 1 for present indicators and 0 for absent ones. Composite scores were calculated with a Weighted Sum Model (WSM), assigning 60% weight to Safeguard indicators and 40% to Catalyst indicators, which measured structural risk and regenerative potential [38]. The project used a 60:40 ratio to normalize Safeguard and Catalyst domains because conservation sequencing required the project to first achieve stability and risk reduction before it could implement adaptive measures [39].

The formula, Composite Score = $\sum(Wi \times Pi)$, produced a consolidated value for each Mandapamm, which was then ranked to establish a clear priority order [40]. The priority ranking system determines which resources will be used for stabilization work and urban regeneration projects, while it shows which mandapams need immediate attention due to structural stability and their high catalytic potential.

2.8. Phase 8: Priority Ranking of Mandapams and Urban Regeneration Strategy

The priority model enables organizations to allocate their financial resources and institutional assets through targeted funding, which results in faster project execution and improved chances of successful regeneration. The framework achieves sustainable development by using historic mandapams as permanent cultural establishments, which serve as pilgrimage route facilities instead of building new pavilions with unconnected design elements. The methodology operates at multiple scales because it can be used in various contexts while maintaining its core design elements, making it suitable for application to historic towns and heritage sites worldwide that contain scattered heritage buildings that preserve local cultural traditions and support economic development.

The Weighted Sum Model (WSM) was selected for the prioritization analysis because it provides a transparent, computationally straightforward method for aggregating weighted indicator scores. The WSM method enables direct application of indicator weights from systematic literature analysis, which differs from the Analytic Hierarchy Process (AHP) that needs both extensive pairing tests and consistency ratio evaluation.

The method produces reproducible results through its simplified procedure, which effectively handles binary indicator assessment. The WSM method delivers efficient results that heritage decision-support models need to analyze indicators because it requires only basic system understanding.

The evaluation of mandapams uses binary scoring because it creates evaluation standards that enable both understanding and exact results. The graded and fuzzy scoring methods can identify detailed differences, but they need extensive calibration combined with expert evaluation throughout their development. In the present study, binary scoring was therefore used as a transparent baseline evaluation method that could be consistently applied across all sites while maintaining compatibility with the weighted sum aggregation model.

This hybrid framework model, integrating literature-based indicators with expert validation, was applied to 12 mandapams along the processional route of Ekambaranathar Temple in Kanchipuram, and a phased priority order for conservation within an urban regeneration strategy was generated. This is a hybrid model because the indicator weights are derived from both systematic literature analysis and context-sensitive expert judgement, allowing them to vary across settings and making this research framework adaptable to different heritage environments.

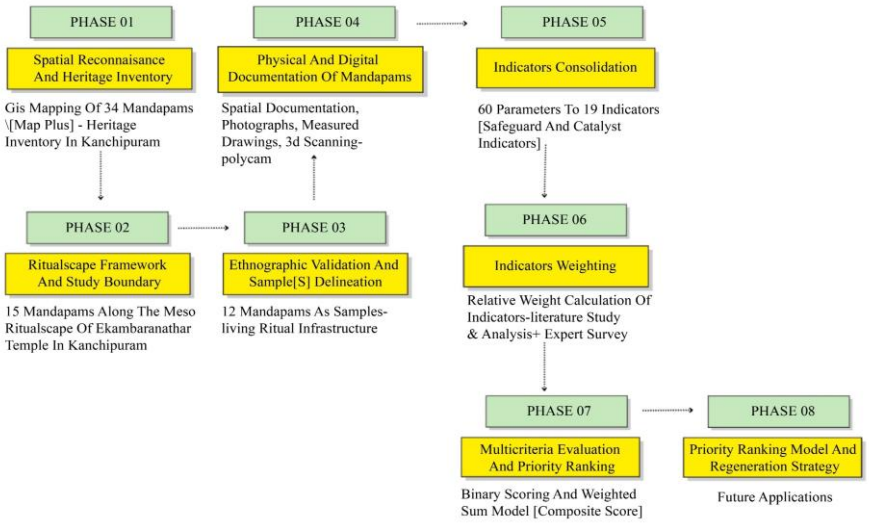


Fig. 1(a) Methodology (In Phases) Source: authors

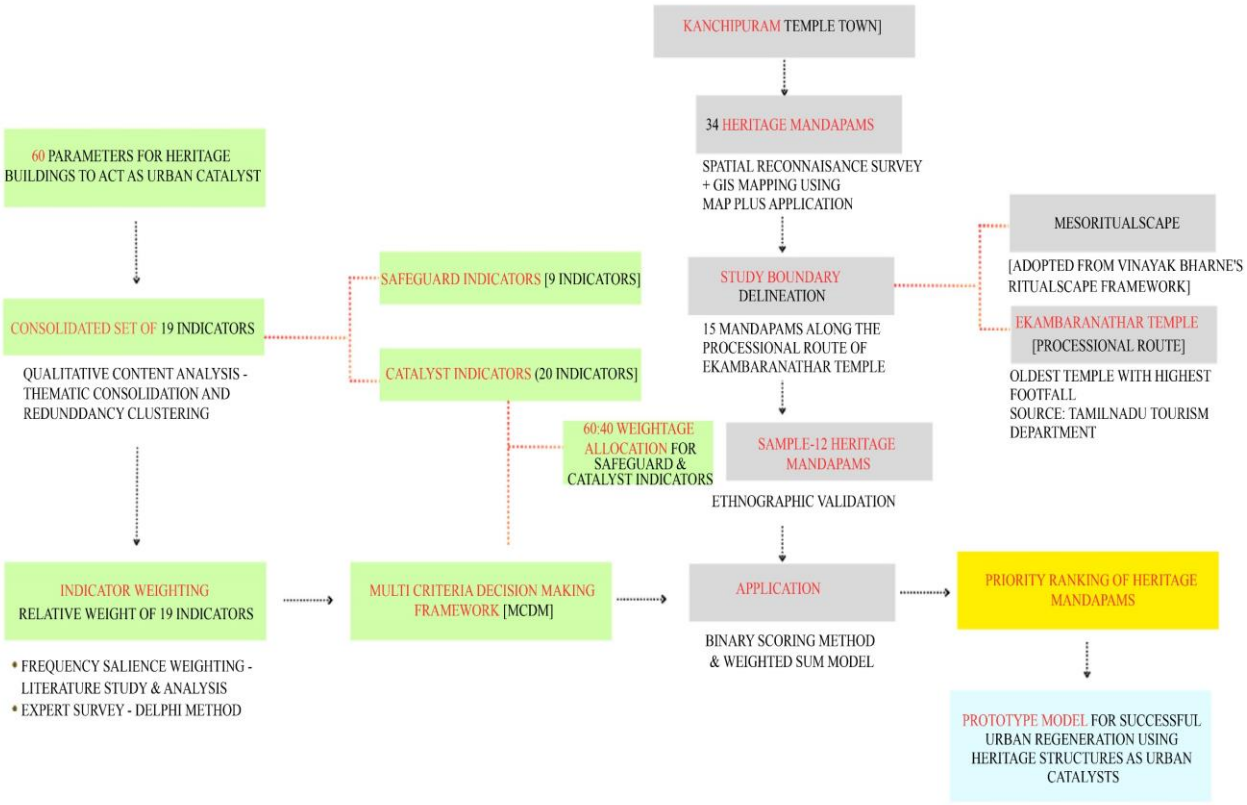


Fig. 1(b) Methodology (Tools and methods) Source: authors

3. Literature Study

3.1. Theories and Definitions

The study of the definitions and theories provided here has been conducted through various sources of secondary data, which include research papers, articles, books, official websites, doctoral theses, and news articles from reputable sources.

3.1.1. Urban Built Heritage

Heritage definition, as well as the scope of monument and site conservation and restoration, was developed from the Venice charter of 1964 [41]. Three major categories under urban heritage, as defined by UNESCO, are as follows. First is the monumental heritage, characterized by its high cultural significance. Secondly, there are non-exceptional heritage elements that, while lacking individual significance,

contribute meaningfully when arranged coherently and exhibit relative abundance. Finally, includes new urban elements within the scope of urban heritage, such as the urban built form, open spaces like streets and public areas, as well as urban infrastructures including material networks and equipment.

This comprehensive categorization underscores the diverse facets that constitute the rich tapestry of urban heritage [42]. The concept of heritage is defined as a complex cultural interaction between people, memory, and place [43]. Built heritage is a broad term for the built environment with cultural significance and is often referenced as a tangible/immovable form of cultural heritage [44]. Local heritage can be conceived as a tool to promote social cohesion and well-being, as embracing heritage and the histories, traditions, and values, as well as the urban fabric, can be perceived as a means to improving the quality of life, social cohesion, and well-being [45]. No matter how old the urban heritage is, historical urban areas are considered an essential part of the local culture, a crucial base for cultural tourism, and local society prosperity [46].

3.1.2. Heritage Conservation

Conservation of built cultural heritage is one of the essential factors in the long-term prosperity of a city [47]. According to the National Policy for Conservation of the Ancient Monuments, Archaeological Sites and Remains (NPC – AMASR) protected by the Archaeological Survey of India, Conservation means the processes through which material, design, and integrity of the monument are safeguarded in terms of its Archaeological and Architectural value, its historic significance, and its cultural or intangible associations [48].

3.1.3. Historic Town and Conservation

Historic cities in terms of civilization consist of location, morphology, and physical aspects that differ, corresponding to their environment. They are, mostly, built with indigenous belief and wisdom, which reflects human legacy on how it is settled with traditional, economic, political, and spatial aspects [49]. The ICOMOS "Charter for the Conservation of Historic Towns and Urban Areas" (Washington, 1987) emphasizes the preservation of qualities that contribute to the historic character of a town or urban area. These include the urban patterns shaped by lots and streets, the interplay between buildings and green/open spaces, and the formal appearance of buildings (both interior and exterior) in terms of scale, size, style, construction, materials, color, and decoration. Additionally, the charter underscores the importance of maintaining the relationship between the town or urban area and its surrounding natural and man-made setting, as well as safeguarding the diverse functions the town has acquired over time. It stresses that any threat to these qualities poses a risk to the authenticity of the historic town or urban area.

3.1.4. Urban Pavilions

The meaning of pavilion, both historical and local, derives from people's memories of the past time [50, 51]. A pavilion is a partially open structure, upheld by columns and shielded by roofs. It is a clear element that provides refuge without offering enclosure. The pavilion may also be seen as an arena of liberty regarding physical needs, such as refuge or lodging, as well as liberty for the aim of meeting, changing, or thinking within the urban setting [52]. There are diverse types of pavilions found within India, for instance, Madapas for congregation within Hindu Temples, Baradari for recreational purposes within Mughal and Rajput courtyards, Diwan-i-Am for receiving visitors, and Moti Masjid for prayer, among others [53].

Today, urban pavilions may beneficially increase interaction levels and urban living conditions. In the Indian setting, rather than increasing the number of pavilions, there is potential for renovating existing pavilions for urban regeneration initiatives.

3.1.5. Urban Catalysts

The idea of "catalysts" originated from Attoe & Longa's work, American Urban Architecture: Catalysts in the Design of Cities, in 1989, which taught a very important lesson emphasizing the importance of placing high-priority efforts on catalytic projects in cities that face stagnation or decline because such projects contain immense potential for stimulating further development and revitalization [54].

The Urban Catalyst idea has been utilized since the end of the 20th century, as it was noticed that urban environments do affect people who live within those settings. Catalysts can be described as those buildings that trigger urban development within close proximity to them and seek public support. In some cases, catalytic power is expected to originate from a building regardless of its function. This is more likely true for old buildings, which, after being renovated or repurposed, can give a new life to their urban environment, often doing so with significant expenses incurred in this process [55].

3.1.6. Urban Redevelopment

Urban redevelopment aims to rejuvenate the urban decaying grounds and focuses on economic, social, and environmental issues where both increase or deterioration occurs [56]. It is an approach towards city planning aiming to solve the social and economic problems plaguing an urban area due to the deterioration of the quality of life [57].

Urban renewal uniquely encompasses conservation rather than demolition of dilapidated and obsolete buildings and rebuilding them in order to establish a better living environment. Conservation-led regeneration refers to "the use of conservation-related activity (such as protection, improvement, and enhancement of historic buildings) to bring about social, economic, and environmental regeneration

benefits above and beyond those normally associated with physical improvement of the built environment [58].

3.1.7. Sustainable Tourism

Cultural heritage is a very important element for many countries that have already successfully incorporated and continue to incorporate tourism within a tourism development strategy for economic growth [59]. While leveraging cultural heritage for tourism is not a recent trend, there is a growing recognition that "culture and heritage are becoming more significant in the product mix" for tourism, particularly in less-developed nations [60]. The origin of tourism in the modern world is closely linked to recognition and appreciation of cultural heritage. When heritage falls into the possession of private owners, additional issues arise. A significant portion of these owners believe that allowing public access to their properties is economically disadvantageous. They argue that hosting visitors and organizing commercial activities to generate income can harm or even jeopardize the preservation of the heritage they aim to protect.

The sustainability concept is of equal importance for long-term tourism development, destination competitiveness, and heritage protection. Scholarship today demonstrates that risk-based conservation research needs better methods for assessing structural vulnerabilities. Urban morphology frameworks examine spatial continuity and street-temple integration in historic towns. Climate resilience studies highlight material durability under changing rainfall and temperature patterns. The various research fields maintain their separate existence without connecting to one another. The current research framework lacks connections between structural risk assessment methods and their relationship to ritual-network design and urban regeneration patterns. The research combines three elements: structural protection measures, spatial ritual assessment, and regeneration assessment using heritage structures as urban catalysts into one unified system of priority evaluation framework.

3.2. Global Heritage Prioritization and Decision–Making Models

The current heritage preservation methods use Multi-Criteria Decision-Making (MCDM) frameworks to help them make funding decisions when facing resource limitations. The Analytic Hierarchy Process (AHP) enables users to compare different conservation options by using its pairwise comparison matrices. AHP provides users with a structured decision-making process, yet the system depends on expert-based subjective evaluations, which create inconsistency and bias according to different situations. The Analytic Network Process (ANP) extension enables users to model relationships between assessment factors, but it raises the need for more computational resources and expert assessments.

Heritage site selection and infrastructure prioritization use the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and fuzzy MCDM models to manage uncertainty. Fuzzy logic enhances sensitivity evaluation, but the process of creating membership functions often suffers from transparency and reproducibility issues. The Historic Urban Landscape (HUL) approach, which UNESCO promotes across international borders, enables complete integration of cultural, social, and environmental values.

The HUL framework functions as a policy guideline, but it lacks the ability to implement specific ranking systems, which would evaluate sacred sites located throughout temple towns. The ICCROM and ICOMOS risk-based conservation models focus on two main areas, which include structural vulnerability assessment and the development of preventive conservation plans. The models focus exclusively on monument-scale interventions because they lack the ability to evaluate regenerative urban potential through their assessment framework.

The global methods of prioritizing heritage sites show three main deficiencies that affect the preservation of temple-town heritage. First, the evaluation of dispersed ritual mandapams, which exist within meso-ritualscapes, should regard them as networked infrastructure, but current practices either treat them as separate entities or fail to recognize their presence. Second, existing prioritization models often conflate structural vulnerability and socio-economic potential without explicitly sequencing stabilization and activation.

Third, weight derivation methods primarily depend on stakeholder perception, which hinders reproducibility because they do not use systematic literature synthesis. The existing research achievements need to establish a framework that combines ritualscape positioning with structural safeguarding and regenerative activation through an evidence-based weighting system.

Hence, the current research establishes indicator weights through the average of frequency–salience coding of peer-reviewed literature analysis and expert validation instead of using expert pairwise assessments, which AHP and ANP models depend on. The proposed framework uses binary scoring with domain-normalized weights to achieve transparency, while fuzzy MCDM models require membership function assumptions. HUL supports integrated heritage management, which the current model implements through its safeguard–catalyst dual framework built on conservation sequencing.

The proposed approach introduces a new method for heritage decision-making research through integrating qualitative and quantitative methodological approaches. Qualitative research is performed through ethnographic validation, while quantitative research has been implemented through thematic clustering, Frequency salience weighting, and MCDM in order to frame the heritage-led hybrid model.

4. Study Area

4.1. Kanchipuram

Kanchipuram, popularly known as Kanchi, is the headquarters town of the Kanchipuram district in Tamil Nadu. It is located at 12°50' N, 79°42'E and 72 km. southwest of Chennai on the banks of the Vegavathi River, a tributary of the Palar River. The town was part of historic Tondaimandalam, the region comprising the northernmost parts of Tamil Nadu during the Pallava Kingdom. It is believed that Kanchipuram served as a capital for the Cholas during the 9th and 13th centuries and also for the Pallava Kingdom during the 3rd to 9th centuries. It was during the reign of the Pallava dynasty that Kanchipuram attained its limelight. Many of the town's known temples were built during their reign. The town also came under the rule of the Pandyas, Vijayanagar Empire, Carnatic Kingdom, and the British, who called the town "Conjeevaram".

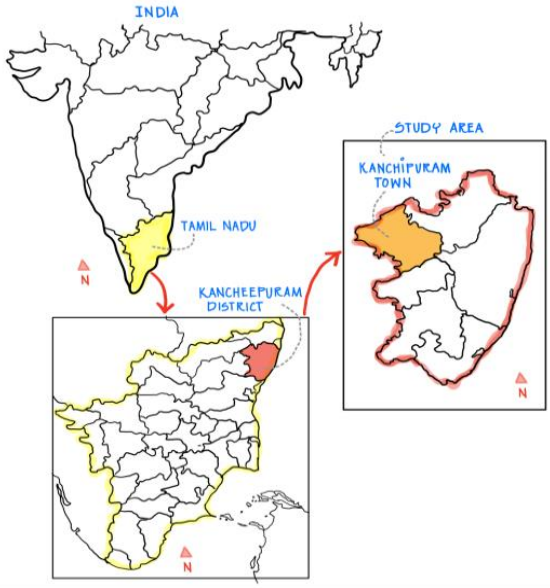


Fig. 2 Location of the Study area – Kanchipuram, Source: authors

The Town covers an area of 36.14 Sq.km. and contains a population of 2.33 lakhs as per the Census of India 2011. Kanchipuram is subdivided into two divisions, namely Big/Periya Kanchi and Little/Chinna Kanchi. Big Kanchi, also called Shiva Kanchi, occupies the western portion of the city and is the larger of the two divisions. Little Kanchi, also called Vishnu Kanchi, is located on the eastern fringes of the city, which also refers to the later developments during the Chola rule. Most of the Lord Shiva temples lie in Big Kanchi, while most of the Lord Vishnu temples lie in Little Kanchi [22].

Kanchipuram is one of the seven sacred cities in India and one of the 21 places of International Tourism importance in Tamil Nadu, and tourism plays an important role in the socioeconomic development of the place [6]. This research pertains to Kanchipuram due to the prospect of various layers connected to historical time periods and dynasties, different typologies of heritage structures, construction techniques, materials, and Architectural styles [22].

4.2. Problems and Conservation Measures

The urbanization of Kanchipuram, influenced by physical, socioeconomic, and sociocultural factors, has brought about significant transformations in its organic heritage evolution. Despite existing conservation efforts, the town is witnessing government proposals aimed at fortifying its heritage, including the ongoing initiative to formulate a GIS-based Master plan for AMRUT CITIES under CMDA [61].

This integrated plan includes temple complex preservation, development of tourism infrastructure, and the establishment of a ‘Heritage Park,’ emphasizing the ability of Kanchipuram to not only preserve but also develop its rich heritage. Though UNESCO, ASI, and TN Archaeological departments mainly concentrate on temples, forts, megalithic sites, and ‘traditional dwelling units,’ there seems to be a lack of attention to preserving the Heritage Mandapams. Being a necessary part of this heritage, spread all around the town and closely linked to famous temples, there seems to be rapid deterioration caused by neglect and privatization, which seems to be provoked by urbanization. There is an urgent need to safeguard these heritage mandapams, as delayed intervention poses increasing risks to public safety while simultaneously accelerating the loss of an indigenous cultural heritage system.

4.3. Temple Precincts of Kanchipuram

Kanchipuram, with its rich historical background, is decorated with a string of temples, temple tanks, and institutional buildings constructed during different periods of different rulers. In fact, the plan of Kanchipuram and its temples would depict the historical and cultural importance of this region. Kanchipuram is referred to as the "City of a Thousand Temples"; it houses more than 150 Hindu temples, which represent the cultural heritage and pious dedication of this city and its people. These temples exceed their limitations as places of worship, as they represent the artistic and historical prowess of a different era [53].

From among all the temples in Kanchipuram, Ekambaranathar temple, Kamakshi Amman temple, and Varadaraja Perumal temple stand out for their genuine devotion on a daily basis, pulling in local people and devotees from worldwide [6].

Thus, it is clear that these temples become the most honored and visited sites in the region for pilgrimage. Currently, there are eight temples that fall under protection from the Archaeological Survey of India (ASI), while another five fall under the State Archaeological Department.

Table 2. List of protected temples, source: city HRIDAY plan - Kanchipuram

Temples declared as Protected Monuments under the AMASR Act, 1958	Temples declared as Protected Monuments by the Director of Archaeology, Tamil Nadu
1. Iravatheeswarar Temple	1. Varadarajaperumal Temple
2. Matangeswarar Temple	2. Kamatchiamman Temple
3. Mukteswarar Temple	3. Ekambaranathar Temple
4. Jivarachareswarar Swami Temple	4. Katchapeswarar Temple
5. Pallavamedu Site	5. Kumara Temple
6. Vaikundaperumal Temple	-
7. Kailasanathar Temple	-
8. Piravathanesvara Temple	-

Superimposed on this intricately planned urban center, the construction or restoration work being undertaken in temples within or around the city has been instrumental in the sustained flourishing of Kanchi, which has been continuous from the eighth-century period up to the present day.

Fig. 3 Entrance gopuram - Ekambaranathar temple, Kanchipuram, Source: authors

4.4. Ekambaranathar Temple - Kanchipuram

The Ekambaranathar Temple at Kanchipuram, a Shiva temple, symbolizes the rich Pallava background and the varied religious traditions of the city [62].

Dating back to the 7th century, the temple is well-known for its massive gopurams, beautifully carved mandapams, and the famous mango tree. Alongside the majestic architecture, the temple has various festivals and processions held throughout the year that amaze devotees and tourists alike.

The Shivaratri festival, held annually, is an important festival for the Hindu community, and sees devotees flock to the temple to attain the blessings of the deity. Another important festival that is the center of attraction is the Panguni Uthiram, which is held for 13 days in the months of March and April and celebrates the union of Shiva and Parvati [63].

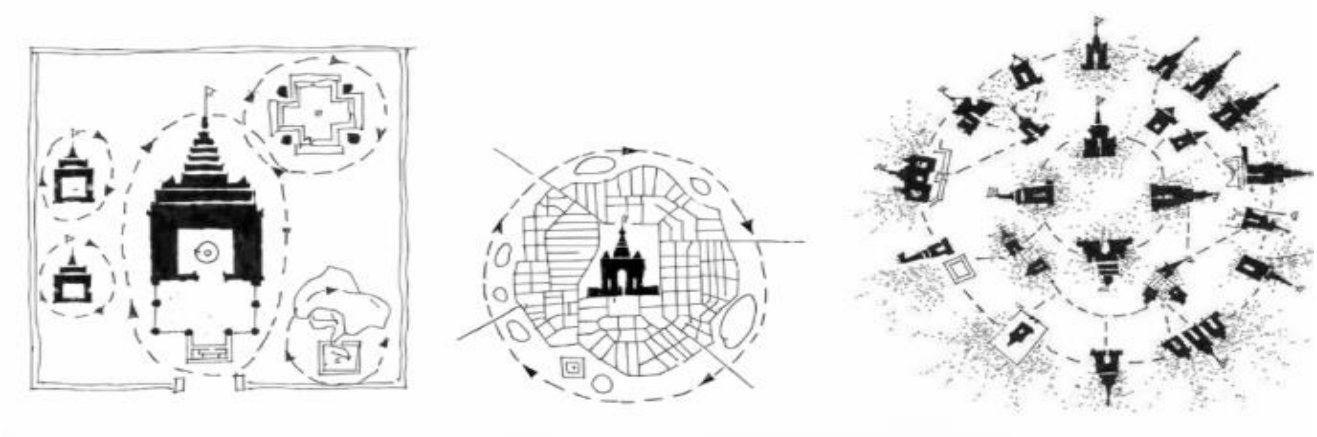
During the festive time, a traditional ritualistic practice of a bronze idol of Lord Shiva ('Utsavar') is taken in procession from the Ekambaranathar temple and carried up to Paalur village (32.7 km away) and brought back.

In modern times, disruptions in temple-related associations seem to have diminished this practice. Further, processions are believed to be held every month in the year, while in Vaigasi, the utsavar is taken to the Mangalatheertham temple tank, and in Aani, circumnavigation of the four raja veedhi is carried out for Aani thirumanjanam. The Ekambaranathar Temple epitomizes Kanchipuram's rich history and vibrant present, its faith, artistic excellence, and enduring traditions, all symbolized by Kanchi. It is one of the oldest and most visited temples in Kanchipuram. Therefore, this research focused on it, especially the heritage mandapams associated with it.

4.5. Utsavams or Festivals Associated with the Temples in Kanchipuram

The ceremonial procession of deities during Utsavams or festivals allows devotees who cannot physically visit the temple to experience virtual Darshan from their homes. Within a Hindu temple's sacred space, rituals can be categorized into three main types: daily rituals, exclusive rituals on specific days, and festivals throughout the year [64]. In the book "Rediscovering the Hindu Temple," Vinayak Bharne explains the complex interactions of rituals in sacred space using the concept of three levels of ritualscapes [19].

The "microritualscape" takes place in the temple or its precincts, in a daily and seasonal cycle. The "mesoritualscape" covers the space beyond the boundaries of the temple, in the case of religious festivals, including the town or village. Finally, the "macroritualscape" covers multiple temples dedicated to the same god, including a nation or a region. There is a merging of sacred, urban, and natural space into ritualscapes in each of these levels, and they capture the complexity of temple rituals. This research paper is centered around the meso ritualscape of the Ekambaranathar temple and the associated mandapams that fall under its heritage category.



(a) (b) (c)

Fig. 4 Ritual geographies in space, (a) Micro - within the temple complex, (b) Meso - outside the temple complex & around the habitat, and (c) Macro - across the region or country. source: [19]

Fig. 5 Mesoritualscape - temple chariot festival of Varadarajaperumal temple – Kanchipuram

Fig. 6 Macroritualscape of Varadarajaperumal Temple Processional deity [Utsavar] carried on the shoulders to Naduvavi well mandapam on Dusi main road - Kanchipuram, Source: authors

In the context of Kanchipuram, renowned for its multitude of temples and festivals, the city stands as a pilgrimage site of great significance. The festivals held in these temples contribute to the thriving tourism in the region. The diverse range of rituals that operate from tiny temple rituals to huge regional ceremonial practices creates an extraordinary cultural atmosphere that defines Kanchipuram. The citybound sacred spaces and natural areas of the city unite during these rituals to create an enriched experience for both pilgrims and visitors [63].

5. Heritage Mandapams or Heritage pavilions

5.1. Pavilions or a Mandapams in Indian Historical Architecture

Pavilions or Mandapams are semi-open spaces that have columns supporting them and roofs that protect from the elements without complete enclosure. Exploring the rich heritage tapestry, numerous historical temple towns and cities showcase many heritage pavilions and mandapams, loaded with religious, spiritual, and community value. Especially in the historical temple towns of Tamil Nadu, mandapams play a pivotal role, intricately associated with temples and their rituals.

Despite being situated outside temple complexes, these mandapams exhibit similarities with corresponding temples in architectural style, construction materials, and designated spaces for rituals [53]. This research paper is limited to the meso-ritualscape of the Ekambaranathar temple in Kanchipuram. Mandapams are integral components of temples, taking various forms such as Artha Mandapa, Maha Mandapa, Neeraattu Mandapa, Alankaara Mandapa, and Sabha Mandapa [64].

Noteworthy among them are specialized Mandapams like Natana Mandapa, Naataka Mandapa, Puraana Mandapa, Tharukka Mandapa, Oonjal Mandapa, Mukti Mandapa, Nritha Mandapa, Vasantha Mandapa, Navaraathiri Mandapa, Kodikkamba Mandapa, and Neeraazhi Mandapa. Besides them, Mandapams with one pillar, 16 pillars, 24 pillars, and 1000 pillars are examples that highlight their architectural greatness.

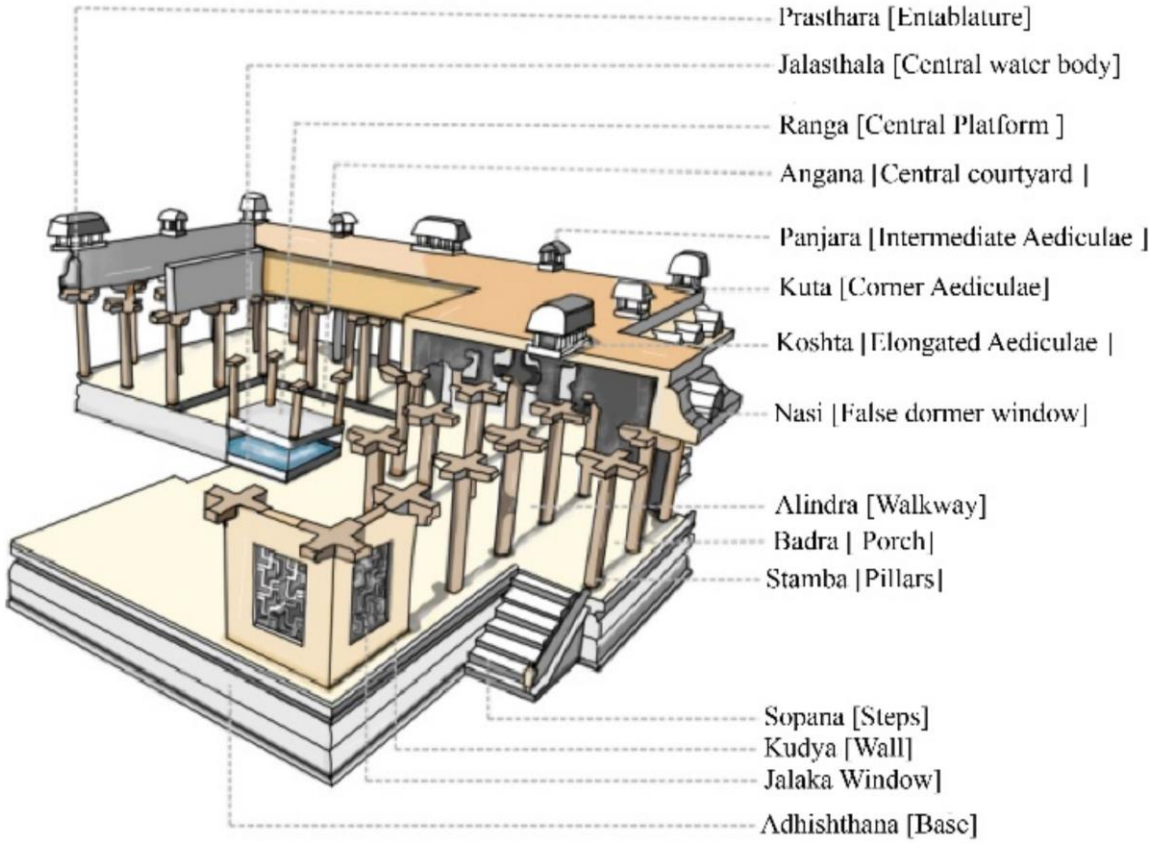


Fig. 7 Typical Parts of the traditional pavilion connected to Indian Temples

[Illustrated by the authors based on Das, V. M. and Garg, Y. K. 2011. Digital reconstruction of pavilions described in an ancient Indian architectural treatise. ACM J. Comput. Cult. Herit. 4, 1, Article 1 (August 2011), 16 pages] [63]

These pavilions or mandapams represent not only a variety in architectural skill pertaining to their respective times but also reflect and expose the cultural, religious, and social importance attached to the heritage of these structures. Unfortunately, most of these pavilions and mandapams, despite their historical significance, have lost much of their identity and social importance in the present times, which once served as vibrant nodes of the community. These buildings, intrinsic parts of the town fabric, have played very important roles in encouraging community interaction, religious rituals, and cultural events [64]. They were not only exemplary architectural creations, but were also living spaces that helped bring communities together. Many heritage mandapams we see today were podiums for socialization and religious and cultural practices that helped imbue major towns with a certain unified culture. Unfortunately, due to the passage of time, changes in social dynamics, and developments in these towns, these constructions have fallen into neglect.

Fig. 8 Dilapidated Heritage Mandapam adjacent to Highway - Gingee, Tamil Nadu. Source: authors

The ever-decreasing relevance of these heritage pavilions and mandapams reflects the erosion of culture and disconnection with our heritage roots. As the vibrancy associated with these structures wanes, so too does a piece of the community's common identity. It is crucial that these structures are conserved and restored for their relevance to architecture, but also to recapture the sensibility associated with the community that these places represent through their reconstruction as urban catalysts.

The relevant hypotheses for this study are presented below. Understanding the history, social, and cultural functions these pavilions and mandapas served would emphasize the need for conservation (Hardy, 1995). By being aware of and conserving these structures, one should be able to preserve architectural heritage while rediscovering the social confluence that revolves around these important aspects of our urban landscape.

5.2. Heritage Pavilions or Heritage Mandapams In Tamil Nadu

In Tamil Nadu, many heritage mandapams have a very intimate connection with temples, either within the temple complex or along routes for pilgrimage [65]. The mandapams have been known to be situated on highways and important routes leading to significant temples in the past and hold pivotal points within the cultural and religious topography of those areas. These mandapams became resting points for devotees who traveled on foot and also provided food and shelter through chatrams along pilgrimage routes. Today, however, many of these mandapams are victims of neglect, resulting not only in the dilapidation of the structures but also in the erosion of their cultural sanctity through improper contemporary use.

The abandoned mandapams currently serve as sites for antisocial activities, which include drinking alcohol, urinating in public, and dumping garbage, thus causing their faster deterioration and eliminating their sacred worth. The existing structures maintain their contemporary significance, yet people choose to build new buildings that do not match the existing environment. The small mandapams contain important architectural, cultural, and social elements, so their disappearance results in both architectural heritage loss and a decline in traditional cultural practices. The devotees of Thiruvannamalai observe this condition during their 14-kilometer path, which leads them to walk around the sacred hill.

The traditional route of mandapams provided multiple rest spots and meal areas for pilgrims, but today, the heritage site contains both destroyed heritage mandapams and newly built tensile and pavilion structures, which take away the historical character of the pilgrimage area. The existing heritage mandapams should undergo adaptive reuse because they still serve functional purposes, which will lead to sustainable development through reduced resource use and greenhouse gas emissions while maintaining sacred and communal customs.

Fig. 9 Dilapidated Heritage Mandapam in Girivalam Path - Thiruvannamalai, Source: authors

Fig. 10 Newly built modern Pavilion in Girivalam Path replacing old Heritage mandapams in Thiruvannamalai to serve the pilgrims, Source: authors

5.3. Heritage Pavilions or Heritage Mandapams in Kanchipuram

The city of Kanchipuram contains multiple heritage mandapams, which connect directly to its temple sites. The mandapams function as vital elements that sustain the town's religious and cultural heritage. The temple complex creates a public space that transforms through the ongoing process of rituals and prayers. The mandapams function as active public spaces that support both business activities and social connections through their operation at temple sites. The Brahmotsavam festival processions use mandapams as temporary stops, which create a street display of religious devotion throughout the city. The historical value of the mandaps in Kanchipuram faces multiple threats because of privatization, structural changes, and building decay, which

need immediate solutions. The heritage management plan for the city's tram heritage tour can incorporate these urban catalysts as three elements. The community will gain income through Mandapams conservation, which requires proper care and maintenance because it will restore their community identity. Mandapams received less research and conservation efforts because most research focused on temples.

The research investigates Kanchipuram mandapams by documenting their heritage value, which leads to aesthetic and social understanding. Notably, previous studies, such as Emma Natalalya Stein's chronological documentation of Kanchi's temples in 2021 [6], briefly mentioned the availability of mandapams, but there is still a lack of in-depth research in this area. This paper seeks to address this gap and contribute meaningful measures for the conservation and revitalization of Kanchipuram's heritage mandapams. Initially, the research involved identifying a set of 34 heritage mandapams scattered throughout the town randomly. However, the focus has narrowed down to the mandapams situated along the processional route associated with the Ekambaranathar Temple.

This shift in focus is a strategic decision in the ongoing research, allowing for a more detailed examination of the cultural significance of the fifteen heritage mandapams along this specific route. Apart from the temple sites, within the meso ritualscapes, very few mandapáms are actually transformed into hubs that facilitate economic activities. Even on occasions such as the Brahmotsavam festival, mandapáms are the temporary landing sites for the deity processions, showcasing the devotion in a dramatic manner on the city roads. Nonetheless, despite their past importance, mandapáms in Kanchipuram are facing challenges that need to be addressed urgently. Currently, these capable catalysts of a city transformation might effortlessly get included in a heritage management plan for a tram heritage tour of the city.

The mandapams could, with proper attention and care, be preserved and not only give back the identity to the people of the region but could earn the community some revenue as well. Despite the vast research and attention being paid to the preservation of the temple, the mandapams have not received adequate attention. The goal of the research is to fill that research gap and explore the mandapams' cultural heritage of Kanchipuram. Interestingly, the research and study of mandapams have received a brief mention in the research that has studied the documentation of the Kanchi temples chronologically by author Emma Natalalya Stein in 2021 [6, 19]. This paper aims to fill this gap and provide some concrete measures for the conservation and restoration of Kanchipuram's heritage mandapams. Initially, 34 heritage mandapams were identified scattered across the town. A mobile GIS walkover survey georeferenced these mandapams using Map Plus, creating a spatial heritage inventory for further analysis. This research paper focuses on mandapams situated along the processional path of the Ekambaranathar Temple, outside the temple complex.

Fig. 11 Thirty-four Mandapams georeferenced using a walkover survey using the Map-plus application. Source: Authors

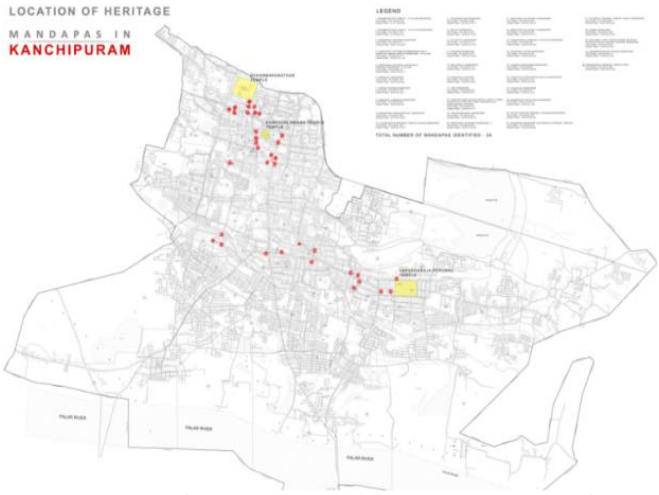


Fig. 12 Location of the 34 Heritage Mandapams initially identified in Kanchipuram, Source: authors

Most of the heritage mandapams in Kanchipuram were built during the Vijayanagara period as part of the deliberate architectural expansion by its rulers to accommodate the new processional festivals that attracted visitors from different regions. Communities often built these mandapams near their local precincts to provide halting points for the processional deity, offering honor through shared contributions such as monetary support for temple upkeep and enhancements. Beyond festival functions, these pavilions served the broader public, scattered throughout Kanchipuram. Today, however, many of these structures have vanished or fallen into ruin; some have been appropriated for private use, losing their cultural identity, and access is further complicated in cases still embroiled in disputes and challenges that have significantly impeded site study.

Fig. 13 Processional deity (Utsavar) placed inside a Heritage mandapam in Kanchipuram. Source: Authors

Fig. 14 Heritage Mandapam currently used as a tailor shop and vegetable shop in Kanchipuram, Source: Authors.

Fig. 15 Heritage Mandapam Converted to a street-side restaurant in Kanchipuram, Source: Authors

6. Heritage Mandapams along the Processional Routes of the Ekambaranathar Temple in Kanchipuram

The Chithirai festival involves the procession of the Utsavar (processional deity) from Ekambaranathar Temple to Paalur village (32.7 km) and back, though this ritual has declined in recent times. Other monthly festivals follow shorter routes. In Chithirai and Vaigasi, the Utsavar is taken to nearby temple tanks for theerthavari; in Aani and Aadi, the procession circumambulates the four raja veedhi of Kanchipuram. Along these routes, 15 heritage mandapams have been identified, of which 12 were selected as samples for this research due to their direct active ritual association with the Ekambaranathar Temple. During festivals, the mandapams are cleaned, the Utsavar is housed within them, and the community head associated with each mandapam is accorded first respect.

Traditionally, these mandapams were maintained through community-based stewardship, with residents pooling resources for maintenance, offerings, and donations to the processional deity, which in turn supported temple upkeep and upgrades. Outside festival periods, at present, many mandapams suffer from neglect, inappropriate alterations, structural stress, and loss of heritage value. Originally intended for community collective use, several are now appropriated for private gain, despite their potential to act as catalysts for community and economic revitalization and improved quality of life [26].

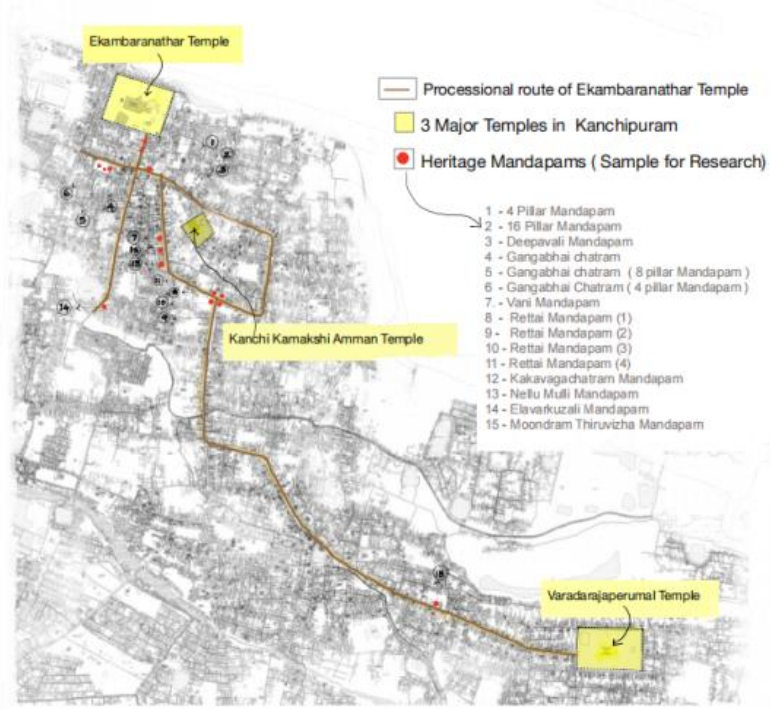


Fig. 16 Location of the 15 Heritage MANDAPAMS along the meso ritualscape of Ekambaranathar temple in Kanchipuram. Source: Authors

6.1. 4 Pillar and 16 Pillar Mandapam in Sannathi Street of Ekambaranathar Temple [Mandapam 1&2]

The four-pillar mandapam or the naalukaal mandapam, placed along the central axis of the temple, represents the four cardinal directions and acts as a symbolic threshold that guides devotees from the everyday world into the divine-sacred realm [66].

In the case of the Ekambaranathar Temple at Kanchipuram, apart from the 4-pillar mandapam located near the gateway, there is a 16-pillar mandapam marking alignment with the entrance to the temple. The positioning of two open-pillared mandapams can be seen as an intervention that was adopted during the Vijayanagara period, which marked the addition of extensive architecture to the temple complex [53]. To meet the ritual and urban space requirements, these mandapams were constructed. The 4-pillar mandapa, normally adjacent to the gopuram, is a transition area where various religious acts such as padi pooja, preliminary deeparadhana, and the reception of Utsavar take place prior to or following a procession. The 16-pillar mandapam, yet again aligned with the axial street, is employed, for instance, during major festivals such as Panguni Uthiram, when the idols pause for alankaram, darshan, and the people's worship as it is about to enter or re-enter the temple [67]. The mandapams facilitate a transition from the worldly outside street to the religious zone of the temple. The 16-pillar mandapam can sometimes correspond to the processional path, where the presence of the deity is extended symbolically into the outside world. This is evident in Vijayanagara's town-planning concepts, where temples and streets are linked by religious infrastructure.

Fig. 17 Location and land use map surrounding the 4 Pillar and 16 Pillar Mandapams along the axis of Entrance Gopuram - Ekambaranathar temple in Kanchipuram

(a) **(b)**

Fig. 18 (a) 4 Pillar Mandapam, and (b) 16 Pillar Mandapam along the axis of Ekambaranathar temple entrance gopuram. Source: Authors

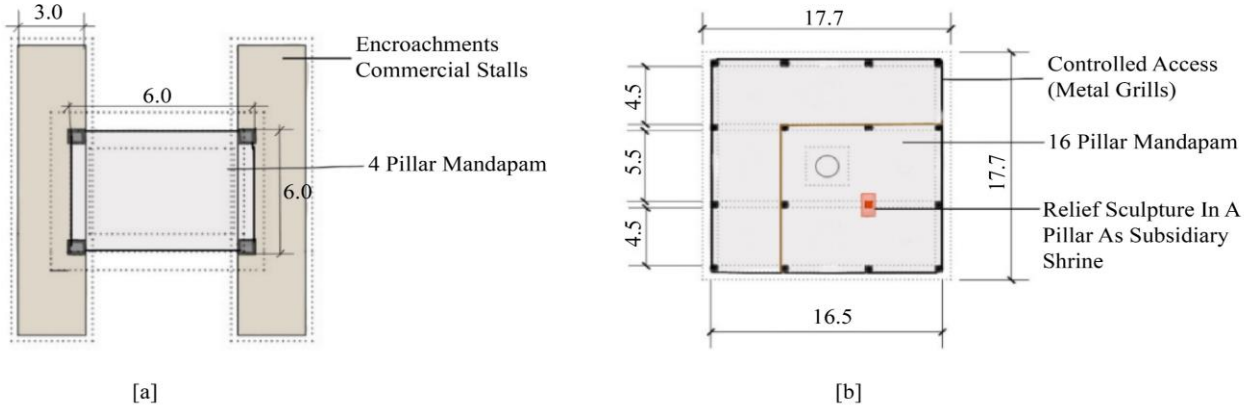


Fig. 19 (a) Plan of 4 pillar Mandapam, and (b) Plan of 8 Pillar Mandapam along the axis of Entrance Gopuram - Ekambaranathar temple in Kanchipuram

Currently, the four-pillared mandapam has been encroached upon, with the pillars being used to support temporary commercial stalls. Another type of adaptive reuse has occurred in the sixteen-columned mandapa, which has been partially encased with metallic grills to prevent entry to certain areas, thus reducing its functionality as well as its significance. The area between the two mandapams has also been used for parking vehicles, resulting in obstructions that reduce the spatial legibility of the mandapams collectively. Such changes cause loss of architectural character, authenticity, and integrity that diminishes the cultural significance of the site according to well-defined principles of conservation by Bernard Fielden [47].

6.2. Deepavali Mandapam [Mandapam - 03]

The Deepavali Mandapam, originally housing 16 pillars, is situated near Sengaluneer Odai Street and within a kilometer radius of the Ekambaranathar Temple in Kanchipuram, and serves as a heritage structure utilized for the Processional deity (Utsavar) of Ekambaranathar temple rituals during the Tamil month of Ipasi. During ceremonial processions, the deity is housed within the mandapam for rituals.

Unfortunately, the mandapam's facade is currently obscured by banners and awnings, and its interior spaces have been divided into three sections using metal sheets for separate purposes, including a cycle shop, coal shop, and sweet stall. The Mandapam is cleaned, and internal partition walls are removed during the processional festival [68]. The mandapam is in poor condition, identity is completely lost, and it requires renovation immediately.

Fig. 20 Location and land use map surrounding deepavali Mandapam

Fig. 21 Altered front facade of the deepavali mandapam - loss of identity

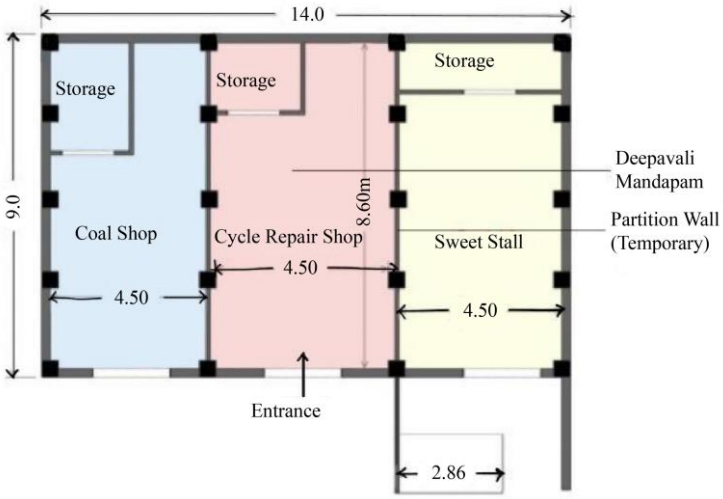


Fig. 22 Plan of the deepavali mandapam

Fig. 23 3D scan of the deepavali mandapam using the polycam application - showing original extent and additions

6.3. Ganga Bhai Chatram Complex [Mandapam 4,5, and 6]

The Gangabhai Chatram or choultry, along with the Four and Eight Pillar Mandapams adjacent to it, form a complex with open spaces along Salai Street. Access to the Chatram was restricted due to its deteriorated structural condition, and subsequent visits revealed that the structures had become obscured by privatization, ownership disputes, and misuse by the public [67]. In contrast, the Four and Eight Pillar Mandapams remain partially maintained owing to their continued association with temple processions. The surrounding context is predominantly residential, with commercial and mixed-use developments concentrated along the main road, where rising land values have intensified pressure on these heritage sites.

Fig. 24 Location and land use of the context - Gangabhai chatram complex

6.3.1. Gangabhai Chatram

The Gangabhai Chatram, located on Salai Street in Kanchipuram, is representative of the 18th-19th century tradition of community choultries that provided food and lodging to pilgrims. Probably endowed by a Gujarati patron, its granite-pillared design renders the utilitarian architecture of late 19th-century temple-related public structures [64]. Historically, it was intimately connected with the Brahmotsavam processions of the Ekambaranathar, Kamakshi Amman, and Varadarajaperumal temples, which served as a shelter for hundreds of Shaiva and Vaishnava pilgrims through the 19th and early 20th centuries. References in the Kamakshi temple's festival route, however, suggest that it remained in ritual use until at least the late 20th century. However, today it is mostly abandoned, encroached upon, and in ruin, with its disuse expressive of both the decline of traditional pilgrimage patterns and the broader challenges of conserving the temple-town choultries in an urbanized context. Architecturally and historically, it aligns with the mid to late-19th-century choultries built under colonial-era patronage, particularly by local elites and merchants during the Carnatic period. Owing to severe structural deterioration, prolonged disuse, and associated safety concerns, the building could not be documented in detail; as a result, precise measurements of the structure and its internal spatial configuration remain unknown.

(a) **(b)**

Fig. 25 (a) Dilapidated raised entrance verandah in the front porch of the chattram with vegetation growth in walls, and (b) Entrance of the Gangabhai Chattram, with vegetation overgrowth surrounding the locked doorway.

6.3.2. Four Pillar Mandapam and Eight Pillar Mandapams - Adjacent to Gangabhai Chatram

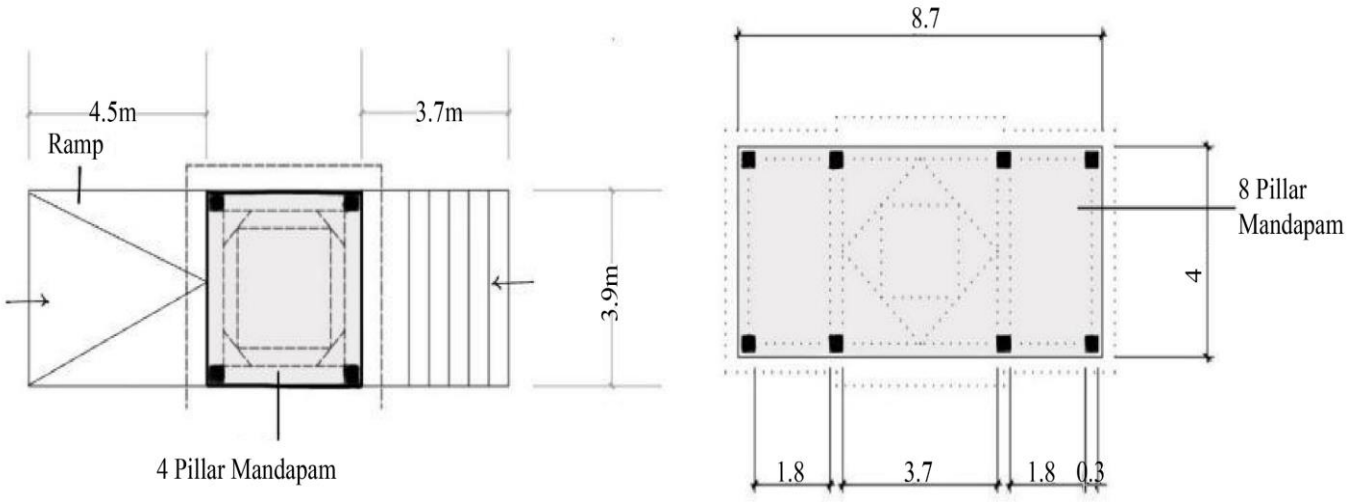
The four-pillared mandapam, situated adjacent to the Gangabhai Chatram, lying between the eight-pillared mandapam and the former, houses the processional deities of Varadaraja Perumal Temple. Most of the heritage mandapams in Knachipuram are linked to their main temples and their deities. The relief sculptures on the mandapam pillars depict narrative episodes from the Puranas associated with the temple deities [19]. Mandapams tied to Shiva temples, for instance, feature relief sculptures narrating Shiva's stories. The eight-pillared mandapam here, associated with Ekambaranathar, carries depictions of its presiding deity.

Fig.26 Eight-pillared mandapa features relief sculptures depicting stories linked to the Ekambaranathar Temple

The eight-pillared mandapam is a processional rest space for the deity of Ekambaranathar during the Panguni Utsavam festival. The granite pillars, as well as the carvings on the column capitals, show Vijayanagara craftsmanship, which dates back to the 16th century CE. Together, these freestanding mandapams reflect the Vijayanagara dynasty's emphasis on festival architecture, designed to facilitate ritual halts and community participation [68].

(a) **(b)**

Fig. 27 (a) 4 Pillar Mandapam, and (b) 8 Pillar Mandapam adjacent to the Gangabhai Chatram



(a) **(b)**

Fig. 28 (a) Plan of 4 Pillar Mandapam, and (b) Plan of 8 Pillar Mandapam adjacent to the Gangabhai Chatram.

Currently, both the mandapams (4 Pillar & 8 Pillar Mandapams) are highly restricted from public use. Initially closed off with grill gates and now completely sealed with opaque metal sheets, they remain inaccessible except during specific festival occasions.

(a) **(b)**

Fig. 29 Restricted public access to the Mandapams from the Main road [Salai Street] (a) Mandapams access was restricted by metal grills in 2022, and (b) Mandapams frontage is concealed at present with a metal sheet barricade. Source: authors

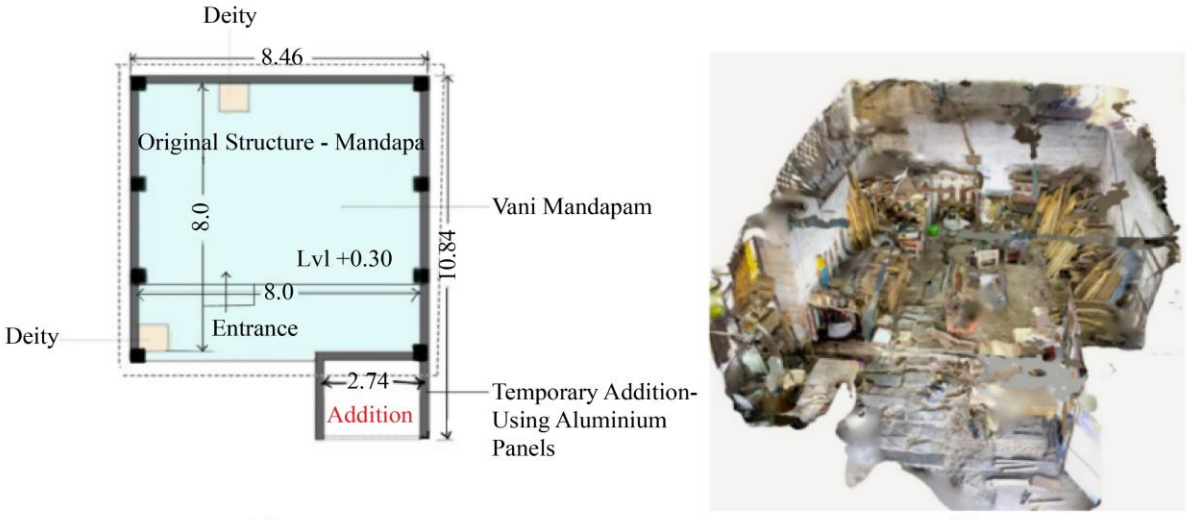
6.4. Vani Mandapam [Mandapam 7]

The Vani Mandapa, situated near Rajaveedhi and just a few buildings away from Kakvagachatram Mandapam, is currently in an advanced state of decay and neglect. Its original character has been lost, with the interior now filled with carpentry materials that obscure the space and even make it difficult to locate the idol amidst the dust and debris. The roof is extensively damaged and has never been repaired, while unsympathetic structural alterations have further weakened its stability [47]. Although the Mandapam holds considerable historical significance, it is primarily used by private individuals for carpentry work, except on the 11th day of the Panguni Utsavam, when it is part of the temple procession route [67]. Originally, the Mandapam had eight pillars, none of which survive today; only a pillar capital remains, buried in the clutter.

Fig. 30 Location and Land use of the context - Vani Mandapam

(a) **(b)**

Fig. 31 (a) Front facade of Vani Mandapam - Loss of Identity, and (b) Interior of the Vani Mandapam, insensitively used as a wood shop, resulting in loss of heritage value.



[a] [b]

Fig. 32 (a) Plan of Vani Mandapam, and (b) 3d scanned image of Vani Mandapam using Polycam application.

6.5. Kakavagachatram Mandapam [Mandapam 8]

The Kakavagachatram, located adjacent to West Raja Veedhi near the Kachabeswarar Temple in Kanchipuram, is a community choultry dating to the late 19th to early 20th century. This mandapam features rectangular pillars with plain friezes and simple lintels, which were characteristic of late utilitarian architecture [70]. Unlike the elaborately carved mandapams of earlier centuries, this choultry relies on a straightforward, functional stone form with no epigraphic or ornamental features. Originally, it had eight pillars; six remain today with plain, unornamented shafts. Later, it was extended in the back to accommodate rooms, a feature that seems to indicate its adaptive reuse as a lodging facility. Like all other chatrams, it functioned earlier as a rest house with dormitory accommodation and kitchen facilities for feeding pilgrims and the poor.

Currently, it is let out for weddings and small ritual festivals, the returns going into its upkeep process. Owing to its occupation during active functions, detailed physical documentation and manual measurement were not possible; although the structure was 3D scanned, exact dimensional data and internal spatial measurements remain uncertain.

(a) **(b)**

Fig. 33 (a) Current view of Kakavagachatram Mandapam, and (b) 3d scanned image of Kakavagachatram using Polycam application.

6.6. NelluMulli Mandapam [Mandapam 9]

The 16-pillared mandapam near the eastern gopuram of Kachapeshwarar Temple, locally known as the Nellu Mulli Mandapa, is a freestanding pavilion in the classic Vijayanagara style, built in the early 16th century CE (around 500 years ago). Rising about 5 meters high, it was originally an open ritual space with beautifully carved granite pillars, serving as a Veedhi mandapam where the utsavar murti (processional deity) would rest during festivals, receive offerings, music, and community honors [68]. Today, however, the mandapam has been divided into three partitions. The central portion is still retained at its full height and used for community rituals with limited public access, while the sides have been converted into a tea shop and a sweet stall, each enclosed with lowered roofs at around 3 meters, concealing the original pillars. This reuse not only alters the scale and spatial character of the pavilion but also hides and diminishes the craftsmanship of its sculpted pillars, undermining the historic identity of the structure [47].

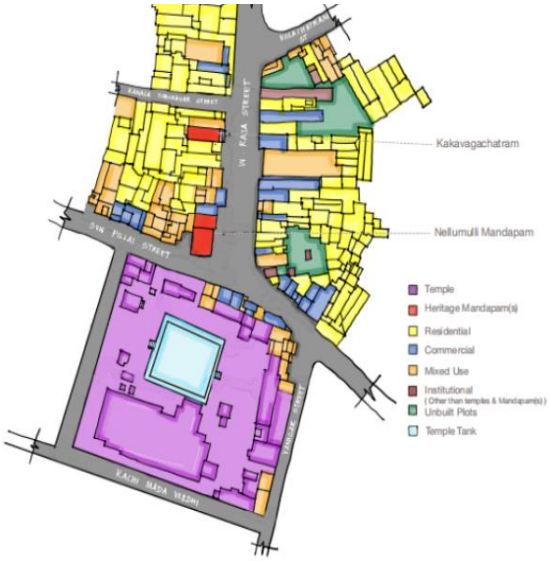
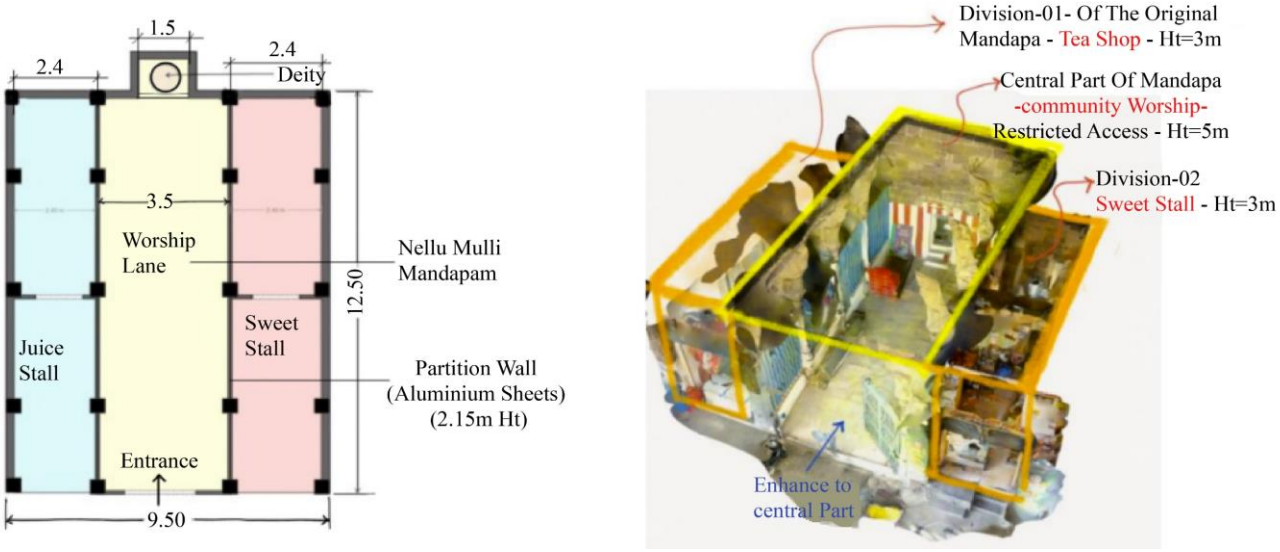


Fig. 34 Location and Land use of the context - Kakavagachatram and Nellumulli Mandapam



(a) **(b)**

Fig. 35 (a) Plan of Nellumulli Mandapam, and (b) 3d scanned analytical image of the Nellumulli mandapam at present using the Polycam application

(a) **(b)** **(c)**

Fig. 36 Current use of Nellumulli Mandapam (a) Juice & Tea stall, (b) Central space reserved for daily worship and partitioned using metal sheets, and (c) Sweet stall hiding the original façade.

6.7. Rettai Mandapam Complex - Kamarajar Salai Junction [Mandapa 10,11,12 & 13]

At the historic core of Kanchipuram, anchored by the major commercial axis and junction of Kamarajar Salai (formerly Kamarajar Street), stand four heritage mandapams, one at each corner of the intersection [6]. Researcher Emma Natalya Stein, in her monograph Constructing Kanchi: City of Infinite Temples (2021), also refers to the presence of these mandapams in mapping the city's sacred and urban landscape. Of the four, two Rettai Mandapam 1 and Rettai Mandapam 2 are historically associated with the Ekambaranathar Temple, while the other two are linked to the Varadarajaperumal Temple and serve during its processional festivals. Constructed during the Vijayanagara period to emphasize this significant urban junction, the mandapams were later transferred to community use but are now entirely privatized. Rettai Mandapam 1 has fallen into complete abandonment, is rendered inaccessible, and has been reduced to a garbage dump, with the processional practices of the Ekambaranathar utsavar discontinued. Rettai Mandapam 2 has been converted into a tea shop and restaurant, likewise ceasing its ritual role in temple processions. The other two mandapams, associated with the Varadarajaperumal Temple, have also been adapted as roadside eateries; however, they are kept clear during festivals to facilitate the passage of the processional deity. These mandapams, positioned diagonally opposite each other, thus reflect both the historical significance and the contemporary neglect of sacred urban junctions in Kanchipuram.

Fig. 37 Location and Land use of the context - [Rettai Mandapam 1,2,3 & 4]

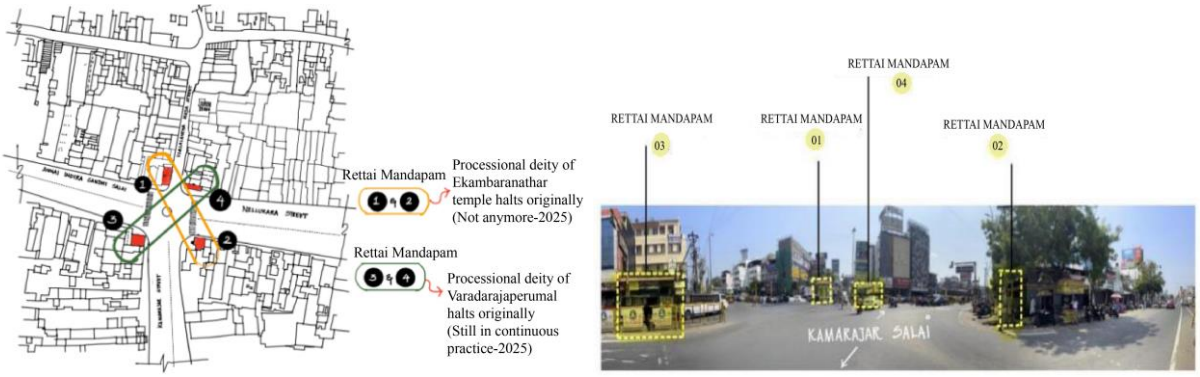


Fig. 38 Diagonally positioned paired set of heritage mandapams linked to the Ekambaranathar and Varadaraja Perumal temples at the Kamarajar Salai junction in Kanchipuram. Source: authors

(a) (b) (c) (d)

Fig. 39 (a) Rettai Mandapam 01 (b) Rettai Mandapam 02 (c) Rettai Mandapam 03, and (d) Rettai Mandapam 04. Source: authors

6.8. Elavarkuzhali Mandapam [Mandapam 14]

The Elavarkuzhali Mandapam near Okkapiranthan Kulam, named after Goddess Parvati (Elavarkuzhali), served as a processional stop of Elavarkuzhali amman utsavar during the Panguni Utsavam of Ekambaranathar Temple, a role it continues to hold today. Built around the 16th–17th century CE (roughly 400–500 years ago), it differs from the richly carved Vijayanagara mandapams elsewhere in Kanchipuram, with its plain granite pillars suggesting either a later Nayak/Maratha reconstruction or a deliberate choice for a simple, functional pavilion [64]. The mandapam started as a public area, which people used for their ceremonial worship and community events, but now functions as a private space that people use for their practical needs. The building exists as a basic structure, but it serves as a vital link to Kanchipuram's historic festival mandapams, which used to connect temple deities with sacred tanks and nearby residents.

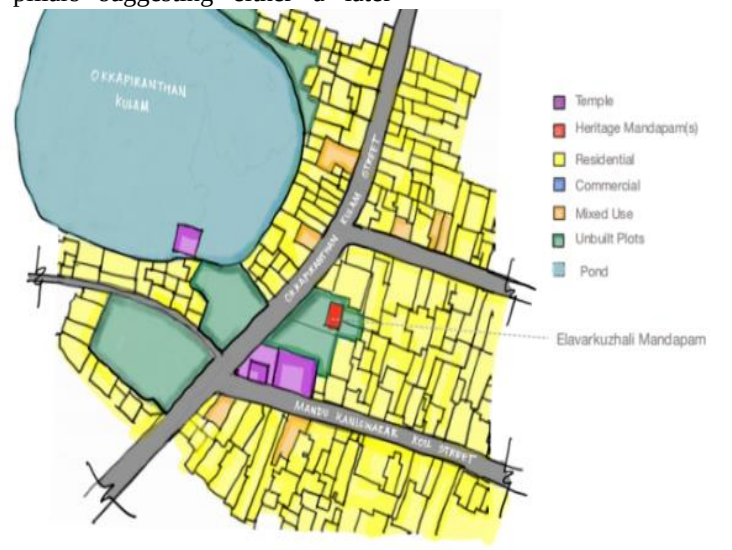


Fig. 40 Location and Land use of the context - Elavarkuzhali Mandapam

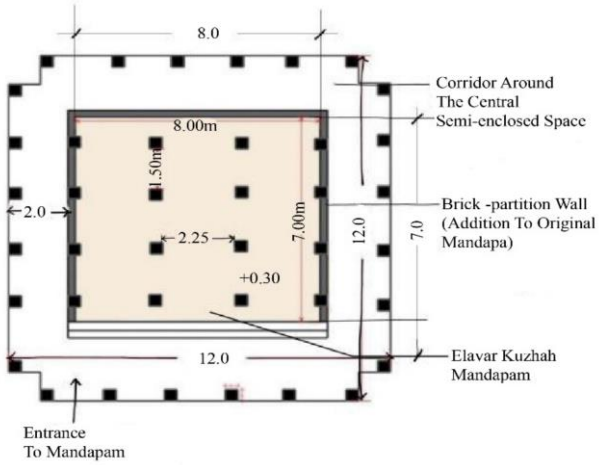


Fig. 41 Plan of Elavarkuzhali Mandapam

(a) **(b)**

Fig. 42 (a) Elavarkuzhali Mandapam's front facade is hidden behind stacked firewood, and (b) Interior view of the Elavarkuzhali Mandapam.

6.9. Moondram Thiruvizha Mandapam [Mandapam 15]

Opposite the Vishnu Kanchi Police Station and near the Varadaraja Perumal Temple, Moondram Thiruvizha Mandapam has a nave flanked on either side by aisles, ending in a small shrine intended for collective worship. Recently, over the last couple of decades, the aisles have been encroached upon and utilized by private vendors for storing construction material, including scaffolding, placing undue structural load on the building and creating significant structural distress [71]. The façade, with sculptural details and ornamentation, is in advanced stages of deterioration, characterized by severe cracks, the growth of vegetation on the roof, and infiltration of water inside the mandapam. Despite these conditions, the structure retains ritual significance; during the Panguni Utsavam of the Ekambaranathar Temple, the mandapam is cleared of all occupation, and the processional deity is ceremoniously brought here as part of the festivities. An immediate conservation intervention is urgently needed to check further deterioration, bring about structural stability, and preserve the cultural and community significance of this mandapam [47].

Fig. 43 Location and Land use of the context - Moondram Thiruvizha Mandapam

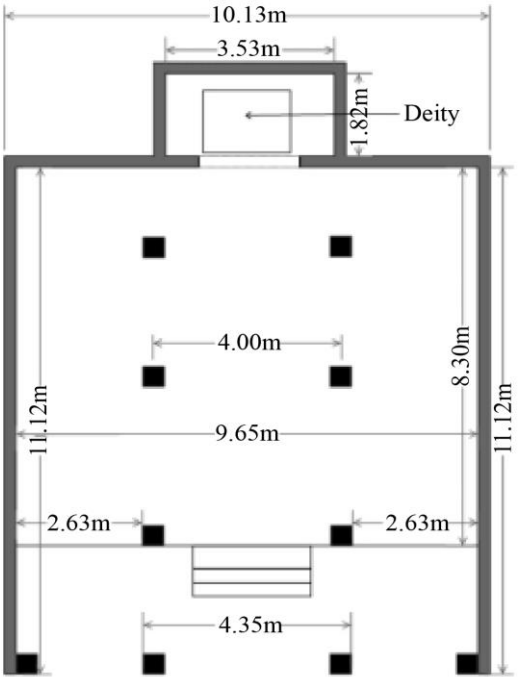
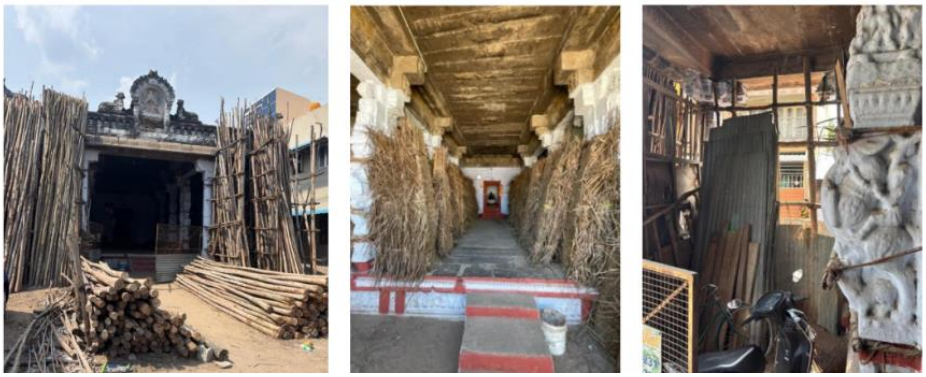


Fig. 44 Plan of Moondram Thiruvizha Mandapam



(a) (b) (c)

Fig. 45 (a) Front facade of the Moondram Thiruvizha Mandapam, currently used for timber storage, (b) Mandapam interior, currently occupied with stored thatch, and (c) Sculptural details hidden under plaster, indicative of insensitive conservation.

7. Heritage Mandapams as Urban Catalysts in Kanchipuram

7.1. Consolidated Indicators for Heritage Buildings to Act as Urban Catalysts

The 60 parameters developed in the earlier work were consolidated into a refined set of 19 operational indicators using a qualitative content analysis through thematic consolidation and redundancy clustering to create a more coherent, usable, and decision-oriented assessment framework for mandapams [24, 25]. These indicators were organised under two domains, Safeguard and Catalyst, to reflect the dual responsibility of heritage management: preventing loss while enabling value creation [26, 27]. The Safeguard Indicators (S1–S9) capture essential conservation obligations, including: Structural Stability & Damage (S1), Architectural Integrity and retention of original fabric (S2), Immediate Safety & Hazards affecting users (S3), Maintenance, Documentation & Past Works (S4), Ownership, Custodianship & Legal Clarity (S5), Emergency Access & Response Readiness (S6), Environmental Risks & Encroachment Control (S7), Regulatory Coverage & Monitoring (S8), and Baseline Security for asset protection (S9). The Catalyst Indicators (C1–C10) focus on a mandapam's regenerative capacity once safeguarding is assured, including: Cultural/Ritual/Heritage Significance (C1), Community Engagement & Current Use (C2), Adaptability & Spatial Support for reversible, significance-led reuse (C3), Tourism & Economic Viability through clustering and catchment synergies (C4), Urban Integration, Visibility & Public Transport Access (C5), Sustainability Add-Ons that are reversible and fabric-sensitive (C6), Placemaking & Identity Revival opportunities (C7), Visitor Interpretation & Experience (C8), Policy & Program Alignment with statutory and mission frameworks (C9), and Visitor-Facing Amenities & Safety Perception (C10). The structured consolidation process aligns with the UNESCO Historic Urban Landscape (2011) recommendation, which directs clustering of related values into manageable groups, while Feilden & Jokilehto's (1993) framework supports operational clarity through cultural heritage protection. The final 19-indicator framework enables more rigorous assessment of twelve mandapams because it combines essential functional elements while maintaining the original 19-indicator conceptual framework [28].

7.2. Structural Condition Assessment

The condition assessment of the heritage mandapams was carried out by structural engineers based on visual observations for immediate safety, based on over a decade of professional experience, and was necessarily limited by funding constraints to indicators such as cracks (vertical, diagonal, and shear), dampness and moisture ingress, loose or displaced stones, vegetative growth, damage to architectural details, surface patina condition, roof slab displacement, and floor dampness, rather than a detailed instrument-based structural investigation.

Table 3. Consolidated Indicators from 60 Parameters. Source: authors

NO	60 PARAMETERS	CONSOLIDATED INDICATORS [S]-SAFEGUARD/[C]-CATALYSTS]
P1	Major structural damages (severe cracks/tilting)	S1
P2	Architectural elements/details intact/repairable	S2
P3	Retains aesthetic/historical/cultural significance	S2

P4	Free from visible dangers (loose stones, unsafe areas)	S3
P5	Actively used by community (cultural, social, economic)	C2
P6	Role in festivals, traditions, cultural practices	C1
P7	Site open and accessible for public use	C5
P8	Strong emotional/historical value for local community	C1
P9	Basic infrastructure present or easily integrable (power/water/sanitation)	C10
P10	Near other heritage/cultural sites (cultural cluster)	C4[C]
P11	Reflects regional architectural/cultural identity	C7
P12	Documented in heritage records/archives/maps	S8
P13	Linked to local stories/intangible heritage	C1
P14	Adequate open space for parking, seating, walkways	C3[A]
P15	Adaptable for commercial/residential/cultural purposes	C3[B]
P16	Located near marketplaces/economic hubs	C3[B]
P17	Potential to generate revenue (tourism, events, rentals)	C4[A]
P18	Extra space to add ramps/elevators/BMS	C3[B]
P19	Can integrate energy-efficient tools (solar, LEDs) w/o disrupting character	C6
P20	Regular maintenance/upkeep over time	S4
P21	Ownership clearly documented and undisputed	S5
P22	Records of past restoration available	S4
P23	Integrates well with surrounding urban environment	C5
P24	Nearby streets manageable for increased traffic/visitors	C5
P25	Near parks/plazas/public gathering spaces	C5
P26	Located in a visible/strategic area (landmark potential)	C5
P27	Roads to the site well-connected/navigable	S6
P28	Cycle paths or rental facilities available nearby	C5
P29	Provisions for differently-abled individuals (ramps, tactile walkways)	C10
P30	Active advocates/local groups/NGOs for preservation	C2
P31	Space to host public events, workshops, cultural performances	C7
P32	Local volunteers willing to participate in maintenance/programming	C2

P33	Suitable for heritage walks, educational workshops, lectures	C8
P34	Religious/ceremonial spaces within 1 km (adds spiritual significance)	C1
P35	Essential visitor facilities (restrooms, seating) can be added w/o disruption	C10
P36	Unique qualities appealing to cultural tourists	C4
P37	Possibility to add guided tours/interpretive signage/storytelling	C8
P38	Hotels/guesthouses/homestays nearby	C4[B]
P39	Information kiosk/tourism office within 1 km	C8
P40	Non-heritage attractions nearby that complement visitor experience	C4[C]
P41	Police station/regular patrol presence nearby	S9
P42	Streets around site are well-lit (evening safety)	C10
P43	Clinics/hospitals/first-aid centers nearby	C10
P44	Traditional or modern marketplaces nearby	C4[B]
P45	Dining options (cafes/restaurants) within 1 km	C4[B]
P46	consideration in Previous policy	C9
P47	Natural energy efficiency via design (ventilation/lighting)	C6
P48	Risks from flooding, vegetation, pollution, or encroachments	S7
P49	Potential for renewable energy integration (solar, wind)	C6
P50	Potential for sustainable landscaping / native planting	C6
P51	Ability to add public art/installations	C7
P52	Space to designate local artisans/vendors	C7
P53	Potential to become social or cultural anchor/sense of place	C7
P54	Minimal interventions required to make site functional	C3[A&B]
P55	Current reuse aligns with government heritage policies	C9
P56	Public transport hubs (bus/metro/train) within 1 km	C5
P57	Pedestrian-friendly pathways/walking trails in vicinity	C5
P58	Parking lots/spaces available within 1 km	C5
P59	Other heritage structures/monuments within 1 km radius	C4
P60	Nearby heritage sites share historical/cultural connection	C4

8.1. Literature Review and Analysis

8.1.1. PRISMA

A structured review was conducted following PRISMA-based screening principles.

Databases

Google Scholar, Scopus, UNESCO Digital Library, ICCROM publications, ASI, and INTACH archives.

Search String

The search string used across Google Scholar, Scopus, UNESCO Digital Library, ICCROM publications, and ASI archives was structured and illustrated below. The search strategy was designed using Boolean operators (AND, OR) to capture literature addressing three key thematic dimensions of the research. ("heritage conservation" OR "risk preparedness") AND ("urban regeneration" OR "adaptive reuse") AND ("temple towns" OR "processional routes"). This structured search strategy enabled a comprehensive retrieval of literature relevant to heritage-led urban regeneration and ritual landscape infrastructures.

Inclusion Criteria

2016–2025 publications, Peer-reviewed or institutional reports, English language, Minimum 10 citations or institutional publication.

Exclusion Criteria

Non-built heritage focus, Pure tourism marketing studies, Non-urban contexts.

Screening Results

Initial	Records	Identified:	328
After	Title	Screening:	184
After	Abstract	Screening:	127

Final Included Studies: 100

Indicator Reference Matrix

Each selected study was coded using a structured matrix identifying: Primary emphasis (weight = 2) and Secondary mention (weight = 1)

Indicator score was computed as:

$$Score_i = (P_i \times 2) + (S_i \times 1)$$

The process of standardizing scores across domains established their proportions, which were used to calculate their relative importance. The process of weight assignment requires this procedure because it provides reproducible results while eliminating personal biases.

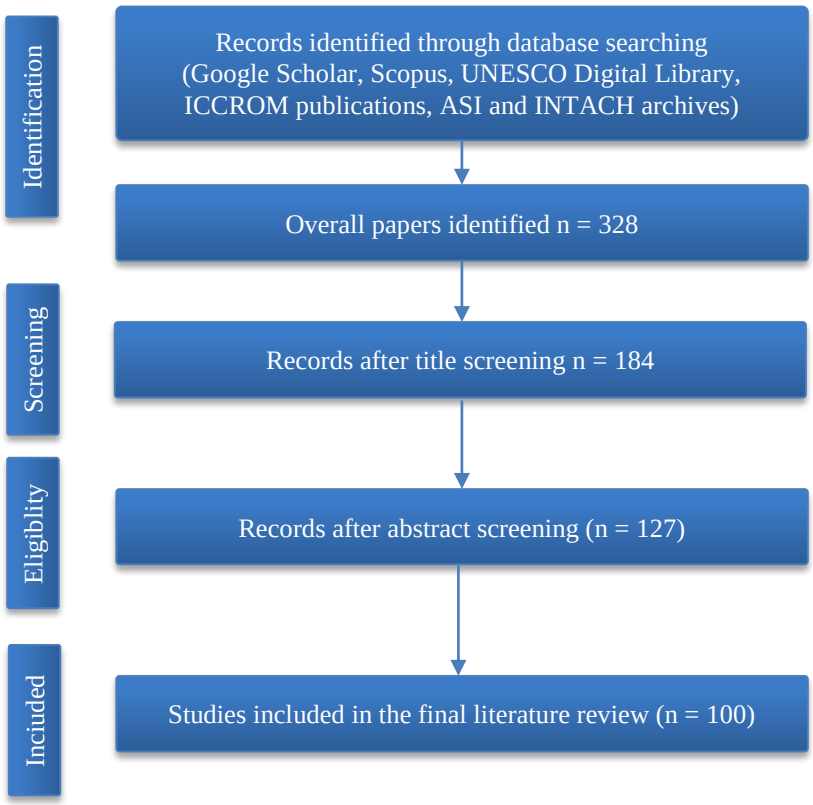


Fig. 46 PRISMA

The current research utilised a systematic matrix to assess the significance of indicators, which they coded for each published work. The study assigned primary classification to an indicator when it served as a main research component or analytical focus of their study. Also, assigned secondary classification to an indicator when it functioned as an additional contextual element that supported the main research findings.

8.1.2. Generation of Relative Weight using Literature

With a focus on obtaining a relative importance weightage for Safeguard (S1-S9) and Catalyst (C1-C10) indicators, a holistic secondary literature study was conducted. The study was guided by a desire to learn from both safeguarding and transformative aspects in cultural heritage management, in alignment with international conventions such as Historic Urban Landscape Guidelines by UNESCO and ICCROM's Guidelines for World Cultural Heritage Site Management by [29].

An integrated keyword approach has been developed to ensure that all aspects - technical, cultural, environmental, and urban are dealt with equally well in the context of management of heritage. The keyword approach would cover Safeguard and Catalyst views that represent equally well the twin tasks of conservation - conversation and unlocking. This article is targeted towards meeting Sustainable Development Goal 11 (Sustainable Cities and Communities) Target 11.4, which suggests that enhanced efforts be made towards protecting and safeguarding cultural and natural heritage on this planet. The article also aims to meet other Sustainable Development Goals, such as Goal 8 (Decent Work and Economic Growth), Goal 13 (Climate Action), Goal 4 (Quality Education), and Goal 17 (Partnerships for the Goals), which identify culture as a driver and enabler of sustainable development. The search strategy for the Safeguard indicators (S1-S9) dealing with protection, stability, authenticity, and risk preparation involved the use of technical and management-related key word combinations that include "heritage conservation," "preventive conservation," "risk preparation," "structural stability of heritage buildings," "temple conservation cracks and tilting," "architectural authenticity," "heritage fabric retention," "maintenance documentation," "ownership and custodianship of monuments," "legal status of heritage sites," "environmental and encroachment risks," "heritage regulation and monitoring," and finally "security and protection of heritage assets." The words demonstrate operational and legal requirements together with environmental needs, which protect physical heritage according to the established standards and charters of ICCROM, INTACH, and UNESCO. At the same time, the Catalyst Indicators (C1 to C10) related to adaptive reuse, social activation, and heritage-led urban regeneration have been analyzed using socially and geographically relevant keywords including "heritage-led regeneration," "adaptive reuse of temples," "community participation in heritage management," "living heritage traditions," "cultural identity and placemaking," "heritage tourism and local economy," "urban integration and visibility of monuments," "sustainable heritage design," "renewable energy in heritage sites," "interpretive signage and visitor engagement," "policy alignment with HRIDAY and Smart City," and "visitor facilities and safety perception." These keywords embody the increasing importance of heritage as an SDG11 catalyst for sustainable urban transformation and placemaking through inclusive culture-led strategies; an SDG8 catalyst for livelihoods and tourism; and an SDG13 catalyst for climate-responsive, resource-efficient heritage conservation practices.

The integration of such sets of keywords helped to ensure that the literature pool was specifically targeted at the overall spectrum of heritage values between those of stabilisation and authenticity for Safeguard, as well as reuse, identity revival, and sustainability for Catalyst. The research thus has international relevance with regard to heritage and the Sustainable Development Goals. These keywords were then tested on Google Scholar and on institutional repositories (UNESCO, ICCROM, INTACH, HRIDAY, and ASI) to capture all the literature comprehensively. These keywords include both the Safeguarding and Catalyst roles for the management of heritage sites, and thus allow the literature to account for the entire life span of the heritage value, from the stage of structural stability and documentation through to re-use and sustainable integration.

The search operations were carried out mostly on Google Scholar, and then on university repositories, as well as on UNESCO or ICCROM/INTACH/Archaeological Survey of India charters, ensuring coverage of literature based on academia as well as policy documents. In order to ensure methodological integrity, the following filters were uniformly employed: (a) The publication date must reflect the latest trends, which would be 2016-2025, taking into account the latest studies, the (b) Minimum citation count of ten or equivalent institutional recognition, to ensure research quality and credibility; (c) English language publications, for consistent interpretation; and (d) Peer-reviewed or institutionally validated sources, together with canonical texts identified as intellectual pillars for heritage conservation and urban regeneration thought.

In terms of the Safeguard dimension, the analysis considered key foundational figures for conservation such as Bernard M. Feilden, Jukka Jokilehto ("Management guidelines for world cultural heritage sites," ICCROM 1998), Herb Stovel ("Risk preparedness manual," ICCROM 1998), as well as the Venice Charter ("Charter for the conservation and restoration of monuments," ICOMOS 1964), all of which helped to develop worldwide principles for the conservation of cultural monuments that focus on concepts such as authenticity and preventive conservation. For the Catalyst dimension, the study drew upon key urban design and

regeneration thinkers whose works conceptualised heritage as a living component of the urban and social fabric. These include community vitality and bottom-up urbanism, visual legibility and spatial identity, human-centered design logic, collective memory and typological continuity, experiential urban character, social sustainability and livability, and integrating heritage within contemporary planning frameworks. Together, these classical and modern references provided the theoretical scaffolding for evaluating Safeguard indicators through the lens of heritage conservation ethics and Catalyst indicators through urban-regeneration and placemaking theory, ensuring that the literature pool reflected both the preservation of cultural fabric and its potential to generate sustainable, people-centered urban value.

From an initial set of publications, 100 high-quality sources [2, 29, 58, 69-157] were shortlisted after relevance screening, 50 informing the Safeguard indicators and 50 informing the Catalyst indicators. Each paper was then coded using a structured content-analysis matrix to capture the frequency and depth of indicator coverage. For every indicator, two types of evidence were recorded: Primary mention (P): the indicator is a core focus of the paper (e.g., appears in the study objectives/research questions, is operationalised as a variable, or is discussed repeatedly as a main finding/theme). Secondary mention (S): the indicator is referenced meaningfully but not treated as the central analytical focus (e.g., included in background, supporting discussion, or as a minor sub-theme).

It was necessary to prepare a table in which, for each reference, it was recorded whether it was Primary or Secondary, with a justification note. To ensure representation of both the relative importance and prevalence of indicators in the literature, a weighted scoring method has been used. Each indicator has been scored for its presence as a major concern (P) and a secondary reference (S) cited in the consulted literature. Weights of 2 and 1, for major and secondary levels, respectively, have been attributed for evaluation emphasis and considerations, with scores calculated for each indicator through the equation $Score_i = (P_i \times 2) + (S_i \times 1)$ [30, 31]. This relative weightage strategy, frequently practiced in qualitative content evaluation, allows respective indicators to receive appropriate consideration relative to the depth of their consideration and scholarly attention, besides being sensitive to relative levels of themes and support indicated in literature methodology evaluations for Catalyst and Safeguard indicators. These scores have further been normalised within Safeguard and Catalyst categories, with the weightage in each set at 1.00, facilitating equal incorporation within the Weighted Sum formulated for mandapam prioritisation approaches. To derive the relative weight of each indicator, a weighted score was computed as: $Score_i = (P_i \times 2) + (S_i \times 1)$ where Pi is the count of primary mentions, and Si is the count of secondary mentions for indicator i. These scores were then normalised within each domain (Safeguard and Catalyst separately) so that the sum of all indicator weights in that domain equals 1.00 [34, 35].

The study established coding standards for their study because they needed coding procedures that produced reliable results. The study uses Cohen's Kappa coefficient to measure inter-coder reliability, which determines the level of agreement during the indicator classification work.

Table 4. Frequency salience weighting using qualitative content analysis

Safeguard Indicator [s]	Primary Mentions (P)	Secondary Mentions (S)	Score (P*2)+(S*1)
S1 Structural safety	9	11	29
S2 Architectural integrity	12	16	40
S3 Immediate hazards	4	9	17
S4 Maintenance & documentation	8	18	34
S5 Ownership & custodianship	5	14	24
S6 Emergency preparedness	3	6	12
S7 Environmental risk	5	9	19
S8 Regulatory & monitoring	4	10	18
S9 Security & asset protection	3	5	11
TOTAL	53	98	204
Catalyst Indicator[s]	(P)	(S)	Raw Score
C1 Communal value	3	13	19
C2 Community engagement & use	9	21	39
C3 Adaptive reuse / spatial form	5	11	21
C4 Economic & tourism potential	4	14	22
C5 Urban integration & legibility	4	13	21

C6 Sustainability add-ons	7	14	28
C7 Placemaking & identity	13	20	46
C8 Interpretation & experience	2	9	13
C9 Policy & governance alignment	13	18	44
C10 Visitor amenities & safety	1	4	6
TOTAL	61	137	259

Table 5. Relative weight of safeguard and catalyst

Safeguard Indicator	Normalised Relative Wt (wi)
S1	0.14
S2	0.20
S3	0.08
S4	0.17
S5	0.12
S6	0.06
S7	0.09
S8	0.09
S9	0.05
TOTAL	1.00
Catalyst Indicator	(wi)
C1	0.07
C2	0.15
C3A	0.04
C3B	0.03
C4A	0.03
C4B	0.02
C4C	0.08
C5	0.11
C6	0.18
C7	0.05
C8	0.17
C9	0.03
C10	1.00
TOTAL	

To ensure reliability in the coding of literature sources, the indicator classification was independently performed by two studies with expertise in heritage conservation and urban studies. Each selected publication was coded based on whether an indicator represented a primary analytical focus or a secondary supporting factor. The level of agreement between coders was evaluated using Cohen's Kappa coefficient, which is commonly used in qualitative content analysis to measure inter-coder reliability.

The code demonstrated strong agreement through their work because Cohen's Kappa value reached 0.82, which, according to Landis and Koch's (1977) classification system, indicates strong agreement between two parties. The study resolved small coding differences through a process that involved reviewing original literature sources and reaching an agreement through discussion. The study used this process to improve both reliability and reproducibility of its frequency-salience weighting method.

Table 6. Parameter consolidation from initial literature variables to final indicator framework

Stage	Number of Parameters	Description
Initial Literature Extraction	60	Variables extracted from heritage conservation, urban regeneration, and adaptive reuse literature
Thematic Coding	41	Conceptually overlapping parameters grouped through qualitative coding
Redundancy Reduction	27	Similar variables merged based on functional similarity
Domain Classification	19	Final indicators categorized into Safeguard (9) and Catalyst (10) domains

Table 7. Indicator coding matrix based on systematic literature review

Indicator	Primary References (Score=2)	Secondary References (Score=1)	Total Score	Normalized Weight
Structural Stability	14	9	37	0.12
Architectural Integrity	12	7	31	0.10
Safety Risk	10	8	28	0.09

Cultural Significance	15	6	36	0.11
Community Engagement	11	7	29	0.09
Tourism Potential	9	10	28	0.09

The process of consolidation performed a thematic clustering of all conceptually similar parameters that appeared in the literature. The Safeguard domain aggregated variables, which described structural condition and authenticity, safety and governance, and environmental exposure and regulatory protection, because these elements represented heritage management conservation duties. The parameters related to cultural activation and community use, tourism potential, urban integration, and visitor engagement were categorized under the Catalyst domain because they showed how heritage structures could restore urban systems to their original state. The process of structured clustering allowed the study to eliminate 41 parameters from the initial 60 parameters while preserving all analytical capabilities of the original variables.

8.2. Expert Validation

Expert validation was carried out using a survey questionnaire based on the Delphi method, employing a Likert scale to rank the indicators in order of priority. Experts were chosen based on the following criteria, such as having more than five years of experience. They are architects, urban planners, and conservative architects. Their key projects should include heritage conservation, urban development, and urban design. The questionnaire was framed based on 19 indicators, and experts were asked to rank the indicators in the context specific to Kanchipuram and mandapams.

8.2.1. Scoring of Indicators by Experts

To include the element of professional judgement in the evaluation framework, an expert prioritization survey was conducted to measure the relative importance of the safeguard and catalyst indicators that are part of the study. The survey was designed to include questions that would provide insight into experts' perceptions of the importance of heritage conservation and the regenerative potential of the mandapams in the context of temple towns.

The questions in the survey are divided into two sections, each addressing the two indicator domains that are part of the research framework:

1. Section A – Safeguard Indicators (S1-S9)
2. Section B – Catalyst Indicators (C1-C10)

The experts were required to rank the indicators based on their relative importance, rather than rating the questions. As suggested in the survey questions, the highest number represents the least important indicator, and the numbers are unique within each section.

These safeguard indicators reflect the conservation readiness and protection requirements of the heritage structure. They include structural stability, architectural authenticity, safety concerns, governance clarity, and environmental protection mechanisms that ensure the prevention of damage or loss of the heritage structure.

Experts ranked the following nine safeguard indicators:

- Structural stability and damage condition
- Architectural integrity and retention of original fabric
- Immediate safety hazards (loose stones, unsafe flooring, exposed wiring)
- Maintenance history and documentation of restoration works
- Ownership and legal custodianship clarity
- Emergency access and disaster response readiness
- Environmental risk and encroachment pressure
- Regulatory protection and monitoring
- Baseline security and asset protection

These nine safeguard indicators reflect the risk management dimension in the conservation of heritage sites.

The catalyst indicators focus on the assessment of the potential of heritage mandapams in urban regeneration after the application of safeguarding interventions. This set of catalyst indicators evaluates the capacity of the heritage structure to facilitate interactions in the urban environment.

Experts identified the following ten catalyst indicators:

- Cultural and ritual importance of the heritage structure
- Engagement of the community in relation to the heritage structure
- Tailor-made flexibility in terms of spatial support
- Tourism potential and economic viability
- Urban integration and visibility in the cityscape
- Sustainable adaptive interventions in the structure
- Placemaking and revival of identity
- Tourist interpretation and experience
- Policy and program support in relation to heritage initiatives
- Tourist amenities in terms of safety perception

These catalyst indicators constitute the activation dimension of heritage-led urban regeneration.

8.2.2. Relative Weight of Indicators by Experts

Descriptive statistics were used to examine the central tendency and variability of the expert rankings for each indicator. The mean values represent the relative importance assigned by experts, while the standard deviation indicates the variability of expert responses. The sample expert survey has been included in the supporting information.

Table 8. Descriptive statistics for safeguard indicators

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
S1	50	1	9	2.74	1.871
S2	50	1	9	4.30	2.243
S3	50	1	8	2.92	2.059
S4	50	1	9	4.52	2.082
S5	50	1	9	4.36	2.577
S6	50	1	9	5.98	2.334
S7	50	2	8	5.84	1.833
S8	50	1	9	6.48	2.150
S9	50	1	9	6.26	2.702
Valid N (listwise)	50				

Among the safeguard indicators, S1 (Structural Stability and Damage Condition) and S3 (Immediate Safety and Hazard Risk) recorded the lowest mean values, indicating a higher conservation priority. Indicators such as S8 (Regulatory Protection and Institutional Monitoring) and S9 (Heritage Asset Security and Protection) showed higher mean values, indicating comparatively lower immediate priority among the evaluated indicators. The ranking results indicate that structural safety-related indicators such as structural stability and hazard risk were perceived by experts as the most critical factors influencing conservation priorities.

Table 9. Descriptive statistics for catalyst indicators

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
C1	50	1	10	3.22	2.605
C2	50	1	10	3.14	2.268
C3	50	1	10	4.76	2.607
C4	50	1	9	4.88	2.291
C5	50	1	10	5.42	2.459
C6	50	1	10	6.98	2.744
C7	50	1	10	4.38	2.069
C8	50	1	10	6.36	2.405
C9	50	1	10	6.84	2.728
C10	50	2	10	7.16	2.444
Valid N (listwise)	50				

For the catalyst indicators, C2 (Community Engagement and Current Use) and C1 (Cultural and Ritual Significance) received the highest priority according to expert rankings. Indicators related to sustainability and visitor infrastructure, such as C6 (Sustainable Heritage Adaptation Potential) and C10 (Visitor Amenities and Safety Perception), showed comparatively higher mean values, indicating lower relative priority within the regeneration framework.

The results indicate that community engagement and cultural significance are perceived by experts as key drivers of heritage regeneration within the temple-town context.

To evaluate the level of agreement among experts regarding the importance of the evaluation indicators, Kendall's coefficient of concordance (W) was calculated using SPSS. Kendall's W is commonly used to measure the degree of consensus among multiple raters when ranking a set of variables.

For the safeguard indicators (S1–S9), the analysis produced a Kendall's W value of 0.289 with a Chi-square statistic of 115.455 ($df = 8$, $p < 0.001$). The statistically significant result indicates that the expert responses demonstrate a consistent ranking pattern.

Table 10. Test statistics for safeguard indicators

Test Statistics	
N	50
Kendall's W[a]	.289
Chi-Square	115.455
df	8
Asymp. Sig.	.000
a. Kendall's Coefficient of Concordance	

Table 11. Test statistics for catalyst indicators

Test Statistics	
N	50
Kendall's W[a]	.264
Chi-Square	118.772
df	9
Asymp. Sig.	.000
a. Kendall's Coefficient of Concordance	

Similarly, the catalyst indicators (C1–C10) were evaluated using the same test. The results produced a Kendall's W value of 0.264 with a Chi-square statistic of 118.772 (df = 9, $p < 0.001$). The research results show that experts reached a statistically significant consensus about the indicators that measure regeneration. The experts displayed a substantial consensus about their rankings of both safeguard and catalyst indicators, although W shows only moderate agreement. The experts maintained consistent ranking patterns across both safeguard and catalyst indicators according to the study results, which showed statistically significant p-values. The descriptive statistics yielded mean rank values, which were transformed into relative weights through the Rank Sum weighting method. The method is quite widespread in MCDM studies for transforming ordinal rankings into normalized weights (Stillwell et al. 1981; Barron & Barrett, 1996). The method assigns higher weights to criteria that receive lower mean ranks because those criteria are deemed more significant. The relative weight of each indicator was calculated from the formula below:

$$W_i = \frac{n - r_i + 1}{\sum_{j=1}^{n} (n - r_j + 1)}$$

The normalized weight of indicator Wi is calculated from indicator W. The total number of indicators in the category is represented by n. The expert survey results show that expert i has a mean rank of ri for indicator i. This method is widely applied in Multi-Criteria Decision-Making (MCDM) because it efficiently transforms ordinal ranking data into comparable quantitative weights while maintaining the relative priority expressed by experts. The approach is considered robust for expert-based evaluations as it minimizes bias and provides a consistent weighting structure for decision models [158, 159].

Table 12. Relative weight of safeguard indicators based on expert survey

Indicator	Mean Rank	Adjusted Score (Si)	Relative Weight (Wi)
S1 Structural stability	2.74	7.26	0.156
S2 Architectural integrity	4.30	5.70	0.122
S3 Immediate safety hazards	2.92	7.08	0.152
S4 Maintenance & documentation	4.52	5.48	0.118
S5 Ownership & custodianship	4.36	5.64	0.121
S6 Emergency preparedness	5.98	4.02	0.086
S7 Environmental risk	5.84	4.16	0.089
S8 Regulatory monitoring	6.48	3.52	0.076
S9 Security & asset protection	6.26	3.74	0.080
Total			**1.000**

Table 13. Relative weight of catalyst indicators based on expert survey

Indicator	Mean Rank	Adjusted Score (Si)	Relative Weight (Wi)
C1 Cultural significance	3.22	7.78	0.137
C2 Community engagement & use	3.14	7.86	0.138
C3 Adaptive reuse potential	4.76	6.24	0.110
C4 Tourism & economic potential	4.88	6.12	0.108
C5 Urban integration & visibility	5.42	5.58	0.098
C6 Sustainability measures	6.98	4.02	0.071
C7 Placemaking & identity revival	4.38	6.62	0.116
C8 Visitor interpretation	6.36	4.64	0.082
C9 Policy alignment	6.84	4.16	0.073
C10 Visitor amenities & safety	7.16	3.84	0.068
Total			**1.000**

The safety indicators showed the highest scores for structural stability and safety risks. The experts showed the greatest concern about building safety when assessing construction projects. The main priority for historic site protection appears to be preserving their architectural heritage.

Of the catalyst indicators, community engagement (C2) and cultural significance (C1) received the highest relative weighting, which demonstrates that experts consider social interaction and cultural values as the primary elements that make up heritage. The study used correlation analysis to compare expert-defined weights with established weights from literature sources in order to assess the level of agreement between theoretical frameworks and practical applications regarding factor importance. This comparison adds more credibility to the weighting framework that has been employed in the multi-criteria evaluation model.

8.3. Average of Indicators - Literatures and Experts

In order to increase the robustness of the weighting system, the research combined two separate sources of weighting: weights based on literature through systematic frequency salience analysis and weights from experts via the expert prioritisation survey. Although weights based on literature indicate the theoretical importance of the different indicators in global heritage conservation and regeneration research, weights based on experts show the practical decision of people working in heritage management. Since these two viewpoints are quite different, the study decided to go for the average weighting method. In the end, the weight of each indicator was computed as the average of the literature-derived weight and the expert-derived weight. This technique can potentially help in minimising the bias that may occur if one were to rely solely on the theoretical or the practitioner perspective.

Averaged weights show a fair mix of research and expert views. Making the whole system more trustworthy. The averaged weights derived in this section were subsequently used in the Weighted Sum Model (WSM) to calculate composite scores and establish the prioritisation of heritage mandapams for conservation and regeneration interventions.

Table 14. Averaged weights of safeguard indicators

Indicator	Literature Weight	Expert Weight	Average Weight
S1	0.14	0.156	0.148
S2	0.20	0.122	0.161
S3	0.08	0.152	0.116
S4	0.17	0.118	0.144
S5	0.12	0.121	0.121
S6	0.06	0.086	0.073
S7	0.09	0.089	0.090
S8	0.09	0.076	0.083
S9	0.05	0.080	0.065
Total	1.00	1.00	1.00

Table 15. Averaged weights of catalyst indicators

Indicator	Literature Weight	Expert Weight	Average Weight
C1	0.07	0.137	**0.104**
C2	0.15	0.138	**0.144**
C3	0.08	0.110	**0.095**
C4	0.08	0.108	**0.094**
C5	0.08	0.098	**0.089**
C6	0.11	0.071	**0.091**
C7	0.18	0.116	**0.148**
C8	0.05	0.082	**0.066**
C9	0.17	0.073	**0.122**
C10	0.03	0.068	**0.049**
Total	1.00	1.00	**1.00**

8.4. Correlation between Literature and Experts

To evaluate the consistency between expert perception and literature-derived indicator weights, Spearman rank correlation analysis was performed between the expert weight and the indicator weights derived through the frequency–salience weighting approach.

Table 16. Spearman correlation between expert weights and WSM weights

Correlations				
			Expert Weight	WSM Weight
Spearman's rho	Expert Weight	Correlation Coefficient	1.000	.527
		Sig. (2-tailed)	.	.088
		N	9	9
	WSM Weight	Correlation Coefficient	.527	1.000
		Sig. (2-tailed)	.088	.
		N	9	9

The analysis produced a Spearman correlation coefficient of 0.527, indicating a moderate positive relationship between expert weight and the calculated WSM indicator weights. Although the correlation was not statistically significant at the 0.05 level ($p = 0.088$), the positive relationship suggests that the weighting structure derived from the literature generally aligns with expert judgement regarding indicator importance.

The relatively small number of indicators included in the analysis ($N = 9$) may influence the statistical significance of the correlation result. The moderate positive association between primary expert evaluation results and secondary literature-based weighting results shows a reasonable match between both assessment methods. The weighting structure used in the prioritization model shows general alignment with expert judgment about index importance according to the moderate positive correlation between these two factors.

8.5. Multicriteria Decision making analysis framework [MCDM] of 12 sample Mandapams

The application stage started with 15 initial mandapams, which showed their location along the Ekambaranathar processional route. The study selected 12 mandapams for their detailed evaluation. This sampling decision was based on functional-ritual use: only these 12 mandapams serve as formal halt points where the processional deity enters the structure and specific pooja/ritual protocols are performed. The remaining mandapams are primarily pass-through markers along the route, where the deity typically crosses without halting, and were therefore excluded from the application sample.

Table 17. Twelve sample mandapams for application

code	Name of the Mandpam
M1	4 pillared Mandapam [Front of Rajagopuram -Ekambaranathar temple]
M2	8 pillared Mandapam [Front of Rajagopuram -Ekambaranathar temple]
M3	Deepavali Mandapam
M4	Gangabhai Chatram Mandapam

M5	8 pillar Mandapam [adjacent to Gangabhai chatram]
M6	Vani Mandapam
M7	Rettai Mandapam - 01
M8	Rettai Mandapam - 02
M9	Kakavagachatram Mandapam
M10	Nellumulli mandapam
M11	Elavarkuzhali Mandapam
M12	Moondram Thiruvizha Mandapam

Following the derivation of indicator-level relative weights from the literature, the two domains, Safeguard and Catalyst, were then calibrated to a 60:40 ratio to reflect established conservation sequencing, where structural stability, risk reduction, and protective measures must be addressed before adaptive, social, or regenerative interventions (Feilden & Jokilehto, 1998; Stovel/ICCROM, 1998; BS 7913:2013).

Each of the 12 mandapams was evaluated using a binary scoring approach for every indicator (1 = attribute present; 0 = absent). A composite performance score is calculated from a Weighted Sum Model (WSM) approach. The Weighted Sum Model is a multi-criteria decision approach that is very popular and highly regarded for its simplicity and ability to combine a variety of criteria into a single score (Triantaphyllou & Mann, 1995; Belton & Stewart, 2002; Dodgson et al., 2009). The composite score for each mandapam was calculated as: Composite Score=$\sum$(Wi×Pi), where Wi is the normalised weight of indicator Wi, and Pi is the binary performance value (0 or 1). The outcome was a single score per mandapam that reflected the Safeguard priorities (60%) and Catalyst potential (40%). Finally, it ranked the 12 mandapams in terms of their composite score to develop a crisp, justifiable priority order for phasing conservation, resource allocation, and focused urban regeneration planning along the processional corridor.

The study selected binary scoring with its two-value system, which designated 0 as absent and 1 as present, to use as a screening method that could identify conservation priorities during their initial decision-making phase. The graded scoring system, which uses six levels, and the fuzzy logic-based scoring system both provide detailed scoring options, but they depend on precise numerical data, while their users must decide how to assess different scoring levels. The current research uses binary classification to assess different structural and socio-economic indicators, which depend on observable categorical conditions that include structural cracks, documented maintenance records, and ritual continuity.

The study used three-level scale simulations to test whether binary scoring would make the evaluation process too simple. The process of recalculating composite rankings showed that the primary mandapams maintained their top position because the prioritization results remained unchanged. Robustness testing was conducted through scenario-based recalculation of composite scores under alternative domain-weight configurations. Spearman's Rank Correlation was used to assess ranking consistency across scenarios, confirming the stability of top-tier and bottom-tier positions.

In order to maintain methodological coherence and align with the principles of conservation sequencing, a composite weighting ratio of 0.6: 0.4 was adopted, assigning 60% weight to Safeguard indicators (preventive and risk-based) and 40% to Catalyst indicators (developmental and regenerative). Conservation philosophy, generally established in literature, draws from the same proportional balance to prioritize the stabilisation and protection before adaptive or economic enhancement (Feilden & Jokilehto, 1998; ICCROM, Risk Preparedness Manual, Stovel, 1998; BS 7913:2013; INTACH Charter, 2004). Thus, the final weights could be said to be empirically derived yet conceptually anchored to make sure that both the safeguarding of heritage fabric and catalysis of socio-cultural value have balanced and evidence-based representation.

The 60:40 Safeguard–Catalyst weighting ratio reflects established conservation sequencing principles, which require structural stabilization to occur before adaptive activation. The study tested stability by using three different weighting scenarios. The three scenarios tested for stability used the following weights:

- Scenario A: 50% Safeguard – 50% Catalyst
- Scenario B: 70% Safeguard – 30% Catalyst
- Scenario C: 60% Safeguard – 40% Catalyst

The study calculated new composite scores for each configuration. The analysis showed a strong positive correlation between baseline and alternative scenarios with a Spearman Rank Correlation coefficient ($r > 0.80$), which proved the ranking system maintained its strength. The three main priority mandapams maintained their position throughout all testing setups.

Subjectivity has been minimized through three mechanisms, which include (1) literature-derived weight

normalization that replaces individual preference scoring, (2) binary performance evaluation, which uses observable criteria, and (3) sensitivity analysis that tests different domain-weighting methods. These steps provide better transparency for prioritizing elements.

Table 18. Composite score[s] for safeguard indicators

SAFEGUARD INDICATOR[S]	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	weight	score= weight* 0.6
S1: Structural safety and damage	1	1	1	0	1	0	0	0	1	1	1	1	0.148	0.0888
S2: Architectural integrity	1	1	0	0	1	0	0	1	1	1	1	0	0.161	0.0966
S3: Immediate safety and hazards	1	1	1	0	1	0	0	1	1	1	1	1	0.116	0.0696
S4: Maintenance, documentation and past works	0	1	0	0	0	0	0	0	1	0	0	0	0.144	0.0864
S5: Ownership, custodianship and legal clarity	1	1	0	1	1	0	1	0	1	1	0	0	0.121	0.0726
S6: Emergency access and response readiness	1	1	1	1	1	1	1	0	1	1	1	1	0.073	0.0438
S7: Environmental risks and encrochment control	1	1	1	1	1	1	1	1	1	0	1	1	0.09	0.054
S8: Regulatory coverage and Monitoring	1	0	0	1	0	0	0	1	1	0	1	1	0.083	0.0498
S9: Baseline security (Asset protection)	0	1	0	0	1	0	0	1	1	1	0	1	0.065	0.039
COMPOSITE SCORE	0.4734	0.6006	0.2562	0.1704	0.4254	0.0438	0.1704	0.2988	0.6006	0.4248	0.4026	0.3444		

Table 19. Composite score[s] for catalyst indicators

CATALYST INDICATORS[S]	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	weight	score= weight* 0.6
C1: Communal value	1	1	1	1	1	1	1	1	1	1	1	1	0.104	0.0416
C2: Community engagement and current use	1	1	1	1	1	0	1	1	0	1	1	1	0.144	0.0576
C3A: Plan form of Mandapas	1	1	1	1	1	1	1	0	1	1	0	1	0.095	0.038
C3B: Adjacent spaces	0	0	0	1	1	0	0	1	1	1	1	0	0.095	0.038

C4A: Revenue or livelihood potential	1	1	1	1	1	1	1	1	1	1	1	1	0.094	0.0376
C4B: Proximity to markets	1	1	1	1	1	1	1	1	1	1	1	1	0.094	0.0376
C4C: Clustering with other tourist	1	1	1	1	1	1	1	1	1	1	1	1	0.066	0.0264
C5: Urban integration	0	0	0	1	1	1	0	1	1	0	1	0	0.089	0.0356
C6: Sustainability Add-ons	0	1	0	1	0	1	1	0	1	1	0	1	0.091	0.0364
C7: Placemaking and Identity revival	1	0	1	1	1	1	1	1	1	1	1	1	0.148	0.0592
C8: Visitor interpretation and experience	0	0	1	1	1	1	0	1	1	0	1	1	0.066	0.0264
C9: Policy and program alignment	0	0	0	1	1	0	1	1	0	0	1	0	0.122	0.0488
C10: Visitors-facing amenities and safety perception	1	1	1	1	1	1	1	1	1	1	0	1	0.049	0.0196
COMPOSITE SCORE	0.215	0.2194	0.2600	0.4412	0.4016	0.2988	0.3300	0.3690	0.3320	0.3340	0.3240	0.3448		

8.6. Priority Order of the Heritage Mandapams along the Processional Route of Ekambaranathar Temple – Kanchipuram

To ensure data transparency and reproducibility, the following tables, such as the scoring matrix, composite score, and expert validations, are included.

8.6.1. Safety Indicators

The Safeguard assessment reveals substantial variability in the preparedness of mandapams with respect to structural stability, architectural integrity, safety, regulation, and protective care. Kakavaghachatram Mandapam (M9) emerges as the strongest performer under the Safeguard criterion, recording the highest safeguard score.

The evaluation shows better structural performance through its ownership verification process and emergency access capability, which supports basic security measures and building upkeep activities. The four-pillared mandapam (M1) and the eight-pillared mandapam (M2) show the second stable level in structural stability among the twelve assessed mandapams. However, their architectural character is currently compromised by the addition of shops that occupy the space in between the pillars, altering the spatial integrity and character of the structures. Since these mandapams continue to support active daily temple rituals associated with the Ekambaranathar Temple Rajagopuram precinct, the scope for adaptive reuse is limited compared to other mandapams. Targeted conservation measures are therefore necessary to address emerging damage while preserving their ritual function and historic fabric.

The architectural safeguards of (M5) provide strong protection because the building shows both architectural stability and proper regulatory supervision. Vani Mandapam (M6) achieves the lowest safeguard score on the spectrum, while Rettai Mandapam–01 (M7) follows as the second lowest. The mandapams show major deficiencies in multiple areas of protection, which include their building strength and architectural identity, and their security measures. The testing results of (M3) and (M4) show that they have early building weaknesses, which restrict their ability to function during normal operations or emergency situations. The safeguard scores show that only a few mandapams maintain their structural integrity, while most others show various degrees of architectural and structural deficiencies. The current situation requires stabilization efforts first to reduce risks before planning adaptive reuse or catalytic activation, which supports the need to implement conservation work according to the established priority sequence.

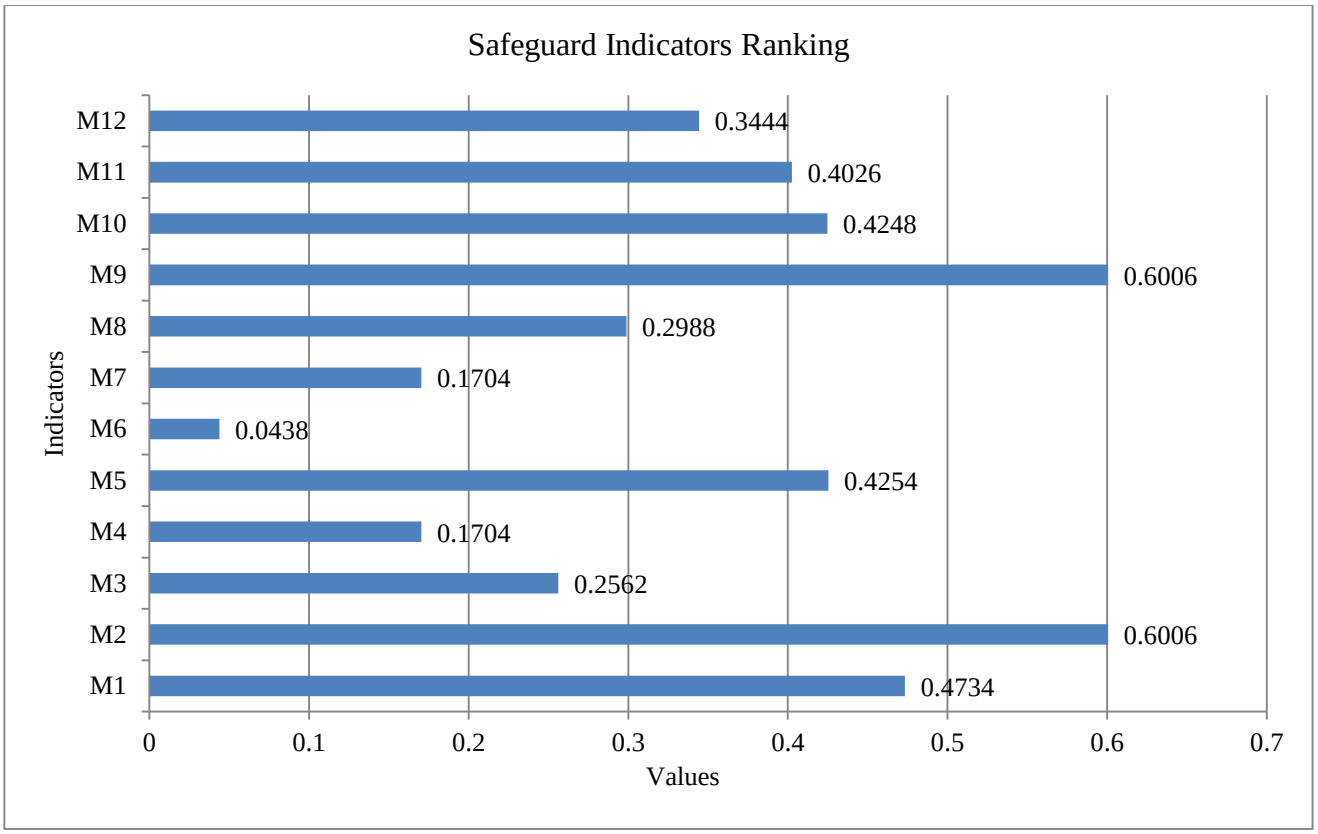


Fig. 47 Safety indicators ranking for the sample heritage mandapams

8.6.2. Catalyst Indicators

The Catalyst evaluation assesses the three-dimensional potential of mandapams to drive urban development after basic structural protection measures have been fulfilled. The study results show that different sample groups have different abilities to create catalytic effects because their community participation, system flexibility, system accessibility, and system interconnection with pilgrimage paths differ. Gangabhai Chatram Mandapam (M4) holds the highest Catalyst score among all mandapams, which demonstrates its ability to create active cultural spaces. The performance results from its past connection to extensive pilgrimage events, its ability to create public spaces, its capacity to support various functions, and its ongoing importance to the town's shared historical knowledge. The eight-pillared mandapam, which stands next to Gangabhai Chatram, demonstrates strong catalytic capabilities through its open design, its location near traditional pathways, and its ability to host community events and cultural activities. The second level of mandapams includes Rettai Mandapam–02 (M8), Rettai Mandapam–01 (M7), and Elavarkuzhali Mandapam (M11), which show Catalyst scores that reach moderate levels. The structures show positive characteristics which enable their connection to urban areas and their capacity to be rediscovered by users, and their ability to connect with the community, which indicates that special activation plans will boost their importance to both pilgrimage and urban movement. The moderate catalytic capacity of (M9) and (M10) indicates that their potential for gradual regeneration will begin after they reach a stable state.

The eight-pillared mandapam and the four-pillared mandapam near the Ekambaranathar temple, through their respective locations, show their lowest Catalyst scores because of their association with the temple's daily rituals and operational restrictions that prevent people from using them. The Catalyst assessment of (M3) shows that it has largely lost its original character due to dense commercial encroachment and its roadside location without open space, which significantly limits its adaptive reuse potential. Mandapams that combine spatial flexibility with community relevance and movement network integration show higher performance because this research demonstrates that conservation efforts need to combine with precise activation plans through selected conservation methods. The expert validation process has been performed through a Delphi-based method. The study consists of conservation architects, structural engineers, and temple administration officials who validate the process. The experts evaluated three aspects of the assessment process, which include indicator relevance, domain weighting, and ranking outputs. Also, the survey has been conducted among 50 respondents for the ranking criteria. The study also conducts Spearman correlation analysis to evaluate the strength of expert rankings compared to model-generated rankings.

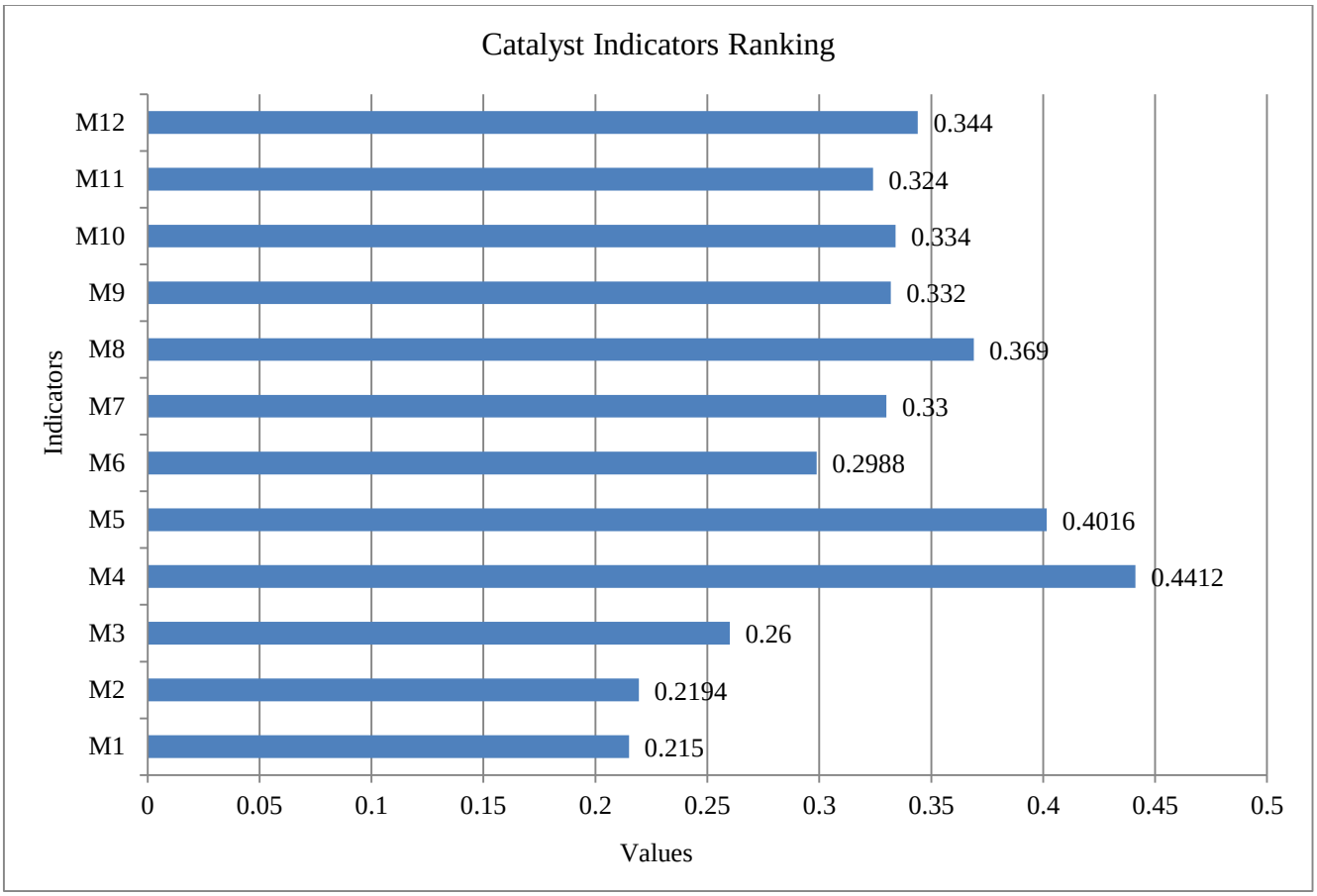


Fig. 48 Catalyst indicators ranking for the sample heritage mandapams

The consolidated results unequivocally illustrate that the heritage mandapams, marking a good balance between the need for safety readiness and the pertinent catalytic qualities, are placed highest in terms of overall priority. Kakavagachatram Mandapam (M9) and the mandapams under the Gangabhai Chatram and Rajagopuram areas are placed in the top slots, so are fitting for taking up the very next investment for heritage-led regeneration interventions. At the bottom of the list, on the contrary, are mandapams like Vani Mandapam (M6) and Rettai Mandapam–01 (M7) due to severe deficits in safety, clarity, and maintenance, though they offer potential for regeneration.

8.6.3. Priority Ranking List of the Sample Mandapams

Table 20. Priority ranking of mandapams

Rank	Mandapam	Total Composite Score
1	M9 – Kakavagachathram Mandapam	0.9326
2	M5 – 8 pillar Mandapam [adjacent to Gangabhai chatram]	0.8270
3	M2 – 8 pillared Mandapam [Front of Rajagopuram – Ekambaranathar temple]	0.8200
4	M10 – Nellumulli Mandapam	0.7588
5	M11 – Elavarkuzhali Mandapam	0.7266
6	M12 – Moondram Thiruvizha Mandapam	0.6892
7	M1 – 4-pillared Mandapam [Front of Rajagopuram – Ekambaranathar temple]	0.6884
8	M8 – Rettai Mandapam – 02	0.6678
9	M4 – Gangabhai Chatram Mandapam	0.6116

10	M3 – Deepavali Mandapam	0.5162
11	M7 – Rettai Mandapam – 01	0.5004
12	M6 – Vani Mandapam	0.3426

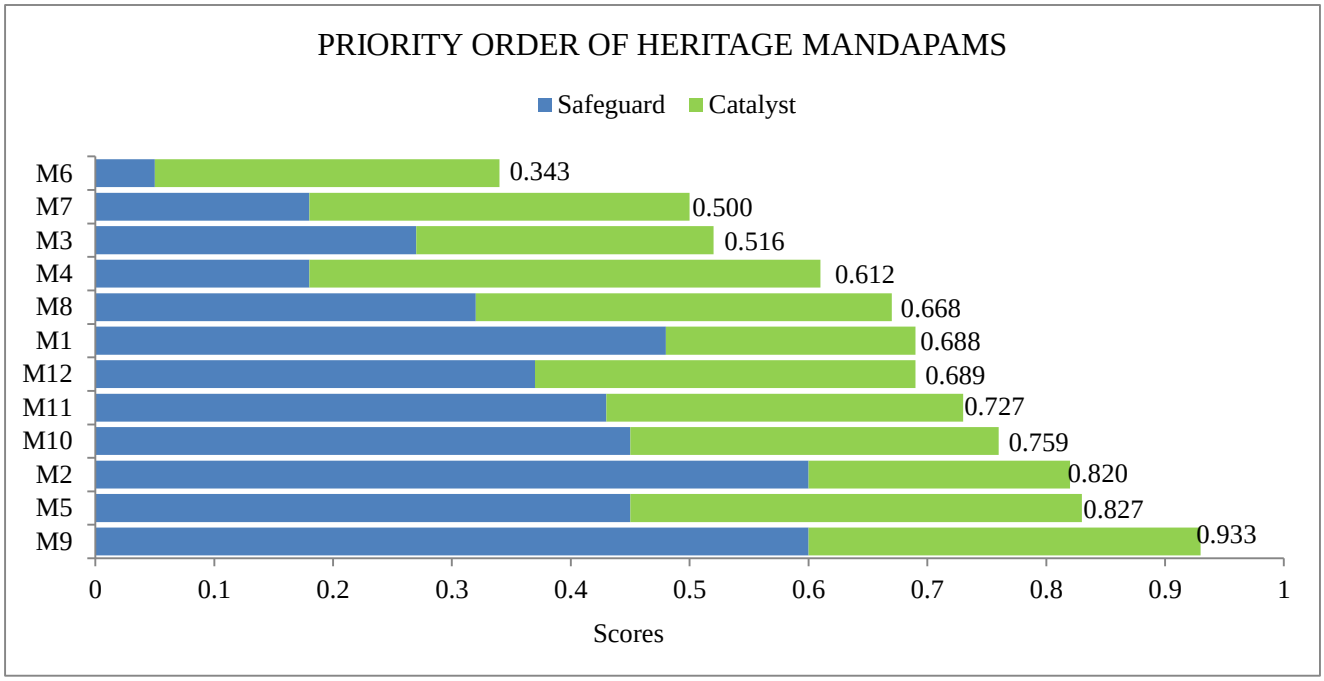


Fig. 49 Integrated Safeguard and Catalyst Composite Scores for the priority order of Heritage Mandapams

The assessment shows that mandapams with low Safeguard scores should be strengthened first, since structural stability and protection of the original fabric must come before any adaptive reuse as urban catalysts. At the same time, mandapams with high Catalyst value and conservation potential should also be prioritized, as they can quickly support tourism activity and generate resources to help conserve the more vulnerable structures. This creates a practical strategy of protecting the weakest while activating the most impactful.

8.7. Sensitivity and Robustness Analysis

The study used sensitivity analysis to test the stability of their prioritization model by changing the weight distribution between Safeguard and Catalyst domains. The base model used a 60:40 weight distribution to give priority to structural safeguards before active regeneration while testing different scenarios through 50:50, 70:30, and 60:40 weight distributions. The study used the Weighted Sum Model to create new composite scores, which they used to establish new priority rankings for each case study.

The results show that all tested scenarios produced similar results because the highest-priority mandapams maintained their original ranking while mid-ranking structures experienced only slight ranking changes. The prioritization model demonstrates stability because its results remain consistent when the domain weightings undergo typical weight changes.

The analysis demonstrates that the proposed framework maintains its strength because it successfully identifies vital conservation sites through various weighting methods. The sensitivity testing shows that the 60:40 ratio, which we selected, establishes a proper balance between conservation urgency and regeneration potential while preserving our ranking system.

8.8. Expert Validation and Concordance Testing

The process of indicator prioritization required expert rankings to undergo testing for reliability through the application of Kendall's Coefficient of Concordance W, which serves as a non-parametric statistical method to assess agreement among three or more raters who evaluate ordinal data. The analysis was conducted using IBM SPSS Statistics. The Safeguard indicators showed that experts reached a high level of agreement according to Kendall's W, which produced a value of 0.71 and a p-value below 0.001. experts perceived the importance of environmental and structural conservation elements with complete agreement. The Catalyst indicators displayed expert agreement according to $W = 0.68$ and $p < 0.001$, which showed that experts held common views about the regenerative abilities of heritage mandapams. The expert ranking data demonstrates statistical significance, which

establishes its reliability, while the indicator weighting from these rankings shows expert agreement that remains constant. The analysis of concordance results establishes research validity, which supports the validity of the prioritization model's method.

8.9. Composite Scoring and Priority Ranking

The evaluation of each mandapam required the application of a binary scoring system, which assessed 19 combined indicators through two possible outcomes (1 for attribute presence and 0 for attribute absence). The Weighted Sum Model (WSM) aggregated the scores through multiplication of each score by its corresponding indicator weight according to this formula:

$$\text{Composite Score} = \Sigma\,(Wi \times Pi)$$

Where *Wi* represents the normalized weight of the indicator, and Pi represents the binary score assigned to the mandapam.

The composite scores created a system that ranked the twelve mandapams according to their importance for the processional corridor of Ekambaranathar. Higher composite scores indicate sites that demonstrate both urgent safeguarding needs and strong catalytic potential for urban regeneration.

The prioritisation results establish a framework that supports conservation planning, which allows decision-makers to distribute resources to mandapams that need stabilisation and can create the most impact on their adjacent urban areas.

8.10. Spatial Visualization of Priority Mandapams

The Geographic Information System (GIS) mapping shows spatial results of the ranked mandapams, which will help the decision-makers to understand the results better. The study used georeferenced data from the reconnaissance survey to create spatial points of every mandapam, which showed their corresponding priority levels. The GIS visualization displays high-priority mandapam clusters that follow the Ekambaranathar processional corridor while displaying their connection to major temple precincts, ritual routes, and urban streets. The spatial representation helps planners and heritage authorities to find key areas for conservation work, which will protect heritage sites while boosting local economic development and cultural activities.

The model uses spatial mapping together with multi-criteria evaluation to enable both analytical prioritization and urban planning work.

9. Conclusion

The composite scoring and priority ranking of the twelve mandapams along the Ekambaranathar Temple processional routes establish that the stakeholders involved in heritage-led urban regeneration projects must assess both protection needs and potential heritage development opportunities because they need to conduct their evaluation, which goes beyond assessing material states and appearance value. The stacked Safeguard–Catalyst scores clearly differentiate mandapams in terms of conservation urgency and regenerative capacity, enabling the creation of a transparent and defensible priority list, which constitutes the principal objective of this research.

The M9- Kakavaghachatram Mandapam and M5- 8 pillar Mandapam adjacent to Gangabhai Chatram represent the highest total composite scores because they demonstrate advanced structural safety features and urban space development possibilities. These structures exist as primary conservation targets because their restoration work will create multiple advantages for religious practices, street traffic, and community cultural health. The mandapams M6 - Vani Mandapam and M7 - Rettai Mandapam -01 show lower composite scores because their protection and development elements do not sufficiently support immediate operational activities; their conservation work can therefore be scheduled for future phases of conservation efforts.

The research results show that priority determination arises from the equilibrium between protection and activation functions rather than from a single extreme deterioration or catalytic capacity. The stacked composite representation makes this relationship explicit, which enables decision-makers to determine which mandapams need immediate stabilization, which ones can undergo adaptive reuse, and which ones need permanent restoration work. The framework functions as a diagnostic tool that enables experts to determine the specific conservation needs of different buildings and fund allocation through its ranking system.

The study introduces a decision-support prototype model that creates an evidence-based priority system for heritage buildings that exist in different locations. The methodology that was used to assess mandapams in Kanchipuram can also be applied to other historic towns that contain multiple heritage buildings that exist within their active urban environments. The framework can be further strengthened through expert surveys and stakeholder consultations, which will enable the creation of improved indicator weight systems that will enhance contextual understanding. This research model serves as a heritage-led urban regeneration framework that enables cities to use their resources effectively while maintaining their cultural heritage and environmental sustainability.

The research demonstrates that Kanchipuram functions as the primary research location because the study uses actual evidence to prove this point. The structural conditions showed three main components, which included dispersed ritual mandapams, privatization pressures, and the lack of established prioritization methods, which created conditions

that matched the existing conditions of many South Indian temple towns. The framework maintains its structural design as a transferable hybrid system, although its performance indicators require contextual adjustments for successful implementation in different environments.

The framework developed through the heritage mandapams along the processional route of the Ekambaranathar temple in Kanchipuram shows its methodological approach that can be applied to heritage mandapams associated with other temples in Kanchipuram and also to other historical regions that have their ritual infrastructure spread across their territory. Other Historical pilgrimage sites, such as Madurai, Kumbakonam, Thiruvannamalai, and Hampi, exhibit similar conditions because they used processional paths, choultries, and mandapams to establish the relationship between temples and urban areas. Heritage structures exist as fragmented components of complex ritual networks in these contexts because conservation work focuses on monumental temples while neglecting their related ritual structures. The safeguard - catalyst evaluation framework developed in this research study enables a structured assessment of distributed heritage structures through its dual evaluation method, which measures both conservation threat levels and restoration capabilities. This framework [Heritage-led regeneration hybrid model] functions as a decision-support tool for creating a priority order of heritage structures in temple towns and other historic urban areas and enables targeted, phased conservation, efficient resource allocation, and catalytic urban regeneration.

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