Re-Validating the Uniqueness of Urban Morphology of the Shekhawati Region Through Reconnaissance Using Hotspot Analysis

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ABSTRACT

This study focuses on Lakshmangarh, a town in the Shekhawati region of Rajasthan. The medieval towns of Shekhawati, established between the 16th and early 19th centuries, served as a distinct representation of the Shekhawati merchants' identity and their significant role in shaping the urban landscape during the 18th and 19th centuries. At this period, the region's urban geography had a notable presence. The results generated by the Geographic Information System evaluate the changes in Lakshmangarh town from 1975 to 2024. Due to growing urbanization, merchants' out-migration, inadequate infrastructure, and deteriorating built fabric, towns are losing their significant values. The purpose of this study is to evaluate the cultural values for improved conservation and management by identifying the distinctive urban morphology of Lakshmangarh town. The methodology has been carried out by systematically analyzing the densely crowded urban elements thematically (Fort, Cenotaph, Temple, Caravanserai, Water Tank, and Mansion) as unique landscapes and their potential to stand out and be recognized globally, through Inverse Distance Weighting and Hotspot analysis. The result will identify areas of significant historical, cultural, or architectural value that may require special attention. Additionally, justification of the results will lead to the visual representations of intensity imagery using interpolation mapping to rationalize the cultural magnitude of Lakshmanagarh town. Additionally, the article discusses the potential meeting criteria under outstanding value justification for the tentative listing process under the United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Keywords: Urban Morphology, Urban Elements, Hotspot, Inverse Distance Weighted, Outstanding Universal Value

INTRODUCTION

Urban studies related to hotspots in conservation and planning have been explored and analyzed by clustering the spatial phenomenon. These identified clustering areas have a concentration of particular urban characteristics, such as traffic accidents, major crime, pollution levels, or fabric density(Cardone & Di Martino, 2022). The hotspot analysis is a spatial analysis tool demonstrated through thematic mapping-based illustrations using a Geographic Information System (GIS). It helps identify areas of a significant historical/cultural region on a map. In the context of heritage conservation sites, cultural or architectural value may require special attention to signify, conserve, and manage historic places (Bai et al., 2018). Inspecting

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historic places and towns involves systematically studying the visualization, exploration, and explanation of interesting patterns in geographic data (Cárdenas, 2021). The hotspot analysis can aid in analyzing the towns/ cities/ specific areas based on urban patterns, cultural/architectural/artistic significance, tourism, and other specific areas (Dai et al., 2023; Withanage et al., 2024a).

This paper determines the historic areas of town that have developed with distinctive urban (Withanage et al., 2024b) morphological elements (Fernández et al., 2021). The clusters will be referred to as high and low values, where high values (characterized by greater density, the larger the area) are referred to as hotspots, and low values are referred to as cold spots (Anselin et al., 2010). The approach to the hotspot analysis utilizes the IDW (inverse distance weighted) interpolation method to estimate the closeness of built fabric in cluster form. IDW operates on the principle that the influence of a known data point diminishes with distance. The Illustration of mapping closer point data (building footprint) shows a greater influence on each neighboring point data, which is inversely proportional to the distance. Points that are less than the defined distance (1 meter, mapped in the thematic presentation) will represent weight in the larger size, and these points are considered as hotspots (Anselin et al., 2010). The IDW interpolation method is employed in the study area for the demarcation of significant buildings, and their types represent the spatial layout in the core area. The interpolation is used to predict the land use pattern of a highly significant site (Anukrati Sharma, 2015), as well as to describe the distinctive behavior of the built fabric of Lakshmangarh (Laxmangarh) town. Urban morphologies have evolved through the study of human settlement and its built-form relations, with settlements forming during their transformation (Whitehand, 2003). The analysis of town patterns, layouts, and arrangements of buildings, streets, and open spaces constitutes urban landscapes. Urban forms are the recorded vocabulary that has transformed over time due to cultural, social, economic, and environmental changes. There are various research studies on urban morphology that have utilized hotspots as an effective tool for identifying areas to be prioritized for action (Cao et al., 2018). Studies in the economy, social sciences, urban planning, medicine, and health have been investigated using a variety of hotspot analysis filters (Xie et al., 2023). Lucchi applied a spatial clustering analysis using the hdbscan (Hierarchical Density-Based Spatial Clustering of Applications) algorithm to identify the typology approach, considering only building shape and physical form. The focus on urban elements as variables was analyzed in terms of building typology, age, value, conservation state, technical aspects, and use. This approach is applied in the historic town of Calavin by utilizing data mining methods and GIS integration to enhance the building stock with specific historical values. Results represent the cluster definition used to outline conservation and energy demand evaluation and renovation measures (Lucchi et al., 2019). Zee, investigate the applicability of user-generated content for destination management by analyzing restaurant reviews from five Flemish art cities (Ghent, Antwerp, Leuven, Brussels, and Mechelen) retrieved from the web 2.0 platform TripAdvisor. The Getis-Ord hotspot analysis revealed spatial clusters of frequently reviewed (hotspots) and rarely reviewed (coldspots) restaurants, comparing spatial patterns and digital footprints to regulate policy for tourism industries (van der Zee et al., 2020). Dai has chosen Beijing and Xian as the primary case studies to assess the living environment conditions, categorized into residential, living, recreational, and transportation convenience. To assess the conditions, a hotspot analysis was conducted in both studies using the Analytical Hierarchy Process (AHP) and the entropy method. Both cities' recommendations for sustainable development compared with hotspots and coldspots for suitable Transit-Oriented Development (TOD)-(Dai et al., 2023).

Xu et al. 2019) focus on urban elements consisting of high-intensity zones and explore the economic performance associated with their spatial structure. The increase in population density at hotspots influences an inverted U-shaped curve in urban planning(Xu et al., 2019). Kucukpehlivan et al. (2023) provide an analytical framework for public investments, spatially and functionally. The study was conducted in Eskisehir, Turkey. Public point of interest (POI) by producing hotspot maps by significant public investments using the Kernel Density Estimation (KDE) method to create the POI differencing maps(Kucukpehlivan et al., 2023). Qin, utilize a hotspot tool to identify various changing patterns between traffic control and public transportation services. The data field-based cluster analysis technique, which explores pick-up and drop-off points of taxi trajectory data, aims to improve and normalize the estimate of potential value in the data field. The short distance and short time are experimentally analyzed using taxi trajectory data in Wuhan city and are found to be in a hotspot area. To avoid hotspot areas, the spatiotemporal data field method was applied to optimize parameters and the interaction among hotspot areas(Qin et al., 2017). Wu proposed a network distance and graph-partitioning-based clustering method for detecting urban hotspots using cell phones. Cell phone traces

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were computed using four key methodologies: selecting city boundaries, defining spatial units, applying interpolation, and analyzing hotspot variables in a large-scale call detail record (CDR) database from Mexico(Wu et al., 2021). Chainey et al. (2008) discuss hotspot mapping as a tool to facilitate the identification of areas for allocating police and crime reduction resources. Crime hotspots are identified through the analysis of crime data, encompassing census output areas, spatial ellipses, grid thematic mapping, and Kernel Density Estimation (KDE), which helps identify areas to target police and crime reduction resources. Crime hotspots are identified using crime data through census output areas, spatial ellipses, grid thematic mapping, and KDE. This investigation focused on burglary, street crime, and vehicle theft by adopting the prediction of spatial pattern mapping methods in practice(Chainey et al., 2008).

The above-stated definitions, concepts, and cases have been employed in an interdisciplinary approach with a growing interest in hotspot analysis methodologies. The research foundation for urban studies concerning the authenticity and integrity of historic towns has not yet been identified using hotspot analysis in a particular region of India. The study, which examines existing hotspot tools and mapping on an initial investigation basis, can provide recommendations and guidelines for improved protection management. (Klöpp et al., 2015). This study focuses on Lakshmangarh, located in the Sikar district of the Shekhawati area in Rajasthan, which was established between the 16th and early 20th centuries. The major approach in the research evolved with a theoretical study to establish the cultural significance of Lakshmangarh town. The reconnaissance survey served as an operational tool for constructing the town's history, planning, and architectural significance.

Evolution and Cultural Significance

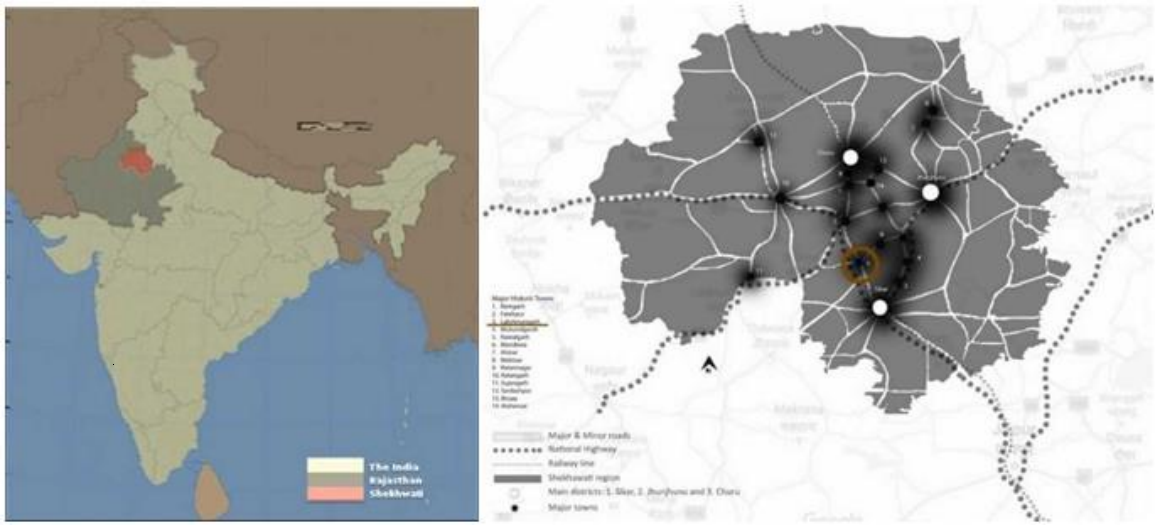

Fig. 1&2. Left: Location of Lakshmangarh town, Right: Shekhawati Region with three districts

The Shekhawati region is primarily defined by the virtual boundaries consisting of 37 varied towns, primarily identified towns within these districts as significant urban clusters are Mandawa, Nawalgarh, Fatehpur, Ramgarh, Mukundgarh, and Lakshmangarh (2023; Kumar & Rai, 2015). Shekhawati comes under the Jaipur division and is located in the north-west of Jaipur with 27º20', 28º34' north latitudes, 74º41', and 76º6' east longitudes with a total area of about (Sikar 7732+Jhunjhunu 5929) 13 661 sq. km (Taknet, 1960).

Historically, the region was named after Rao Shekha, a noble of the Kachhwaha dynasty of Rajputs in the 15th century. (Ilay Cooper, 2014)The region served as an administrative office prior to 1947. In the 17th century, Jaipur, Bikaner, and Shekhawati were under multiple rulers and patrons(Riyajuddin, 2019; Shikha Jain, 2006). The region is the distinctive representation of the Shekhawati merchants' identity and their significant role in shaping the urban landscape during the 18th and 19th centuries. This period is notable for the region's urban geography (Kaiwan Mehta, n.d.). Town settlements evolved with urban morphological elements like Garh (Fort), Chhatri (Cenotaph), Mandir (Temple), Dharamshala (Caravanserai), Johara (Water tank), Kuan (Well), and Haveli (Mansion), with fresco images evolving and transformed over the period, almost in every town (Mukherjee, 2021). (As mentioned in Figure 2.)The early development of the Rajputs, Shekhawats, Merchants, and Mughals' globally known town planning in Shekhawati(Alka Patel, 2013). Towns often planned with grid-

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iron patterns and an organic form of development. As shown in image 3. the planning inspired by the Jaipur plan, specifically Lakshmangarh and Ramgarh town planning, is adapted with the same street pattern and space division concept (Shikha Jain, 2006). The presence of Minarets, Chhatris, and Bangladhari pavilions is crowded on every possible edge, street, and chawk along the town's roads, making these towns a unique statement of urbanity (Ilay Cooper, 2014).

Fig. 3&4. Left: Grip Iron pattern planning approach, Right: Architecture evolved with Courtyard as the foremost functional space and other noticeable architectural features.

The merchant's role in shaping these towns through trade, cultural migration, and diversity is significant. These merchants were businessmen, agents, and moneylenders. They had developed a diversified network and mixed culture by traveling across the world in medieval times (Abha Narain Lambah, 2013). Well-known communities with diverse cultural expression values include the Goenkas, Birlas, Dalmias, Kedias, Khaitans, Poddars, Ruias, Jhunjhunwalas, and others. The Shekhawati architecture evolved with local materials, craftsmanship, Images borrowed (fresco paintings), building orientation, and climate responsiveness. The early architectural growth of the Rajput, Shekhawat, Merchant, and Mughal dynasties is globally recognized. These dynasties globally established architectural features such as Jharokhas, projections, brackets, murals, trefoil arches, and tribari, as shown in figures 4 and 5. The public Water Tank, Caravanserai, private and public Well Complex, Cenotaph, Temples, and Fortifications are urban elements that express Mughal and Rajput styles. Along every edge, street, and check, the Minarets and Chhatris, the Bangladhari Pavilion, and octagonal chhatris are visually planned to maintain visual cues (Jaishree Mishra & Vineet Shrivastava, 2022; Click or tap here to enter text.Kip Scott, 2016).

Fig. 5. Salient architecture features in the Shekhawati region with frescoes on all the surfaces

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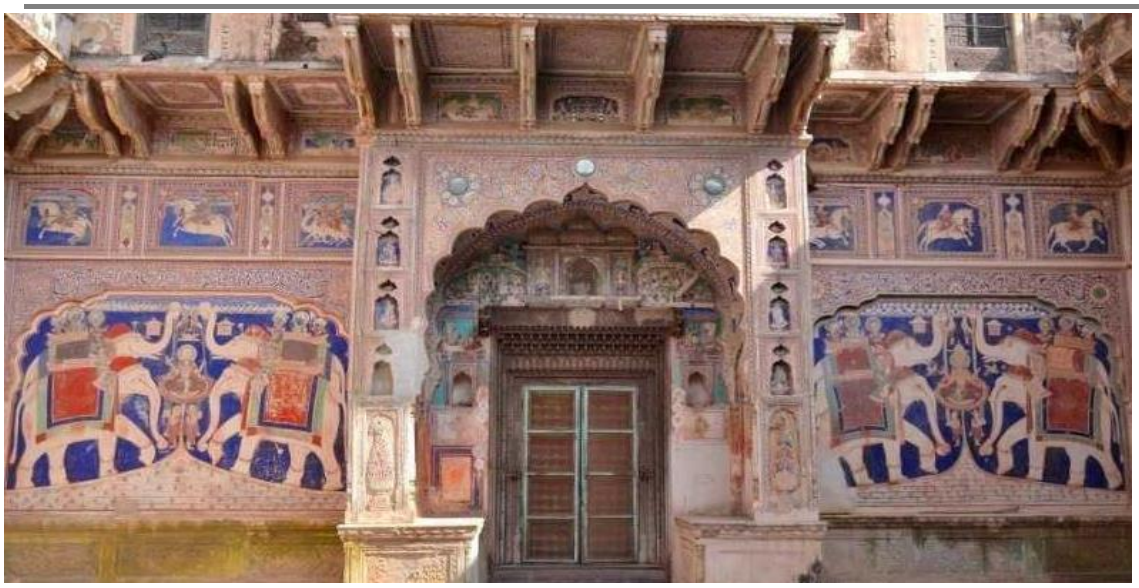

Fig. 6. Cultural context of Fresco paintings as folk art and ritualistic practices on the external surfaces of Havelis

These building typologies, as prominent landmarks and virtual boundaries, serve as areas where people can communicate, symbolize, and identify these towns. This distinctive community-based culture, also renowned for its painted mansions (havelis), emerged with the notion of a living homeland, a belief, and a tradition.(Alka Patel, 2013). The fresco paintings are the images interpreted by the local and migrant artisans on the built surfaces of the distinctive building typology. This visual urban morphology is characterized by intra-regional art expression, which two distinct schools of thought follow (Li et al., 2016). The Paintings are based on the pigment selection by local artisans using the fresco technique, applied to the outside surfaces. These merchants borrowed artistic expression through their travels around the world. The manifestation of these paintings in the form of frescoes depicts the Vaishnava Avatars of Krishna, Rama, folk heroes, troops, and everyday environments, as shown and represented in figures 6, 7, and 8. These paintings on the surfaces abstracted the multicultural knowledge specific to the regional unique identity. The concept of recontextualization, as illustrated by images 6, 7, and 8, encompassing subjects, places, and environments, led to the diversity of art and architecture in the early 20th century. This planned way of arranging built fabric (Jaishree Mishra & Vineet Shrivastava, 2022; Kulbhushan Jain, 2000)Based on the forms, scale, streets, landmarks, nodes, and paths, it is a unique way of perceiving the medieval urban landscape, as illustrated in image 3.

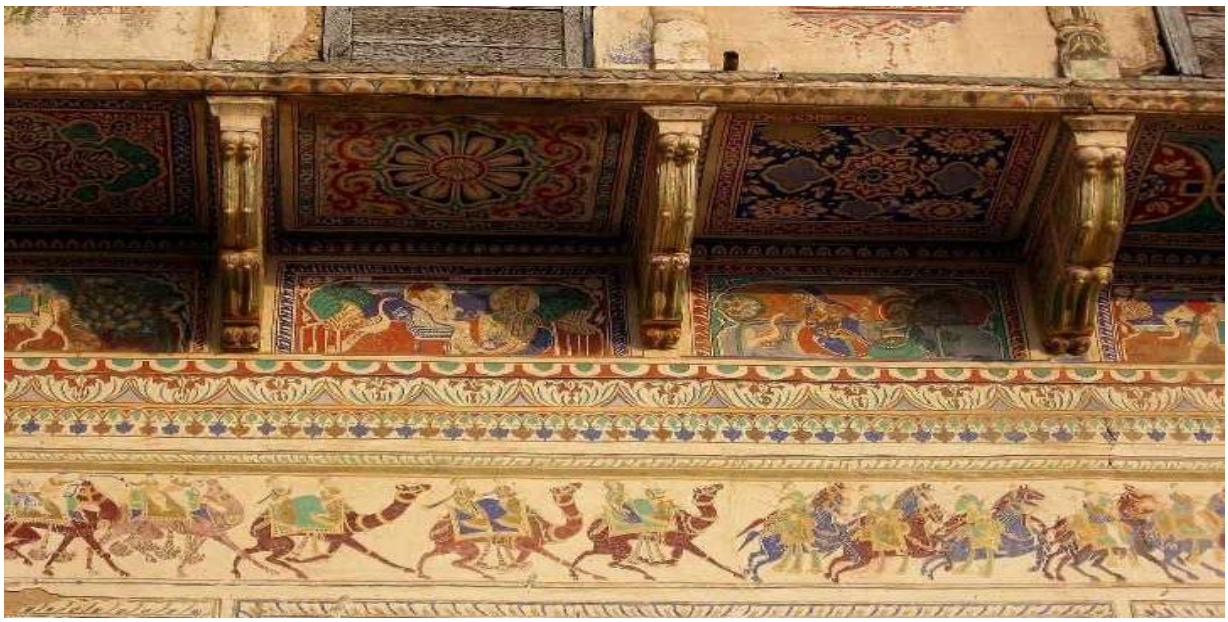

Fig. 7. Cultural context of Fresco paintings as folk art, personage, and decorative motifs on the external surfaces of Havelis

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Fig. 8. Multi and cross-cultural context of Fresco paintings (Krishna riding on a car) on the external and internal surface panels

Presently, merchants' out-migration over generations causes challenges to the physical conditions of towns' cluster planning and architecture. As a result, havelis are mostly locked up, with some left in the care of caretakers, others abandoned, and many in a state of disrepair. Unplanned construction development is currently practiced (Abha Narain Lambah, 2013) By local development authorities. In most cases, havelis undergo unthoughtful adaptive reuse for residential purposes. The towns are facing vulnerable conditions due to a lack of infrastructure, civic services, and neglect of maintenance, which is hindering urban social development. There is a serious need for safeguarding these urban elements as an integral part of conservation and planning through maintenance and management (Jaishree Mishra & Vineet Shrivastava, 2022).

METHOD

A systematic inquiry investigated whether hotspot analysis can reveal the cultural significance of Lakshmanagarh town, which exhibits distinct spatial morphological patterns. Towns are crowded with urban elements, such as a Fort, a cenotaph, a Temple, a Caravanserai, a Water Tank, and a mansion, all of which contribute to a more defined visual urbanity. The data were collected in two phases of the pilot study; the initial recording involved creating an inventory of 110 Havelis and other urban elements. The inventory was noted with stakeholder consultation and a survey about their association with the place/town (Moreno-Marimbaldo & Manso-Callejo, 2020). A qualitative survey approach evolved with an on-site survey in December 2019. The data was gathered from PhD scholars, professionals, and residents; other information was provided by the Jaipur Development Authority (report and map). The second phase of data collection took place in February 2020 to map the urban fabric and strategically inquire about the cultural uniqueness and the possibility of attempting a tentative listing under a World Heritage Site (WHS) nomination.

What to study?	Outcome	How to study?
Towns Record	**Unique Urban Elements**	**Pilot Study**
Merchants Contribution	_ Spatial arrangement	_ Stakeholder Analysis
Architecture & Planning	_ Crowded built fabric	_ Possible Inventories
Urban Morphology (spatial urbanity)	**Recognition of high cultural significance**	_ Questionnare Survey
Urban elements (distinctive built form)	**Justification of Outstanding Value**	**Reconnaissance survey**
Fresco painting	**Contribution to the existing knowledge**	_ Land Use Mapping
Cultural significance		_ Georeferenced Mapping _ ArcGis 10.4
Outstanding Universal Value Criterias		_ Govt. & Scholars interactions
		Hotspot & IDW
		_ Point data/ Collective Events/ I-Count/ Z- Score
		_ IDW Interpolation
		_Thematic to Numeric representation
		_ Spatial Symbology representation (High significant to low significant area)

Fig. 1&2. Theoretical framework methodology

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To examine the research contribution, hotspot analysis has been employed as a method to illustrate the hypothesis and research statement. The hotspot statistical analysis is a significant methodology that recognizes the patterns and cultural significance of the towns. The approach to assessing the significance of Lakshmangarh town was conducted using a hotspot and IDW (Inverse Distance Weighted) method.

The analysis is performed in ArcGIS 10.4 version using weighted features. Here, the urban built fabric (Fort, Fort a cenotaph, Temple, Caravanserai, Water Tank, and Mansion) is represented with dots, indicating their locations. This data is visualized on the town's map, the Raipur Development Agency (RDA) map, and the Renaissance survey, which combine to locate the built fabric on Google Maps. The dots (built fabric) show the intensity based on the distance from the hotspot using the local G index. (Gi-Z-score) Statistical analysis by grouping dots (based on near neighboring distances) will identify hotspots, which then cluster and intensify into a single large area. These integrated dots will be represented as hotspot locations within the map. At the same time, the dots located in the distance will be represented as cold spots. These collected events will be analyzed using the spatial statistics tool to represent intensifying dots (closely located built fabric, such as Haveli) thematically. The larger dots will indicate the I count, with a higher count corresponding to a bigger size and greater intensity (weight). These counts will be performed by selecting a hotspot that utilizes the Inverse Distance Square method under IDW. This method represents how, as distance increases, the influence decreases more rapidly, with the weight between features inversely proportional to the square of the distance. The Gi-Bin feature, used in calculating the z-score inverse distance, yields a positive value when the count is highest. Conversely, a negative value indicates a very low z-score count of dot intensity, which is represented as a cold spot in thematic mapping. These hotspots and cold spots will be displayed in the spatial weight matrix file, with layers reflecting the number of counts.

The hotspots here represent extremely significant locations, high significance areas, moderate significance areas, and low significance areas based on the distance between the dots (Havelis). Furthermore, the hotspot–Inverse Distance Weighted (IDW) result will be analyzed using an interpolation spatial analyst tool to convert numeric values into representations of the thematic values. These value raster surfaces, which represent the intensity of the z-score, will be more concentrated and significant. Here, the method suggests that the maximum concentrated areas are the haveli clusters, built densely, to define the unique urban identity of Lakshmangarh.

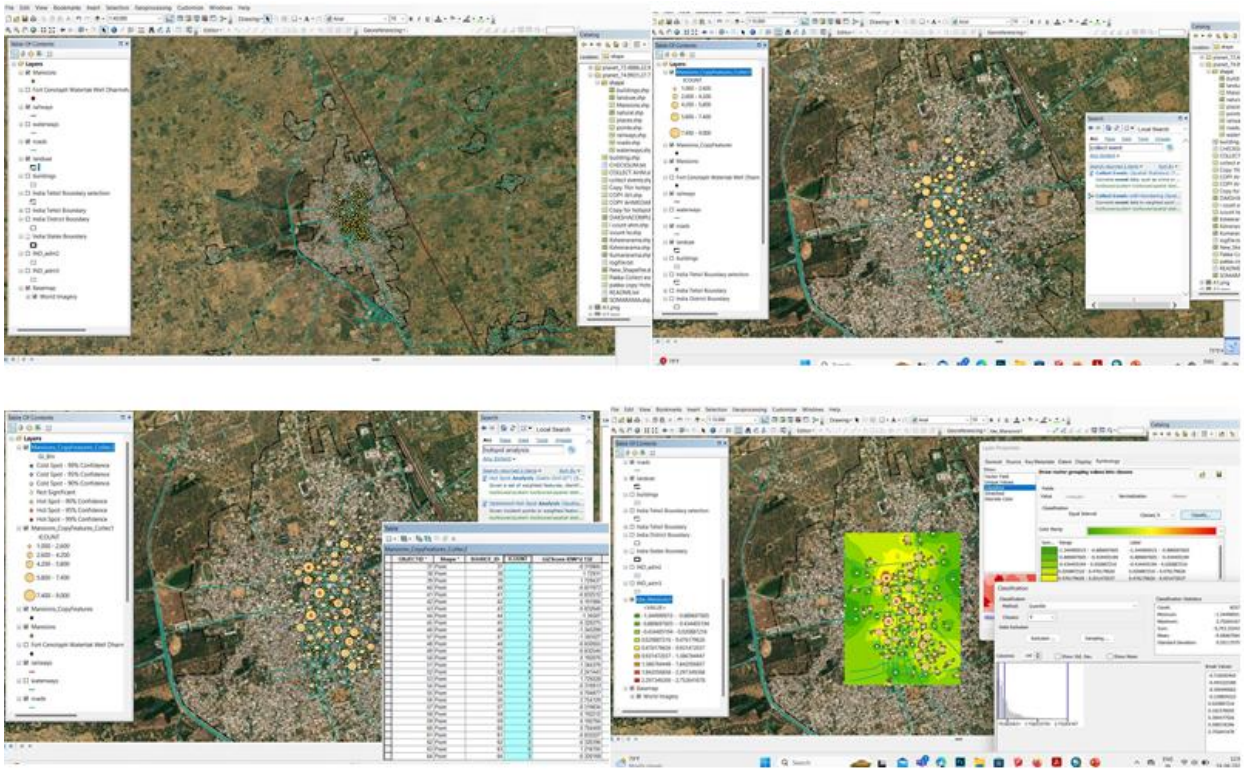

Fig. 9,10, 11, & 12. The spatial symbology process graphically represents the significance of built fabric as a unique urban morphology. Right above: point location (haveli footprint), Left above: Collect event (based on

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the inverse distance measurements, larger dots: distance between havelis are less and it overlapped), Right Below: I- Count, Gi_Bin Hotspot Analysis, more count (red point shows the higher concentration and higher significant area), Right Below: The IDW representation using symbology classification, red is the max. The concentration is indicated by green, which represents the low-concentration area.

DISCUSSION & RESULT

In conservation, it becomes essential to validate the inquiry with value-based justifications. The value-based assessment has the potential to reintroduce recognition of heritage sites, towns, and cities. Value-based heritage conservation focuses on understanding and preserving the significance of heritage sites by considering their cultural, social, historical, and economic values. The Narra document of authenticity defines the authenticity and integrity of conserving or managing historic sites from a value-based approach. Cultural and historical values influence stakeholders' engagement in decision-making to ensure the well-informed essence of heritage (Barełkowski, 2023). Concepts and practices of values-centered conservation (VCC), as they continue to evolve, can provide a dynamic framework for conservation and planning approaches (Dreyfuss et al., n.d.). Cultural values belong to a dynamic and complex system, such as the conservation discipline. The approach should be recognized with additional contextual values to prolong the sustainability of heritage in the future.

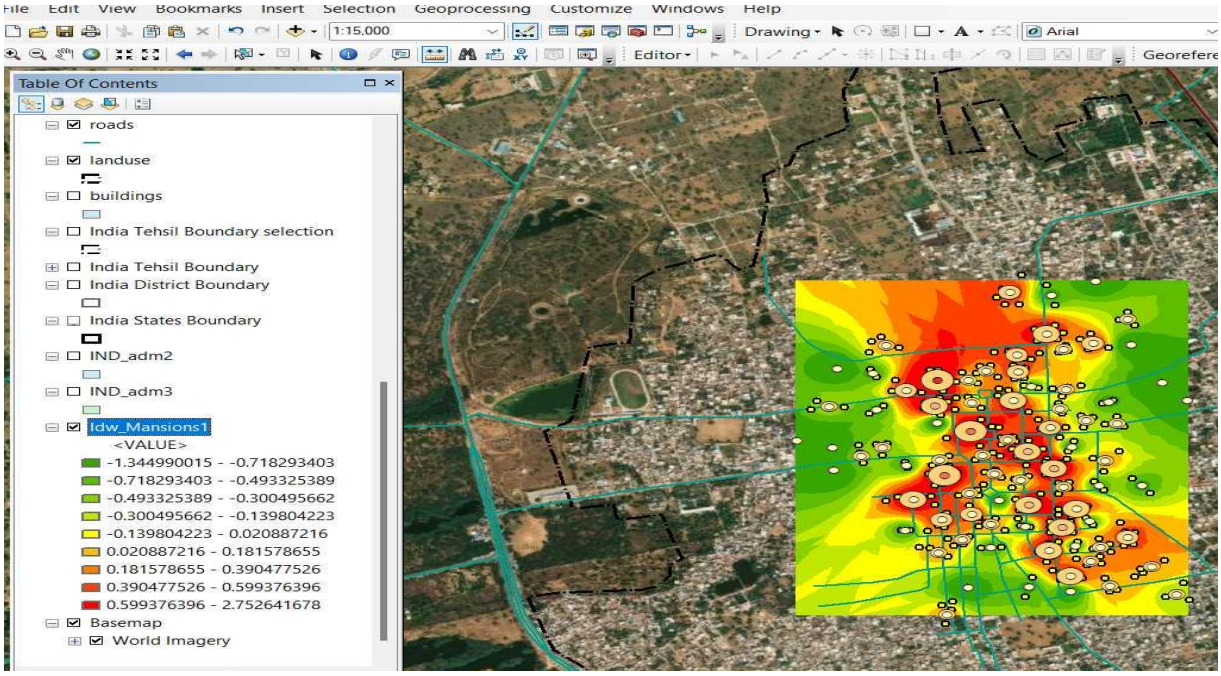

Fig. 13. The spatial symbology representation of Lakshmangarh town is unique and potentially stands out in urban morphology

On the World Heritage platform, the conservation of cultural places/sites is outlined and guided by the Burra Charter, as well as the International Council on Monuments and Sites (ICOMOS) Australia Charter (2013). Bozeman B. offers a framework for understanding and mapping public and narrative values that can be applied in heritage conservation practice (Heritage_values_vl, n.d.). Conservation practices, such as preserving the historic value of historic centers, are investigated through various concepts, including preservation, conservation, revisiting, revitalization, redefining, strategy planning, and management planning. All concepts are valid once their associated values and validation have been defined and identified. The preservation of urban fabric in Lima, Peru; the city of Bath, UK; Golkonda Fort, and Hampi, India; the Management plan, etc. A range of strategies and methods have evolved from participatory planning, stakeholder engagement, cultural mapping, Heritage Impact Assessment (HIA), Significance assessment, interpretation, and adaptive reuse to risk assessment and management.

The cultural significance of Lakshmangarh town in the present context is justified using ArcGIS 10.4 Hotspot Spatial Analyst mapping as a qualitative approach. The results of the Hotspot and IDW methods using symbology and categorical representation of quantile distribution of the -Ve and +Ve Values range. The +ve

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had a Maximum clubbing of 9 I-count, whereas the -ve I-count had one value. The maximum I-count represented the maximum concentrated havelis' footprints, and the lowest count had very little concentration and was represented in thematic mapping as a hotspot and a coldspot. The result (Fig. 12) represents the color quintile classification, which divides the concentration from high to low. This fig. 12 shows red-colored areas as high significance areas, where havelis are densely planned, and green areas as low significance areas, where havelis are less dense and located outside the historic town core. The red spread highlights the need to recognize the significance of the haveli's unique urban morphology and emphasizes the requirement for immediate action to preserve the town's identity.

This unique morphology emerged with merchants' contributions, bringing a multi-diversified culture into a significant context. The contribution to planning, architecture, and art is the mixture of Rajput and Mughal styles, which can be appreciated as existing knowledge that justifies their significance and values for world recognition. Lakshmangarh town exhibits an important interchange of human values directly associated with criterion II – Outstanding Universal Value (OUV). This cultural exchange may be recognized as part of the ten tentative listing nominations. The town also represents an outstanding example of a distinctive type of built fabric, with its architectural, planning, artistic, and technological ensemble, as the townscape features demonstrate a significant stage in humankind's evolution. This description justifies the criteria iv- OUV under the UNESCO World Heritage Site. This inquiry is collated and examined through a reconnaissance survey of Lakshmangarh town to reveal the cultural significance of the town as a case study. Almost every town in the region has a similar urban morphology. The Serial nomination can be made by identifying a town cluster with similar features, e.g., Lakshmagarh, Ramgarh, Nawalgarh, Bissau, and Ratannagar. Towns are initially planned with 90-degree street planning, sharing similar urban elements as the urbanity of the Shekhawati region as a whole. In the present context, the havelis are devastated. The neglect, lack of association, and unplanned alterations are causing these towns to deteriorate, as Abha believes that sustainable building is one that already exists; the foremost priority is to preserve and conserve. The conservation and management of Shekhawati town are crucial for preserving our traditional knowledge, moving beyond a monument-centric approach to include the historic neighborhood. The cultural significance assessment was identified through visibility analysis using GIS mapping, which protects the visual corridors and sight lines of heritage structures, an important component of the urban landscape. Value-based visual investigations for regulating conservation-based guidelines, recommendations, and Byelaws, adopting a method of observer point locations. Historical layering and chronological mapping, cultural heritage zoning, buffer analysis (Dey & Pasupuleti, 2025),cultural routes analysis (Navickienė & Meištė, 2025). This approach can be applied to identify culturally significant places for informed heritage conservation and planning.

CONCLUSION

The results drawn from the study will address the current management issues caused by out-migration, rapidly growing urbanization, inadequate infrastructure, uncontrolled development, and deteriorating built fabric to make more accurate protection and management of the region (Ashrafi et al., 2021). Additionally, the study focuses on the significance and justification of potential outstanding values, which have been evaluated through a comparative study of a World Heritage site and a tentatively listed site under the UNESCO umbrella. The intensity imagery with interpolation mapping created through surface mapping rationalized the redefinition of the town's significance and unique urban morphology by thematically representing it through hotspot and IDW analysis. Thus, this uniqueness, equivalent to the World Heritage Site(Chaieb, 2025). The anticipated outcome of a research study will be recorded based on existing data and the diverse land use of heritage components.

This study reaffirms the cultural and morphological distinctiveness of Lakshmangarh within the Shekhawati region by applying hotspot analysis and IDW interpolation to evaluate the density and spatial significance of its urban elements (Qin et al., 2017). The results highlight that the clustered distribution of havelis, temples, cenotaphs, and caravanserais forms a unique urban identity shaped by centuries of merchant patronage and cultural exchanges. The red hotspot zones revealed through GIS thematic analysis uniquely transformed urban morphology with varied urban built elements. This exceptional significance is justified and meets the two primary criteria (II and IV) of Outstanding Universal Value (OUV) in the world's areas that urgently require conservation attention, thereby linking the outcomes to UNESCO's Outstanding Universal Value (OUV)

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criteria (II and IV). These criteria encompass the exchange of human values over several recorded years within the global cultural domain, as reflected in the development of architecture, town planning, and landscape design. Additionally, it contributes to an outstanding building typology that underwent a crucial and notable period in the 18th and 19th centuries for the development of fresco paintings, urban morphology, and various built fabric elements, as well as their footprints, contributing to the historic urbanity.

This research demonstrates that not only does Lakshmangarh town reflect an important interchange of human values through architecture, design, and planning, but it also represents an outstanding typology of medieval merchant towns in India. Thus, hotspot analysis emerges as an effective tool to rationalize and complement value-based heritage conservation approaches thematically. Furthermore, it provides both visual and spatial justification for recognition, management protection, and potential serial nomination to the UNESCO World Heritage Tentative List. Future research can extend this study in various directions, including comparative regional studies of towns such as Ramgarh, Nawalgarh, Mandawa, and Fatehpur, which can be recognized universally through the UNESCO serial nomination process under the UNESCO Convention. There are further potential areas, such as exploring the relevance of buffer zones, conducting visual studies, mapping cultural routes, developing a heritage integrated management plan, and crafting historical narratives. Furthermore, at the local level, developing a comprehensive heritage management framework that includes policy, guidelines, and conservation byelaws based on hotspot zones can aid urban planning bodies in safeguarding cultural routes/corridors. Nonetheless, significant attention should be given to the community and their engagement throughout the conservation process for a holistic approach. Furthermore, a Sustainability perspective suggests that conservation itself necessitates a focus on developing tourism, adaptive reuse strategies, and socio-economic revitalization to ensure long-term heritage management of Shekhawati towns, incorporating advanced analytical methods (Fernández et al., 2021). Wholistically, this research provides a methodological foundation for bridging spatial analytics with heritage conservation worldwide.

Abbreviations

IDW: Inverse Distance Weighted

GIS: Geographic Information System

AHP: Analytical Hierarchy Process

TOD: Transit-Oriented Development

JDA: Jaipur Development Authority

WHS: World Heritage Site

UNESCO: United Nations Educational, Scientific, and Cultural Organization

OUV: Outstanding Universal Value

RDA: Raipur Development Agency

VCC: values-centered conservation

Local General G index (Getis-Ord Gi*)

HIA: Heritage Impact Assessment

ICOMOS: International Council on Monuments and Sites

POI: Point of Interest

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