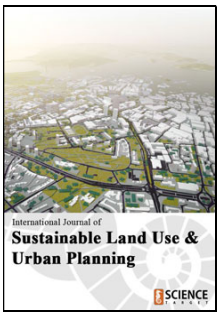
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Advancing Smartness of Traditional Settlements - Case Analysis of Indian and Arab Old Cities

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Abstract. This study aims to investigate the concept of Smart Sustainable Cities in traditionally planned and organically grown settlements. Smart Cities Mission is an ambitious project of the Government of India targeting 100 cities for improving their urban quality of life. There is no universally accepted definition of smart cities because of its vast and vague scope. In such a situation, it becomes important to understand where our old cities stand in terms of smart sustainability and inclusiveness. The methodological approach adopts case analysis of old Indian cities and Arab cities in terms of their environmental, economic, and social planning paradigms. These include land use mix, compact development, dwelling density, internal and external connectivity, open spaces, walkable neighbourhoods, access to social services, collective cohesiveness, local area governance, crime and safety, economic diversification, and sociocultural diversity.

The study enlists smart urban elements in our existing old cities, which are derived from an extensive literature study of Middle East cities and primary surveys of around 160 samples in a medium sized old Indian city in Rajasthan. The study assesses the baseline situation of culturally rich and varied old cities and needs to advance from their inherent smartness using innovative and interactive ICT and urban engineering solutions.

Keywords. *smart sustainable cities; inclusiveness; Middle East; old Indian cities; smart urban elements*

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1. Introduction

Cities in general are the face of the future acting as the engines of economic growth and centres of excellence. Cities provide opportunities, economies of scale, and a future with more choices; yet cities have also been blamed for causing environmental disasters and diminishing the quality of life of the poor and are castigated as centres of social exclusion, insecurity, natural disasters, and global warming (ICLEI and the Cities Alliance, 2007). Characterisation of a successful city as an ideal city, capable city, resilient city, secure city, and liveable city means bringing together the major aspects of socioeconomic growth and sustainable environment to foster its future growth. Conceptually, liveability refers to the state of living in an environment, which must offer an acceptable quality of life to the inhabitants of a particular locale (ICLEI and the Cities Alliance, 2007). It is a subjective notion with its gamut varying with different economic, social, cultural, and local influences; thereby governing the inhabitants' impression and perception about liveability. While in the USA, liveability refers to overall quality of life and wellbeing, in the UK, liveability focuses strictly on aspects of the local environment such as cleanliness, safety, and greenery. In India, the concept differs slightly from the concept of developed countries though the essence remains the same.

The international and national community realize that a successful city should balance social, economic, and environmental needs and should respond to all the domains of urban life. It should offer security, quality level basic urban infrastructure, and a healthy social environment to prosper its culture and community needs by recognizing its natural assets, citizens' needs, and environment on which it builds (Elmer & Leigland, 2013). Many authors, such as Giffinger

et al. 2007 and Caragliu and Nijkamp, 2009, define smart cities not only from a technology or infrastructure point of view but also give due respect to the quality of the living environment and social capital. The Indian government's definition in 2014 for smart cities included more economic, technological, and physical infrastructure elements (Anon., 2015). Hence, interventions of the Government of India for smart urban development require understanding this concept in the Indian context and an exploration of methods to measure smartness of its traditional settlements for inclusive development.

Looking at the underlying potential to redevelop congested old cities in India, it is imperative to choose a smart and sustainable pathway for development. In this context, two main research questions have been identified. First, is the concept of smart cities in India and the Middle East inclusive and sustainable considering its varied social, physical, economic, and environmental needs? Second, is there a need to contextualize the definition of smart cities according to the needs of traditional cities and modern cities? A contrasting urban pattern is observed between the old city and new city areas of Asian and Arab cities. Many scholars have also opposed the insensitive and incongruent approach of modern planners for such old settlements with a complex society system and values. The study aims to compare the traditional settlements in the Indian subcontinent and Middle Eastern Arab World and further evaluate the sustainability of their smart urban elements on the basis of certain criteria. The main objectives of the study are:

i. To understand the meaning of smart sustainable cities
ii. To identify basic planning principles of traditional Arab and Indian settlements using case studies with their significance
iii. To list a set of criteria to assess sustainability of these smart urban elements and present a case analysis

Physical, societal, and economic aspects can't be viewed in isolation. It is almost impossible to delink the past from the future. If smart and sustainable are the buzz words for future cities, then the old and historic principles can't be ruled out, and it needs to integrate heritage and technology altogether. The primary agencies that act on the city, such as everyday inhabitants who make or remake cities, are generally overlooked.

2. Literature Review

Concept of Smart Sustainable Cities

"Smart" in general is associated with quick mental alertness, resourcefulness, capability of independent and intelligent actions, and ability to reason. It is nothing but a pro-active operation especially when it is required the most. However, the smart city is a concept rather than a term with a universally accepted definition (Kondepudi, accessed 2015). With the change in approach of the modern world towards urbanisation, the concept of digital cities, smart cities, and wired cities have flourished over time. During the 1980s and 1990s, technological advancement and economic growth led to migration as common phenomena in major cities. This urbanisation had profound negative impacts on the resources of the city and led to the development of ideas of smart urban growth during the 1990s. The initial idea was to invoke effective community participation to solve urban issues, but later with the Kyoto protocol, the emphasis shifted to environmental protection (Kondepudi, accessed 2015). International institutions, such as the European Union and the Organisation for Economic Co-operation and Development (OECD), realised a strong correlation between the concept of a smart city and sustainability along with green growth, quality of life, ICT infrastructure, and citizens' involvement. There is no concrete definition of a smart city, rather it is treated as a concept and adjective, which is ambiguous and takes shape with the needs and priorities of its users.

A smart city is a broad concept with many subthemes, such as urban and regional planning, economic development, environment and sustainability, ICT, and technology, in a literature study conducted using a mathematical model by Von Brocke et al. (Cocchia, 2014). Several au-

thors highlighted the difficulty in defining smart cities because of its multifunctional and fuzzy label. However, all definitions almost share some common characteristics, features, and boundaries. These concepts are not contradictory and isolated but partially or fully overlap (Cocchia, 2014). The trend analysis shows five phases of development of this concept:

1. Kyoto Protocol (1997): It influenced the way the world perceived modern and industrialized cities with a major thrust on environment.
2. Information Technology Boom (2000): The flow of information became smoother among citizens, and life became much easier with IT. The term digital city as wired city became widely accepted with Internet diffusion into public and private life to create socioeconomic value.
3. Enforcement of the Kyoto Protocol (2005): The publications with the term smart city started to increase, which were mostly centered on specific projects.
4. Smart Technology (2007): Apple Ltd launched its first smart phone, the i-phone, and from here onwards the use of smart devices became routine for the general public. These devices have smart features, which combine telephony and computing together and enable high speed data access and real time digital services to improve the quality of life. This also led to the building of a digital urban arena by merging meanings of smart and digital for innovative urban policies.
5. Europe 2020 strategy (2010): Journals with the smart city label started rising phenomenally until 2012. The Europe 2020 strategy widely used the term smart city in terms of urban sustainability with its focus on environmental protection and social and economic sustainability.

Therefore, it can be seen that the smart city focuses more attention on the environmental quality of cities unlike digital cities, which focus more on the use of ICT in urban areas. Also, the concept is more of a political nature driven by international resolutions to implement innovative solutions to tackle complex urban challenges. The four key attributes of Smart Sustainable Cities (SSCs) are: sustainability, quality of life, urban aspects, and intelligence with the four core themes of society, economy, environment, and governance (Kondepudi, accessed 2015). Approximately 116 most cited definitions of smart sustainable cities were analysed on the basis of chosen attributes and themes of SSCs developed in a parallel International Telecommunications Union's Technical Report on the Overview of Smart Sustainable Cities. Also, 30 common keywords were found to be overlapping among all these definitions, which were further categorised into eight categories 1) quality of life and lifestyle; (2) infrastructure and services; (3) ICT, communications, intelligence, and information; (4) people, citizen, and society; (5) environment and sustainability; (6) governance, management, and administration; (7) economy and finance; and (8) mobility. The five most important keywords in terms of percentage of occurrence were quality of life (6.1%), technology (5.8%), people (5%), systems (4.7%), and economy (4.7%) (Kondepudi, accessed 2015). Based on this analysis, a smart sustainable city is characterised as one with the following goals to be achieved in an adaptable, reliable, scalable, accessible, and resilient manner:

1. Improve quality of life of its citizens
2. Ensure economic growth with better employment opportunities
3. Improve the wellbeing of its citizens by ensuring access to social and community services
4. Establish an environmentally responsible and sustainable approach to development
5. Ensure efficient service delivery of basic services and infrastructure such as public transportation, water supply and drainage, telecommunication, and other utilities
6. Ability to address climate change and environmental issues
7. Provide effective regulatory and local governance mechanisms ensuring equitable policies

Urban Fabric Evolution

City making is a process whereby social, economic, political, and physical urban components interact with each other. Urban forms are more or less a result of urban experiences, which are key to human settlements, culture, and society. This material organisation of urban space is crucial to produce and re-produce social and economic arrangements and divisions. Elements of urban form tend to mediate physically and spatially with its social, economic, and environmental setting (Lynch & Rodwin, 1958). This implies that urban form can't be defined only in terms of its physical and tangible constructs but requires a deep understanding of its intricate mix of social, economic, legal, and political modes of organisation and interaction. Therefore, any city is a result of a complex relationship among its socio-economic, spatio-temporal, and environmental processes and practices (Tonkiss, 2013).

In cities, there are lots of urban processes and urban systems interacting within an urban space. This idea of urban interconnectedness overpowers the traditional definition of cities as discrete spatial or functional units. Lynch (1981) defined urban form from the perspective of narrow fixity as a spatial pattern of large, inert, permanent physical objects in the city. However, Tonkiss (2013) redefined it from a broad, non-fixed point of view not limited to fixed elements of morphologies, taking into consideration more dynamic and provisional features of city environments such as the patterns of mobility, inward and outward flow of people and things, events and interactions, and occupation and history, which are highly formative for cities but may or may not be permanent in nature.

In old cities, there are no end users rather there are users over time. All urban occupations are temporary, as urban context changes more quickly than urban form. Urban design is expressive, but what is formative of an urban space is not its physical shape alone but several personal and impersonal processes such as the socioeconomic, environmental, political, and legal. These processes may appear abstract but are not less social to individualise (Lynch & Rodwin, 1958). Wherever there is a society or mix of people staying together, it has resulted in social and economic practices from which an interactive environment is woven (Lynch & Rodwin, 1958). Even an organic pattern depicts some kind of arrangement or organisation of urban space relevant to human settlements and an urban context. (Tonkiss, 2013). Technically, they are socially and economically planned through a more complex process resulting in an intricate urban fabric.

Generally the physical form of cities is measured in terms of distribution and density of population, housing stock, public buildings and spaces, work places and consumption, balance between private and public land uses, environment, etc. The social life of urban form refers to how cities are structured as spatial environments around and through social relations, practices, and divisions. Hence, urban form is not only about buildings and spaces between them, skylines, and city boundaries but also about density and distribution of people and functions, spatial relationship between social groups, spatial markings of legal boundaries and entitlements, urban environments, and the submerged or social infrastructures that shape and segment them (Tonkiss, 2013). The scales at which urban form can be considered or measured include the individual building, street, urban block, neighbourhood, and city. These levels of spatial disaggregation influence how urban form is measured, analysed, and ultimately understood in terms of aspects shown in Figure 1 (Jenks & Jenks, 2009).

Sustainability Assessment Matrix

The evaluation of the case studies in the Middle East and India is based on a matrix that is developed based on an extensive literature review of urban form elements, which contribute to sustainability in the long run. This assessment is important to make us understand whether our traditional settlements have been smart in their approach of urban planning and hence assess our baseline situation to move to the next level of introducing ICT and other urban engineering solutions. Jabareen, 2006 identified urban elements composing complex urban pattern and urban form. These urban patterns can be

grouped together conceptually to form concepts, and the author conducted a thematic analysis to discover these urban patterns, themes, and concepts (Jabareen, 2006). In the present study, these seven concepts are further being used to assess the urban fabric of traditional settlements and are termed smart urban elements leading to inclusive and sustainable communities. Each of these concepts has an overlapping influence on the aspects of sustainability from social, economic, and environmental paradigms as shown in Figure 2.

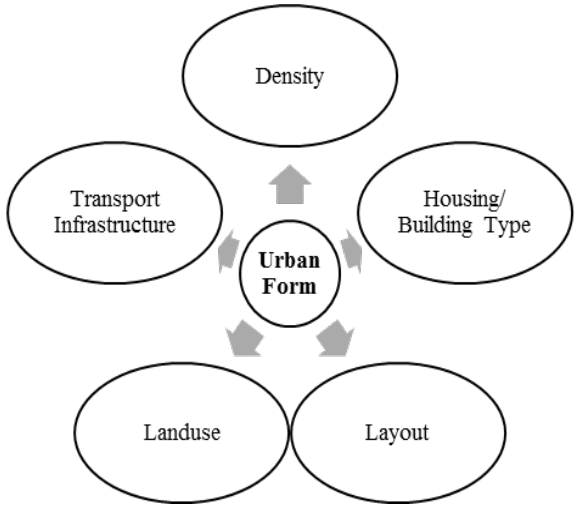


Figure 1: Aspects of a sustainable built environment (Jenks & Jenks, 2009)

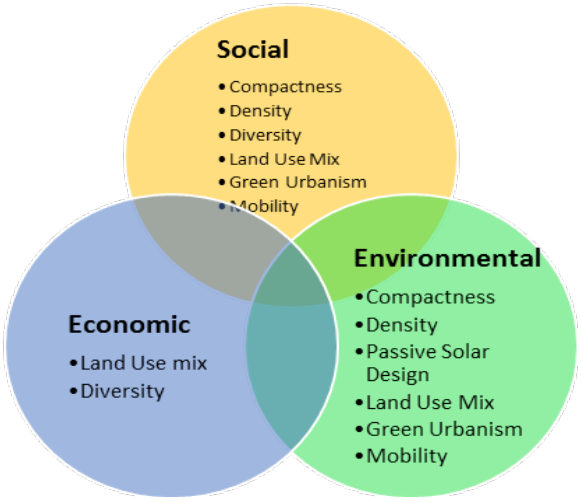


Figure 2: Smart Urban Elements to assess three Sustainability Conditions

These identified seven smart urban elements are listed below in Table 1 with their significance.

Table 1

List of Smart Urban Elements

Smart Urban Elements	Significance
Compactness	Improves walkability; reduced energy usage; high quality of life in terms of social interaction; access to community services; mutual shading; reduced travel demand
Mobility	Reduced travel need; accessibility to services; environment and pedestrian friendly; anti-vehicular growth
Density	Viable interactions between urban functions and activities; encourages compact development; efficient use of scarce natural resources and urban land; reduces automobile ownership and travel demand
Land Use Mix	Ensures safety on streets; reduces number of trips; increases accessibility; attractive local streets; boosts local creative economy and handicrafts; high neighbourhood charm
Diversity	Rich social and cultural mix; promotes walking; closely grained; attractive urban landscapes
Passive Solar Design	Favours microclimatic conditions; reduces cooling and heating energy consumption; environmentally viable; promotes local craftsmen skills
Green Urbanism	favours microclimatic conditions; green spaces for children to play; open spaces for social interaction; promotes participative decision making

3. Case Studies

The two cases have been chosen for the purpose of this study are the city of Riyadh in the Middle East, representing a typical old Arab settlement and the old walled city of Alwar in India. Both cities have undergone a major breakthrough in their population expansion and urban development with the passage of time and both had a strong historical genesis.

The City of Riyadh is the capital and largest city of the kingdom of Saudi Arabia with a popula-

tion of 5.7 million recorded in 2010. The city belongs to the pre-Islamic era and has transformed over time with rapid urban development. Since the 1940s, the city has changed from an isolated and narrow town to a spacious metropolis giving it a tag of a modern city. It lies in the centre of the Arabian Peninsula on a plateau with an area of around 1300 sq km. With post 1940s modern development and economic growth, the traditional urban settlements experienced a constant self-destruction by adopting imported town planning techniques from the western world (Al-Hemaidi, 2001). This urban development process has been widely criticised by scholars, and now the city has started to experiment with something called an improved traditional built environment. The climate of the city is a hot and dry desert climate with extreme hot summers with the average temperature in August 43.6 degree Celsius. Summers are hot in the day and cooler in the nights while winters are warm with cool and windy nights. The region experiences very little rainfall and is known to have frequent dust storms.

The walled city of Alwar is located in the northwestern state of Rajasthan in India at an elevation of 271 m and is bordered by the Aravalli Range to its west. It is the third most populous district in the state out of 33 districts followed by Jaipur and Jodhpur (Town Planning Department, 2011). The origin of the region dates back to the era of the Indus Valley civilisation and the Epic Age in India. Its pre-historic evidence shows a great association with Indo-Islamic heritage. During British rule in India, Alwar was one of the princely state capitals, and the district is now a part of the National Capital Regional Plan 2021 of the Government of India with a total population of around 3.67 million in 2011 (Town Planning Department, 2011). Presently, a traditional way of living is still prevalent in the old city area with a rich tangible and intangible heritage. The climate is local steppe or semi-arid with little rainfall throughout the year. The average temperature is 25.4 degree Celsius and average rainfall is 722mm. June is the warmest month of the year with an average temperature of 34.3 degree Celsius (Department of Architecture and Regional planning, 1988).

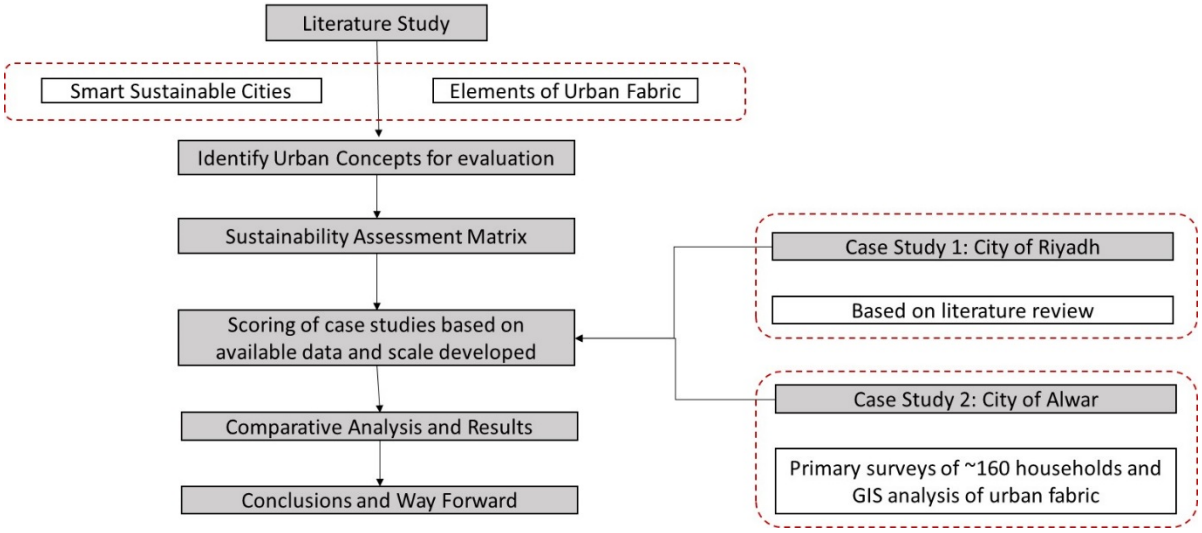


Figure 3: Methodological Approach

Table 2

Scale for Evaluation of Smart Urban Elements

Smart Urban Elements	Indicators	Evaluation Criteria
Compactness	Dwelling Units Density	High = 3; Medium=2; Low=1.
Mobility	Home to Work Distance	Low=3; Moderate=2; High=1
	Internal Connectivity	Good =3; Medium=2; Bad=1
	External Connectivity	Good =3; Medium=2; Bad=2
	Street Layout	Well Connected = 3; Moderately connected=2; Poorly connected=1
	Traffic Calming	Highly technical and advanced=3; Normal traffic management=2; Negligible =1
Density	persons per hectare	High=3; Medium=2; Low=1
	commuter mode choices	Walking/Cycling=3; 2-Wheeler=2; 4-wheeler=1
Land Use Mix	Mixed Residential Land Use	High=3; Medium=2; Low=1
	Walkability to City Centre	High=3; Medium=2; Low=1
	Walkability to Social Services	High=3; Medium=2; Low=1
	Mix of commercial and residential land uses	High=3; Medium=2; Low=1
Diversity	Building typology	Varied=3; Moderate=2; Not Varied=1
	Socio-cultural mix	Heterogeneous=3; Moderate mix=2; Homogenous=1
	Local Creative Economy	Varied and Flourishing=3; Stagnant=2; Negligible=1
	Income groups	Heterogeneous=3; Moderate mix=2; Homogenous=1
Passive Solar Design	Orientation and Siting	climatic considerations: High=3; Moderate=2; Low=3
	Building Layout	climatic considerations: High=3; Moderate=2; Low=3
	Façade and Fenestration	climatic considerations: High=3; Moderate=2; Low=3
	Building techniques and materials	climatic considerations: High=3; Moderate=2; Low=3
Green Urbanism	Accessible Open spaces	High=3; Medium=2; Low=1
	Impervious Surfaces	Low=3; Medium=2; High=1
	Common Public spaces for informal discussion	High=3; Medium=2; Low=1

4. Methodology

Each of the case studies have been analysed, and their qualitative characteristics are converted to scores based on the scale developed to assess the smart urban elements. The indicators have been identified based on a comprehensive literature study (Yigitcanlar, et al., 2015). The City of Riyadh is studied and analysed based on literature available while the walled city of Alwar is analysed based on the primary surveys of approximately 160 households within 3.80 sq.km delineated soft boundary and GIS assisted spatial analysis of its urban fabric (Dhingra, 2014). Both the case studies have further been analysed and compared in a matrix format for each of these urban concepts and results are presented. The methodological approach is shown in Figure 3.

The scale that is developed for the assessment of the identified smart urban elements and their respective indicators are given in Table 2.

For the survey of the old settlements in the walled city of Alwar, a 3.80 sq.km soft boundary is delineated based on several factors such as the master plan boundaries, historical evolution, high density areas, arterial roads, presence of traditional architectural elements, and townscape value. This area contains several layers of historical evolution and comprises approximately 66 identified old neighbourhoods called mohallas, 26 historical landmarks, important streets, and 18 intangible heritage components (Dhingra, 2014). All the identified urban layers were mapped on Arc GIS desktop version 10.1, and figure ground analysis was conducted. Around 160 households and 50 local shopkeepers were surveyed based on the structured questionnaire to identify the development trend

and local behaviour pattern. A stratified random and clustered sampling survey technique was used for primary surveys of local residents and shopkeepers. For the purpose of sample size calculation with the confidence interval of 90%, equation 1 is used.

$$n = \frac{z^2 \times p(1-p)}{m^2} \quad [1]$$

where

n = required sample

z = value of confidence level C.L. (for 90% it is 1.645)

p = estimated prevalence of variable of interest (assumed to be 30%)

m= margin of error (assumed to be 20%)

Correction for finite population is done using equation 2:

$$n = \frac{n}{1 + \frac{(n-1)}{POPLn}} \quad [2]$$

where

$POPL^n$ = ward wise population as per 2011 census

5. Results and Discussion

Riyadh

The Arab world comprises countries that are tied together by common cultural and social ideologies. From an early point in time, there is a specific and unique Islamic quality, which is apparent in traditional settlements of the Arab world. It shows deep affinities based on a set of customs, daily living habits, functional patterns, and structural principles. However, these settlements had climate, socio-cultural values, vernacular building techniques, and religious beliefs as common denominators of development (Bianca, 2000). The real source of unity in traditional Arab settlements lies in its pre-formal archetypes and patterns rather than stylistic features (Ibrahim, 2015).



Image Source: (Aina, et al., 2013)

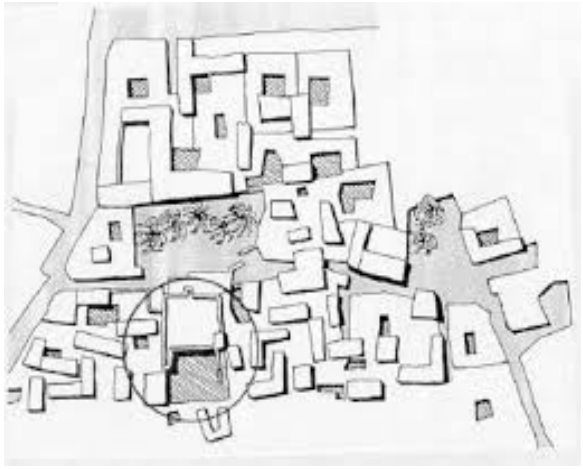


Image Source: (Al-Hemaidi, 2001)

Figure 4: Old Urban Fabric of Riyadh city

A traditional Arabic town is a unique phenomenon moulded around several factors, which are not in sync with formal town planning principles but rather with autonomous management of societies by a class (Kiet, 2011). Most of the traditional Middle Eastern cities followed an organic growth pattern (Figure 4) marked by seeds of certain archetypes (Bianca, 2000). These could in turn develop a wide range of physical shapes responding to site constraints, community size, economic resources, and building materials and techniques. The narrow and shallow street corridors leading to neighbourhoods leads to closer public interactions and closed private spaces, which prevent friction from bustling public life (Kiet, 2011) (Costa & Noble, 1996). The residential units were not merely a result of mechanical subdivision of space but rather a cellular aggregation process.

Table 3

Assessment of Typical Arab Settlement: Riyadh traditional settlements

Smart Urban Elements	Indicators	Typical Arab Settlement-Riyadh	Characteristic Features
Compactness	Dwelling Units Density	3	Dwelling Units form clusters of neighbourhoods further leading to multiple clusters leading to compact development
Mobility	Home to Work Distance	3	The main spines from the great mosque complex lead to entry gates or walls to each of the neighbourhoods within walkability
	Internal Connectivity	3	Shallow and narrow alleyways connected various neighbourhood clusters
	External Connectivity	3	These private street corridors link to main public spaces which are lined with shops leading to core complex
	Street Layout	3	Irregular street network with organic growth pattern makes the settlements less exposed to dust and sun
Density	persons per hectare	3	Dwelling units clustered together especially with closely staying kinship leading to highly dense settlements
	commuter mode choices	3	The narrow roads don't have provisions for vehicular movement and hence preferable mode of movement is walking
Land Use Mix	Mixed Residential Land Use	1	Private and public spaces segregated leading to purely residential land use
	Walkability to City Centre	3	All the activities are in close vicinity of city core with grand mosque, commercial area and government buildings/royal palace
	Walkability to Social Services	3	Local neighbourhood clusters have all the common public services and facilities for its community leading to a self-contained neighbourhood
	Mixed Land Use	1	There is complete segregation of private, semi-private and public spaces leading to somehow a rigid zoning in terms of land use
Diversity	Building typology	2	Social classes dictated the growth pattern from the centre of the city almost in circular or spiral pattern
	Socio-cultural mix	2	Each neighbourhood cluster has its own set of tradition and culture to be followed further integrated into a united urban form
	Local Creative Economy	2	Souqs are the ultimate marketplaces where items such as spices, dyes, jewels, silk and others are passed in the form of tradition from generations to generations
	Income groups	3	Well of families were settled near the central complex and working class people closer to periphery with agriculture land beyond it.
Passive Solar Design	Orientation and Siting	3	Dwelling units are oriented and sited to minimise exposure to direct sunrays further shading the streets with their complex pattern
	Building Layout	3	Courtyard type planning is prevalent which is introvert in nature to ensure high level of privacy of family activities. Vernacular ventilating system of mulgufs are employed
	Façade and Fenestration	3	Openings which are inward looking and raised at certain height to ensure privacy and ventilation
	Building techniques and materials	3	Mud construction is most common which keeps houses cool and is locally available

Table 3: cont'd

Smart Urban Elements	Indicators	Typical Arab Settlement-Riyadh	Characteristic Features
Green Urbanism	Accessible Open spaces	3	There was a strong systems of open spaces, courtyards and circulation patterns at every scale
	Impervious Surfaces	3	Least in number due to minimal metalled road surface
	Common Public spaces for informal discussion	3	Private street corridors were used mainly as spaces for social interaction among the people
	Computed Score	59	
	Total Score	66	

The typical multi-focal pattern was generated by countless centres of individual neighbourhoods and not on the basis of a grid iron system (Costa & Noble, 1996). The centre of the city had a multifunctional core system as a main land use pattern surrounding a central mosque by different layers of interconnected souks or bazaars. Interconnected within are common public and commercial facilities (Ibrahim, 2015). The assessment of Riyadh as a typical Arab settlement against all the smart urban elements with their characteristic features is presented in Table 3.

Also, a hot and arid climate along with the need for segregation of private spaces from semi-private and public spaces has led to introvert urban plans. Most of the buildings were closer to the ground and grouped together to harness the potential of mutual shading to create a cooler microclimate. These also created continuous highly dense compact urban forms. The Arab culture mostly developed around a circular or spiral pattern with religion at its centre (Bianca, 2000). The main mosque lies at the focal point along with markets and government buildings. Also, all neighbourhoods had access to basic public services and a local mosque. The old settlements possessed a high degree of ethnic and religious homogeneity, where outside intruders were not allowed into private spaces of inhabitants. The openings opened inside the central courtyard rather than the main streets to ensure a high level of privacy, especially for its women (Kiet, 2011). The courtyard and high level venting spaces ensured warm air could rise up and that cool convection currents remained near the ground. The orientation of buildings and openings was away from the sun and towards the north and west (Costa & Noble, 1996). The absence of a dominant civic institution increased the need for local consensus and certain mechanisms for human interaction.

Alwar

The origin of Alwar walled city dates back to around 200 years ago. Over time, numerous transformations have taken place in the city. The historical evidence shows a close association of the city with the pre-historic era and Indus valley civilisation. However, the foundation was formally laid in 1049 AD by the Kushwaha clan as Alapur city, which was later renamed Ulwar (Department of Architecture and Regional planning, 1988). In 1775 AD, a grand city wall with five main city gates was established as the city limits with a moat outside it. Several public buildings were constructed by rulers of the region, which still exist, and many of them have been added to the state protected list. Post-independence, Alwar city acceded into the Indian dominion as part of Matsya Union and later in 1949 was reunited to form a district in the state of Rajasthan. Most of the royal structures, including the city palace, were put to adaptive reuse mostly as government offices. In the late 1940s, to accommodate the refugee population from Pakistan, town development schemes were implemented for which the city wall was broken down and the moat was filled. New contiguous old city areas started to develop with a more or less similar pattern. However, with Alwar municipal council in 1958, new housing schemes started to develop as immediate adjacent area to traditional settlements (Dhingra, 2014).

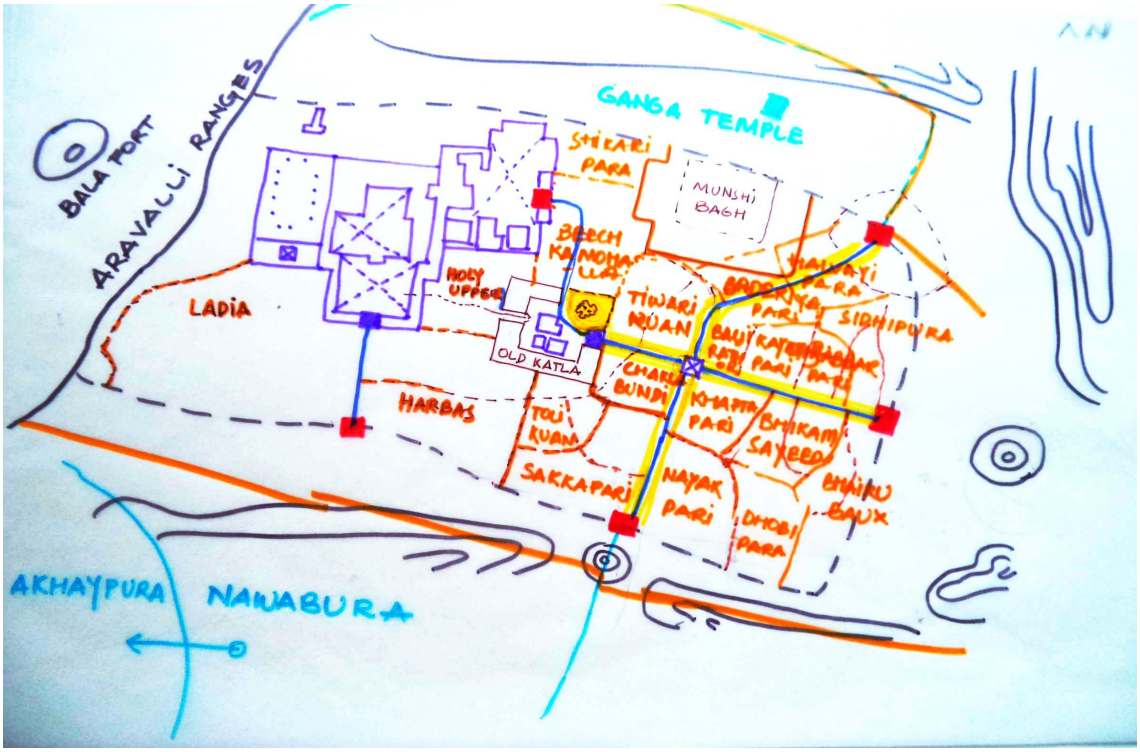


Figure 5: Historic Urban Fabric of Walled City of Alwar



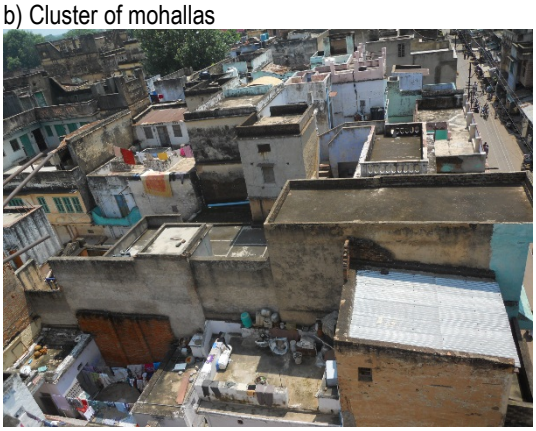
a) Main arterial roads



b) Cluster of mohallas

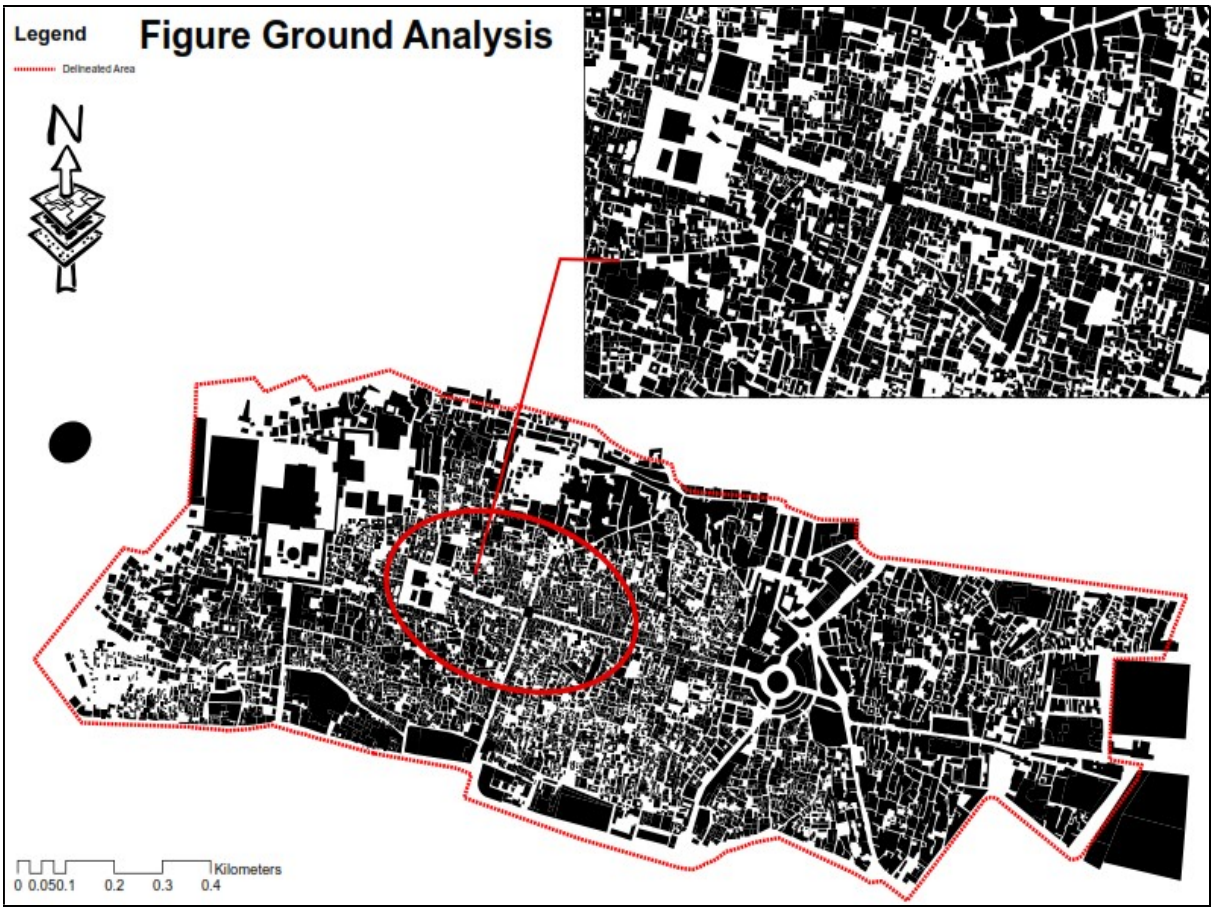


c) Courtyard Planning



d) Multifunctional open spaces

Figure 6: Clusters of Old Neighbourhoods in Alwar



a) Old walled city and contiguous old settlements



b) Compact walled city of Alwar

Figure 7: Figure Ground Analysis

City of Alwar

Figure 5 depicts a city palace complex under the foothills of Aravalli with a unique main streets layout with major landmarks located at the junctions (Figure 6(a)). The streets leading to the Jagannath Temple complex are lined with the traditional shops on both the sides that have been running for generations. There are clusters of mohallas located behind the facades of the commercial streets (Figure 6(b)). These mohallas have no rigid boundaries rather are based on cognitional mapping of its inhabitants.

The figure ground analysis in Figure 7 reveals the urban morphology of the historic city area of Alwar. The city still follows the traditional residential culture of the Mohalla system, which literally means neighbourhood in Arabic. Most of them have a courtyard type of planning, which helps in keeping the rooms cool in summers (Figure 6(c)). Also, these courtyard and roof spaces are used for sleeping in the night and other daily activities (Figure 6(d)).

Usually a mohalla in an Indian context is inhabited by a community of the same social status forming a cluster altogether. In between these mohallas were open spaces with wells or religious places or a banyan tree under which some of the most important decisions of the community were made by the head of the social group. These open spaces, known as chowks, were also places for social gatherings, rituals, celebrations, and dialogues (Cieslewska, 2010). The size of these mohallas varies from a dozen to several hundred houses and follows no strict planning geometry. In terms of its social function, they act as traditional, self-governing small community that organizes the community's way of life. Their nomenclature is usually based upon a dominant professional group inhabiting the area in past and consequently shows a strong historical and cultural association. The material for the construction of houses is mostly stone and lime mortar with prominent use of Rajputana architectural elements such as Jharokhas (balconies) and Jalis (screens). Architectural elements such as brackets have also been widely used in the building structure, employing local craftsmen skills. The area has medium to high density settlements with narrow, winding, and dead alleyways. There is an organic growth pattern observed in the city (Figure 7(b)). Also, there is a sense of visual linkage to old monuments and the Aravalli Hills from its network of roads. The overall morphology of the city is very interesting from the perspective of ancient town planning practices. The assessment of smart urban elements is carried out in Table 4 with their characteristic features.

All these qualities of social and public space ensured effective citizen participation and self-governance at the local level. People of the community used to participate and engage in the development activities of their neighbourhoods. Also, both the cases show a high degree of mobility, compactness, density, passive design, and green urbanism. However, in terms of land use mix, the Arab settlements did not have many mixed residential and commercial uses due to the constraints of segregating private spaces from public spaces. Each of these neighbourhoods had long walls and entry gates for selective accessibility, whereas in Alwar mostly 29% of the surveyed population is involved in home based enterprises or some form of cottage industry resulting in more of a mixed land use pattern. Both the cities had a heterogeneous mix of communities in terms of social as well as economic status. They had their own social hierarchy to be maintained to satisfy their respective cultural needs. These diverse communities formed a repetitive and continuous fabric that is homogenous and united. Also, their rich intangible heritage requires proper management of the creative economy of the region. The planning principles of many old Indian settlements, especially in the northern part of the subcontinent, are aligned with the Arabic philosophy, which can be largely attributed to the cultural exchange and trade between the regions in the past. In terms of sustainability score, the design and function of Alwar is 64 out of 66, and Riyadh is 59 out of 66 (i.e. almost 90%).

Table 4

Assessment of old settlements in Walled City of Alwar

Smart Urban Elements	Indicators	Walled City of Alwar, Rajasthan, India	Characteristic Features
Compactness	Dwelling Units Density	3	Mohallas closely knitted together in the form of clusters leading to compact development pattern
Mobility	Home to Work Distance	3	Around 29% population was found to work in home based enterprises and 51% in core city area within walkable range (Figure 8(e))
	Internal Connectivity	3	Narrow zigzag streets connect to other mohallas forming closely connected network
	External Connectivity	3	The main arterial roads provide access to important community areas, city palace and main temple complex of Lord Jagannath (Figure 8(b))
	Street Layout	3	Organic and irregular street network with excellent connectivity to innermost mohalla community
Density	persons per hectare	3	In 2011, the residential density of the old city area was around 30,000 persons per square kilometre in comparison to net residential density of city of 20,500 persons per square kilometre
	commuter mode choices	3	Except royal carts and other means of movement along main arterial streets, no provision for vehicular movement is provided within mohallas
Land Use Mix	Mixed Residential Land Use	3	Increasing trend since 1940s with around 26% surveyed houses having mixed residential land uses
	Walkability to City Centre	3	The main city core is around 5 to 15 minutes walking distance from various mohallas
	Walkability to Social Services	2	Common facilities and services shared among 2 or more neighbourhoods thereby increasing accessibility of the local community
	Mixed Land Use	3	In most of the case, ground floor is used for commercial purposes and top floors are used for storage or godown and residential purposes (Figure 8(d))
Diversity	Building typology	3	Most of the houses are still inhabited by owners. However, a rising trend of rental housing is observed. Housing transformation is also on rise
	Socio-cultural mix	3	Around 45% of the total sample is found to be of General Category, 27% belong to Scheduled Caste (SC) category and 21% belong to Other Backward Class (OBC) and rest is Scheduled Tribes (ST).
	Local Creative Economy	3	There are numerous intangible heritage and crafts for which Alwar is famous among tourists. Around 21% people were found to be engaged directly in traditional and cottage industries (figure 8(f))
	Income groups	2	There was a time when all classes of people used to stay together in old city area. However, now most of the affluent class has moved out leaving behind poor and socially backward people in the old city area
Passive Solar Design	Orientation and Siting	3	Houses have been oriented and sited to avoid direct sunrays in habitable rooms and facilitating mutual shading on streets
	Building Layout	3	Multifunctional courtyard type planning is quite common with rooms surrounding it. Family uses this space for several purposes such as sleeping, grinding spices, making pickles and making pottery or other craft based industries (Figure 8(g))

Table 4: cont'd

Smart Urban Elements	Indicators	Walled City of Alwar, Rajasthan, India	Characteristic Features
	Façade and Fenestration	3	Jalis (Screens) and Jharokhas (Balconies) are used as architectural elements to ensure cool breeze within the interiors and also to avoid heavy dust storms (figure 8(h))
	Building techniques and materials	3	Stone masonry and lime mortar is commonly used with intricate carvings and thick walls with more time lag is common.
Green Urbanism	Accessible Open spaces	3	Chowks or squares with wells or tanks or trees as sitting places in local mohallas (Figure 8(a))
	Impervious Surfaces	3	Less in number except forming arterial roads. There have been no major drainage issues in old settlements. Rain water used to get collected in wells and step wells for use in summers
	Common Public spaces for informal discussion	3	Chowks were used as places for local gathering, celebrations, rituals and high level engagement and dialogues among its local public (Figure 8(c))
	Computed Score	64	
	Total Score	66	

6. Conclusions

The case analysis was carried out for the typical Arab settlements and old walled city of Alwar in the Indian subcontinent, which is subjected to tremendous pressures of urban expansion. Both the cities-- traditional city of Riyadh and walled city of Alwar—were based on smart urban planning principles. These principles evolved because of social, economic, geographical, and religious paradigms of native communities over a span of time. The archetypes represent various urban elements that are smart and inclusive in nature and are on par with the modern and contemporary city planning approach. Both the cities had a characteristic compact development with low rise and highly dense cluster of neighbourhoods. These old neighbourhood or mohallas were flexible to accommodate the future needs of its community. The basic circulation and transportation planning was sustainable with efficient walkability and accessibility of community to the local city centre and public services. The design and layout of buildings and dwelling units was based on vernacular design techniques well adapted to the harsh hot and dry climate of the region. Also, in Islamic settlements, the houses were introvert in nature in order to maintain a high level of privacy and safety for its inhabitants. The crime rates were almost negligible because of the minimal intrusion of the public into the private life of people. These old settlements also maintained an optimal mix of open spaces in the form of squares and courtyards as well as street corridors for children to play safely and adults to have important discussions and conversations.

The old and historic neighbourhoods of Alwar city exhibits a compact development and social cohesion among its local community. Importance was given to pedestrians and local climatic conditions, which enhances not only the walkability but also the energy efficiency in these old settlements. Chowks or junctions were crucial meeting places for community discussion and participation. Old wells and tanks employ natural water management techniques. Also, a natural drainage pattern has been observed in the walled city as per the natural contours, and the old neighbourhoods seldom face issues of water logging.



a) Chowks or Squares in Mohallas



b) Jagannath Temple Complex



c) Common open spaces in mohallas



d) Mixed Land Use



e) Traditional Handicrafts



f) Potters and Clay work



g) Unique housing styles



h) Balconies and Screens

Figure 8: Characteristic Features in old settlements of Alwar walled city

Overall, these traditional settlements show a holistic planning ideology, which is intuitive and wholesome. Their spiritual values and social belief system have guided them to a more sustainable and inclusive society. Environmentally, they used sound building techniques with sensitivity towards the local climate and natural resources. Socially, these settlements maintained a diverse mix of people with least conflict among its communities. Public participation was of highest order where local decisions were based on consensus of its people. Further, these communities have high potential to harness their local creative economy and intangible heritage. These settlements, which are often termed obsolete and backward, are found to be more sensitive with creative features leading to cultural continuity. As seen in most of the cases, modern planning stereotypes that have been imposed on these areas without considering their socioeconomic and cultural context have resulted in the destruction of a sustainable community rather than advancing their inherent local smartness. Their urban elements had an implicit smart quality, enhancing the inclusiveness and sustainability of the communities. Now the question is how to make way for their smart planning with new urban technology and ICT solutions. It is important that the urban practitioners and decision makers don't forget the roots of existing old cities to develop a plan which won't be even people friendly.

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