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Gulf futuristic cities beyond the headlines: Understanding the planned cities megatrend

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Abstract

Cities of the Gulf Cooperation Council (GCC) region have harboured impressive architecture conveying modernity and affluence. GCC countries are increasingly reshaping the face of their urban areas through the development of futuristic planned cities. These cities are competing for labels that show design innovations and energy-efficient technologies. This paper goes behind the headlines and self-labelling, and compares the region's major planned cities in terms of the nature of the urban development models. It proposes a techno-social framework to characterize the cities based on the criteria of access and innovation. The assessment shows that most developments resemble infrastructure upgrade via digital and smart cities. While ecological innovations are incorporated in urban design, they are limited to few livable cities. Most representative cities for sustainability are either small theme cities or yet to be completed. Economization and mega-events are largely fuelling urban development, with open outcomes on the success to attract long-term residents, and the level of contribution to the region's low-carbon future.

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1. Introduction

Countries of the Gulf Cooperation Council (GCC) (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and Kuwait) have become renowned for adopting flagship technologies and experimenting with futuristic architecture. Cities in the region have been pursuing spectacle and modernity, e.g. the city of Dubai [1]. Many cities have harbored megaprojects in order to attract (local) investors, tourists, or events offering global exposure. The World Cup 2022 in Qatar and the 2021 Dubai Expo are some examples. Often, the new megaprojects include new planned cities that incorporate most advanced design and technologies. They are manifestations of a competition among

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global cities to show off stereotypes of modernization and sustainability [2]. These planned cities are promising to transform major cities in the region, and are often mentioned as a part of ongoing transformation of the region towards a low-carbon future through reshaping the built environment, e.g. using energy efficiency and sustainable design [3]. In fact, sustainability considerations have recently become more important for GCC countries as they are becoming more engaged with the sustainable development agenda [4]. Still, the sustainability interventions are far from being enough to curb the large ecological footprints of the countries. GCC countries exhibit some of the world's largest per capita footprints in terms of carbon emissions, calories consumption, waste or water consumption, while their supply sectors face increasing risks due to dependence on imports or large-scale plants [5]. At the same time, the sustainability agenda in the region is embedded within an economic vision of diversifying and saving revenues [6]. The extravagant megaprojects and architecture have also been criticized for being over-dimensioned for their purposes [7].

GCC countries have abundant energy reserves in terms of fossil fuels — 40% of global oil reserves, and 20% of gas reserves [8]. This energy abundance has caused a high level of energy consumption fuelled by significant energy subsidies which GCC states have recently began to reduce, e.g. from 9.5% energy subsidy share of GDP in Saudi Arabia in 2014 to 4.6% in 2016 [8]. Interventions in the built environment such as the construction of new cities with higher standards of energy efficiency can be seen as a way to reduce the large energy footprint [3]. Alongside new planned cities, there are new interventions in terms of infrastructure updates, smart city projects or modern transport in major cities (i.e. quite large cities such as Dubai, Qatar or Riyadh). Often, these new developments in terms of new cities or modernization efforts of existing cities result in headlines promising futuristic and sustainable cities.

However, the nature and characterization of the urban development in the Gulf are not adequately studied. At the same time, it is difficult to compare citywide developments due to the lack of data since mostly national-level data are available. Even these national-level data have so far indicated that economic growth is not decoupled from environmental impact which remains high mainly due to the excessive use of fossil fuels and the large carbon footprint constituting 67% of the total environmental footprint in the GCC region [9]. In contrast, planned cities offer a prime opportunity for analyzing the directions of master planning and urban development in the region. They constitute a widespread phenomenon (megatrend) in urban development in the region and are associated with many promises such as sustainability and modernity. Using an original techno-social framework based on deployed technologies and the city's scale or access, the paper classifies the planned cities by differentiating and clearly conceptualizing city labels with a special focus on the contribution to sustainability, i.e. a low-carbon, low-energy, low-metabolism and accessible urban living. This conceptual review of planned cities in the Gulf region also critically reflects on the urban development aspects in terms of the urban planning choices and societal context. In this sense, the paper contributes to advancing knowledge on city labels and marketing as well as the nature and limits of urban modernization in the special context of Gulf region.

2. Methods: a techno-social city classification framework

Labelling (GCC) cities in terms of the nature of incorporated innovations is quite common in the literature, with recent labels such as smart or green as quite popular. Some scholars adopted a general linear differentiation category for GCC cities based on the manifestation of the idea of informational cities [10]. Other studies scrutinized the cities' self-prescribed labels [11]. The approach of this paper is to differentiate these labels on two-dimensional criteria in order to come up with a sustainability hierarchy that is helpful with evaluating city development in the region. Fig. 1 describes the city labels and the two broad criteria used. On the access criteria, having access to residency and facilities of the (sustainable) planned cities is important for scaling up benefits. On the innovation criteria, the assumption is that innovations are driving more efficiency, and thus sustainability, with the wide use of ecological innovations resulting in sustainable living. The labels provide a hierarchy, but do not indicate prerequisites. This means for example that it is conceivable to have a carbon-neutral or sustainable city without digital and smart applications, although this is arguably difficult.

Fig. 2 summarizes the city classification matrix and differentiates the cities further using three broad categories. Infrastructure upgrade using IT, smart applications and energy efficiency are considered as a part of common/accessible technologies today, especially if applied to small-sized urban developments. Here, we characterize the respective cities as contemporary or modern cities. If transformative ecological innovations are applied on a larger scale in terms of the amount of innovations or the amount of beneficiaries, this is called

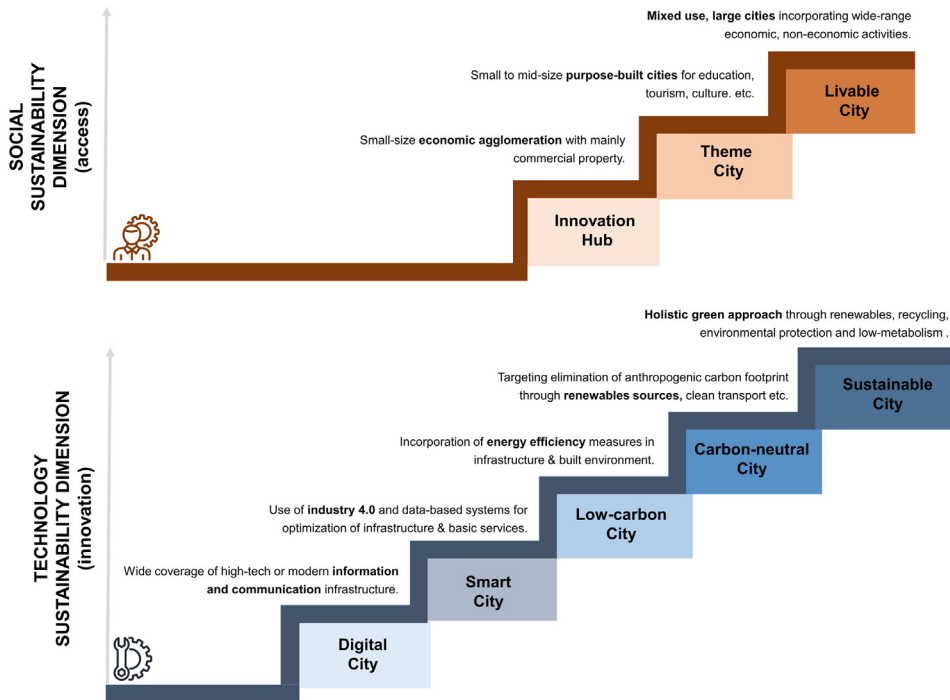


Fig. 1. A techno-social classification system of cities.

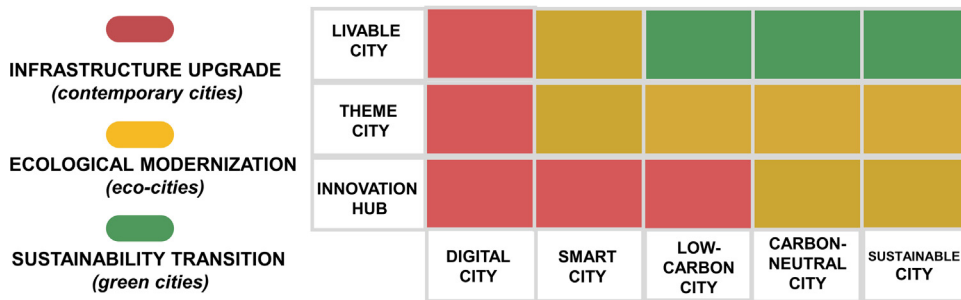


Fig. 2. Broad sustainability differences in the city classification matrix.

ecological modernization, a theory strain that firmly relies on ecological dissemination [3]. We characterize the cities in this category as eco-cities. Finally, green cities are those where large-sized and accessible cities have adopted a wide range of innovations that can effectively reduce or eliminate the carbon footprint or/and tackle sustainability holistically. For example, such cities adopt clean transport including electrical vehicles, renewables for electricity production, energy-efficiency standards for buildings, waste recycling and sustainable life-styles (e.g. small consumption and waste footprints). This city understanding is similar to the urban transformation towards sustainability mentioned in Krass et al. [12]. Such a transformation includes meeting sustainability demands on infrastructure, urban quality of life and environmental protection, e.g. in pioneer cities in sustainable urban planning such as Copenhagen [12].

3. Behind the trend: Gulf planned cities on a relational matrix

The major planned cities in the GCC region are mapped in Table 1. Cities are chosen that incorporate at least some aspects in the categories described earlier. Although the staggering costs are not final as some cities are in the initial phase, planned cities seem to constitute a remarkable trend in the region. However, only few cities exhibit a

Table 1. Key data and evaluation of large planned cities in the Gulf Cooperation Council region.

	Size (square kilometre)	Cost (billion USD)	Access rating	Access justification	Innovation rating	Innovation justification
Neom, SA ^a	26500	500	Livable city	Cross-border city covering a wide region with access to economic and non-economic activities	Low-carbon to carbon neutral city	Designed as a 100%-renewables city; proposition of several sustainability technologies
Lusail City, Qatar	38	45	Livable city	Large-scale city with economic and non-economic activities; hosting the opening of the 2022 World Cup	Smart city to low-carbon city	Mostly based on smart city applications; local energy certification systems; some use of renewables
South Al-Mutlaa City, Kuwait ^a	102	20	Livable city	In planning, large city combining all economic & non-economic activities	Digital city to smart city	Use of modern technologies including smart infrastructure systems
Education City, Qatar	14	15	Theme city	Purpose-built for fostering education through hosting (foreign) universities and technology/research innovation hubs	Low-carbon to carbon-neutral city	LEED energy certifications; renewables deployment; green campus initiatives
Masdar City, UAE	1-2.3 (planned); 0.3 (developed)	18–22	Theme city	Mainly hosting commercial, manufacturing and education facilities related to sustainability and energy	Low-carbon to carbon-neutral city	Original design as carbon neutral city; currently using renewables and energy certification for buildings
Musheireb City, Qatar	0.31	5.5	Theme to livable city	Cultural district rebuilt from old Doha down-town; museums concentration; mixed use districts	Low-carbon to carbon-neutral city	Energy building certifications (LEED); sustainable transport; use of renewables; recycling systems
Madinat Al Irfan, Oman ^a	0.25 (phase one); up to 4.9 total	13 over 20 years	Theme to livable city	Depending on final shape, currently designed as cultural center; mixed use districts	Low-carbon to carbon neutral city	Energy building certifications; light transport; low-carbon interventions; solar energy
King Abdullah Economic City, SA ^a	168	35				
Prince Abdulaziz bin Mousaed Economic City, SA ^a	18 (originally 156)	8				
Jeddah Economic City ^a	5.2	20	Livable cities	Large cities planned as with economic and noneconomic uses; a part of the master plan to construct cities for economic diversification	Digital cities to smart cities	Little announced; orientation towards modern infrastructure; no clear orientation towards sustainability technologies, renewables, etc.

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substantial transformation of being livable (i.e. widely accessible) and ecologically highly innovative (Table 1 and Fig. 3).

Table 1 (continued).

	Size (square kilometre)	Cost (billion USD)	Access rating	Access justification	Innovation rating	Innovation justification
Medina Knowledge Economic City, SA ^a	4.8	7				
Jazan Economic City, SA ^a	100	27				
Al-Qiddiya, SA ^a	334 (by 2030)	NA	Theme to livable city	Designed to be a tourism hub and an entertainment city to become a major national and international attraction	Digital city	Although not yet finished, no clear indications regarding sustainability or smart city measures

^aCity development, infrastructure or actual achievements/merits can still change since largely in initial phase.

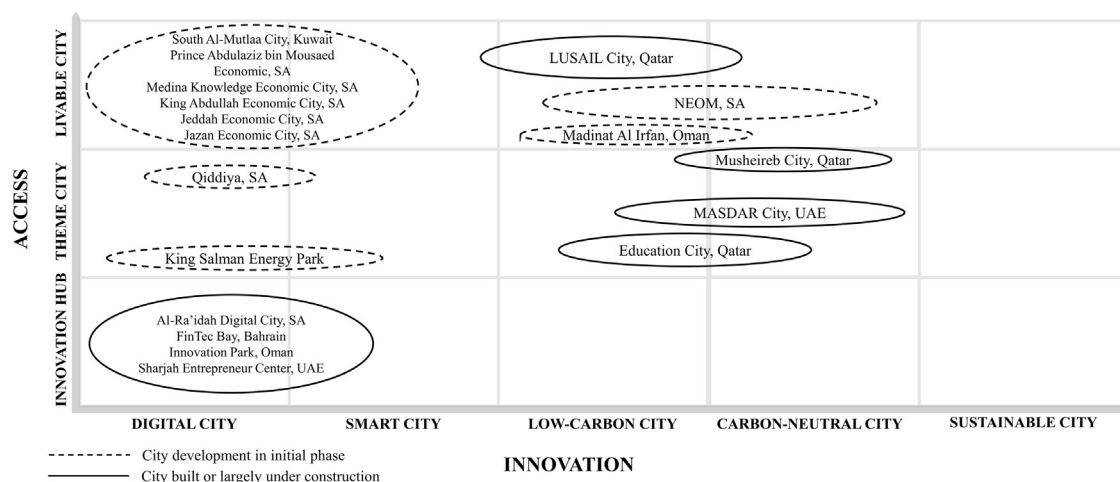


Fig. 3. Classification of major planned cities in the Gulf Cooperation Council region.

Fig. 3 shows the analyzed cities on a relational matrix. This includes cities in Table 1 plus other smaller cities. According to our city classification system, the overwhelming majority of development can be characterized as rather representing an infrastructure upgrade yielding in cities with modern and contemporary infrastructure. However, most of the economic cities (mostly in Saudi Arabia) are not fully revealed, and the final shape can exhibit some elements of ecological modernization. The eco-cities (Musheireb, Masdar and Education City) are maybe the most publicized one in the academic literature or the media. They however resemble theme cities with limited accessibility. Finally, only three cities are potential candidates for being green cities. Here, it is early to evaluate whether this label can hold over time as only LUSAIL City is taking final shape (to be ready by the 2022 World Cup in Qatar).

4. Discussion: city development models and underlying trends

4.1. City development, lifestyles choices and socio-economic stratification

Despite GCC countries setting aggressive developmental targets, there are still inconsistencies in the future plans. These plans seek sustainability while neglecting the aspects of lavish lifestyles, high-consumption, cultural heritage or affordability. Rapid development has created new lifestyles and habits such as modernity imperatives

and consumerism. At the same time, a considerable proportion of these societies still value local traditions and culture. A major segment of the local population in GCC countries prefers living in spacious accommodations and in suburban or isolated areas that are difficult to be integrated as a component in a futuristic low-carbon development. These cultural and structural barriers can be mitigated by considering hybrid eastern–western designs and cultural considerations. Furthermore, sustainable consumption and production are important elements of sustainable living, e.g. the incorporation more design for the environment (DfE) concepts through more environmental components in products in services [13]. In addition, the new generation of planned cities are mainly established as business hubs for investors or modern agglomerations to attract tourists or wealthy residents (e.g. the Palm Islands in the Emirates, the Pearl Island in Doha or Neom City in Saudi Arabia). Such properties might not be affordable for most expatriate residents (non-nationals) as a major social stratum in some GCC countries. The non-nationals constitute around 50% of the population and more than 80% in countries such as Qatar and UAE. While it is reasonable to assume that a large proportion of non-nationals is not expected to be long-term residents, it might take a while until nationals become the majority of residents. Until then, and considering the lifestyle preferences of nationals, occupancy rates of these new planned cities might depend on attracting affluent expats and willing investors. In fact, these socioeconomic dimensions of urban lifestyle choices, affordability and long-term prospects need to be given more consideration in academic research in light of the increasing development of the planned cities across the region.

Furthermore, culture-based sustainable development in the region has led to segmentation and differentiation in local and foreign cultures. This is reflected in the rise of consumerism but also the advancements on heritage and creativity in the form of museums, urban revitalization projects, and heritage sites [14]. However, such activities do not seem to suffice for the region to become a regional or global cultural hub. Several remarkable master plans in the region such as cosmopolitan cultural sites and mega cultural events show the necessity of large-scale promotion and planning to achieve cultural sustainable development goals [6]. Besides, regional cultural development plans have not addressed the value or the design of high-rise buildings in urban planning. Construction firms can attain more economic benefits by creating a balance between the surrounding communities and modern architecture in order to promote more social integration and harmony. In fact, some of the highlighted planned city projects have recognized this since they heavily integrate cultural and traditional design elements. This is especially true for theme cities such as Musheireb, Qatar Foundation, Madinat Al Irfan or Masdar City. In fact, in pursuing the Sustainable Development Goal (SDG) 11 (Sustainable Cities and Communities), GCC states are using projects that are formed with a trophy and spectacular architecture mind-set, which are oriented more towards the Dubai model [14]. Dubai has been a symbol of entrepreneurialism using technologies to convey power and modernity [2].

4.2. Contextual trends: economization, mega-events & green labelling

Sustainable development has been adopted by GCC states as a final objective, but the sustainability agenda has been largely embedded within economic diversification plans. These plans are the core of the National Visions, which represent the overarching strategies for the development, and sustainability engagement of GCC states. This is true for the countries' futuristic city planning which can be regarded as a part of economic diversification in GCC countries [3,6]. Economic diversification has become critical after the decrease of state revenues in the wake of the 2008 economic crisis and the 2014 crash of oil prices. Since then, planned cities are reoriented towards economization. This is evident in the economic cities vision in Saudi Arabia or older projects such as Masdar City in Abu Dhabi. Originally, Masdar City was designed as a truly sustainable, zero-carbon city. In fact, the city has moved towards a commercial model as a hub for clean technology companies in order to generate new revenue streams, although the city retained some elements of sustainable urban design [15]. In addition, mega-events are reshaping urban development in GCC countries. By incorporating low-carbon technologies as well as responsive and reliable infrastructures, these events can stimulate sustainable development and reduce the large carbon footprint of the built infrastructure. On the macroscale, events such as the FIFA World Cup 2022 in Qatar can also make the urban development plans in GCC countries more economically justifiable, e.g. attracting tourism, investors or international events (e.g. future sport events). In this context, the 2020 COVID-19 crisis might affect the speed of the realization of some megaprojects or planned cities, although the exact impacts are yet to materialize. On the microscale, spectacular design and green labelling are seen by GCC states as a way to convey modernity and prestige in the global competition among cities [7]. Green labels have also increased through the establishment of

local energy certification systems for buildings, e.g. the Estidama certification in the UAE or the GSAS Certification in Qatar. This is a positive trend as many of the new cities in the region are utilizing these labels, e.g. LUSAIL city in Qatar using the GSAS (Global Sustainability Assessment System) of Qatar. As we explained earlier, improving energy efficiency is an important intervention, although it should be considered as one element in a comprehensive approach towards a genuinely sustainable and widely accessible urban development, i.e. incorporating sustainable life-styles, clean transport, waste management or design for the environment ideas.

5. Conclusion

The GCC region has become renowned for flagship, modern architecture and as an experimentation arena for spectacular urban planning through planned cities. While the development of planned cities have accelerated recently due to mega-events, economic diversification policies and population growth, they are yet to be evaluated with regard to their sustainability labels and merits. It is important to move beyond the headlines and characterize city labels in a relational context and based on clear criteria. The proposed criteria by this paper are with regard to the scale of the development, i.e. the access to the proposed benefits of modern and innovative urban planning, as well as the spectrum of innovations utilized. Although they have some sustainability benefits, digital or smart city labels are merely indicative of infrastructure upgrade or modernization, particularly if applied in a limited fashion. This is true for most of the analyzed new planned cities in the region, which share the characteristics of being small to midsize, modern infrastructure based developments oriented towards businesses and economic activities. Ecological modernization towards low-carbon, carbon-neutral or genuinely sustainable cities is still limited to prestigious theme cities for education, cultural tourism or technology businesses. Some few cities can be representative of a wide sustainability transition, although the final shape of these cities is not yet clear. The sustainability merits of urban development via planned cities need to be contextualized considering the economic, demographic and cultural context of the region. The idea behind these cities is that they will be attractive for local residents and affluent expats or investors. The economization of the cities depends on the realization of these benefits and the outcomes of mega-events that can attract tourists and visitors. With the increase of spectacular, planned city architecture in the region, the final economic and urban development model might be an interesting mix between modernity, westernization and heritage. However, such a model is yet to be realized while the city labels need to be re-evaluated considering the contribution of the planned cities to a low-carbon future in the region.

CRedit authorship contribution statement

Mohammad Al-Saidi: Conceptualization, Investigation, Formal analysis, Validation, Writing - original draft, Writing - review & editing. **Esmat Zaidan:** Investigation, Formal analysis, Validation, Writing - original draft, Project administration Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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