Article

Futures Impacts of The Kingdom of Saudi Arabia (KSA) Transforming its Cities to Carbon Negative Arcologies.

Phillip Daffara

Principal of FutureSense + PlaceSense, Mooloolaba, Queensland, Australia.

Abstract

This article explores the multi-dimensional impacts of the transition of KSA cities into Arcologies and illustrates the regional benefits to influence the current discourse about future habitation and cities. The future scenario to be examined is the KSA's sustainable urban transition to resilient and regenerative Arcologies - an alternative, transformative form of habitation. The research findings and urban policy recommendations, if widely adopted in the KSA, would accelerate the achievement of select KSA Vision 2030 Goals and Vision Realisation Programs with significant beneficial impacts on society and urban quality of life; as well as demonstrate prototype Arcologies to the World.

Keywords

Arcology, Saudi Arabia Cities, City Futures, Regenerative Urban Development, Urban governance and policy

Introduction

Relevance and significance of the research

Research conducted within Western countries and cities since the second half of the 20th century has proven the negative impacts of urban sprawl upon ecological, sociocultural and economic systems. Research from the last two decades shows the negative impacts of urban sprawl within the KSA's cities and settlements. The KSA's current urban population is 83.8% of the total, with an annual percentage increase of approximately 2.3% over the past five recorded years (2015-2019). Cities within the KSA will continue to experience the negative impacts of urban sprawl (i.e., low-rise, low density, spatially segregated urban growth).

Rather than continue to quantify the negative impacts of urban sprawl in the KSA, this research aims to identify the multidimensional impacts of transitioning the KSA's urban habitats into *arcologies*. *Arcologies* provide an alternative, transformative vision of urban development based on clearly articulated design principles, but no research currently exists to assess the systemic impacts to the KSA's natural environment, society, or economy.

The definition of urban sprawl, taken from the UN-Habitat "The Urban Agenda", is the rapid expansion of the geographic extent of urban settlements, characterised by low density housing. Further characteristics are provided when discussing the litany of urban sprawl.

Literature review – need for a new study

The literature review conducted for this research revealed a stark knowledge gap about the exploration of *Arcologies* as an alternative vision for cities in KSA. Indeed, no studies were found related to, or like, the research described in this article.

This literature review is in two parts and summarises: (1) the main impacts of urban sprawl and rapid urbanisation in KSA; and (2) the urban vision and qualities of *Arcologies*.

Main impacts of urban sprawl and rapid urbanisation in KSA

In this first part the focus is on the generic, global adverse effect of urban sprawl on carbon dioxide emissions. It is clear that "[t]he adverse effect of population growth and urban sprawl burdens ecosystem services and natural resources—leading to the ecological deficit and increases the population's exposure to climate change variability." (Sarkodie, Owusuandi, and Leirvik, 2020).

KSA's cities and rapid urban development since the 1970s has contributed to this global effect. KSA's 2016 Per Capita greenhouse gas (GHG) emissions, comprising CO_2, methane and nitrous oxide, are the seventh highest in the World (Ritchie and Roser, 2020). From 2016 data, KSA was the highest per capita emitter amongst the G20 economies (Figure 1), excluding the aggregated greenhouse gas emissions of the European Union.
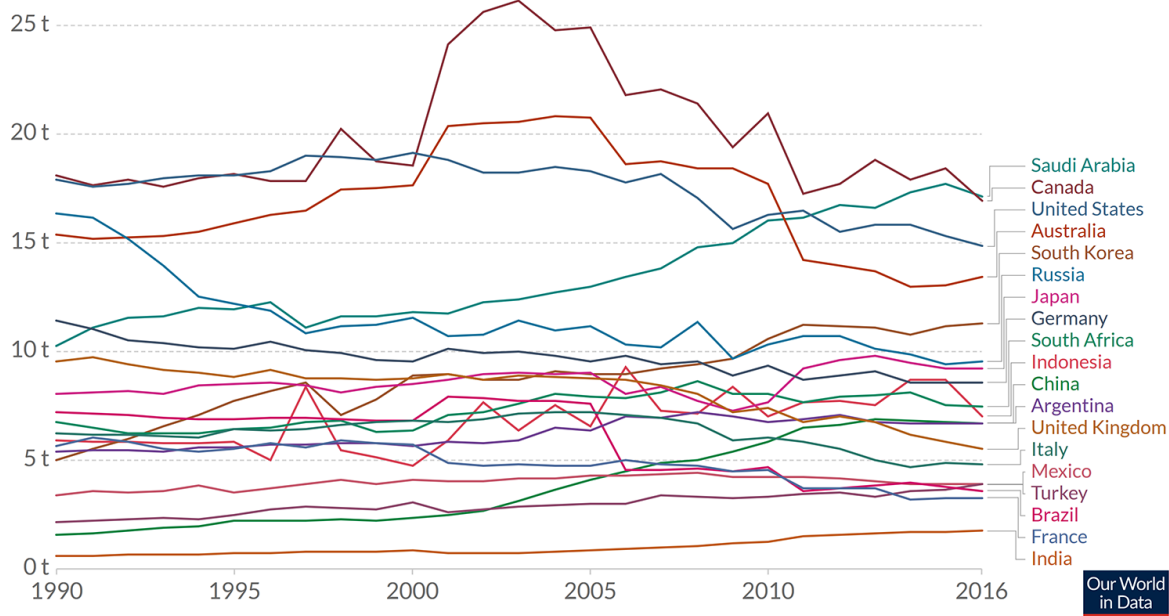

Fig 1. G20 Per Capita GHG Emissions (Our World Data, 2016)

Note: Greenhouse gas emissions—from carbon dioxide, methane, nitrous oxide and F-gases— are summed up and measured in tonnes of carbon-dioxide equivalents (CO_2e), where "equivalent" means "having the same warming effect as CO_2 over a period of 100 years". Emissions from land use change—which can be positive or negative—are taken into account. Source: CAIT Climate Data Explorer via. Climate Watch OurWorldInData.org/co2-and-other-greenhouse-gas-emissions

The links between urban sprawl and carbon emissions continue to be investigated. Many authors claim that urban sprawl, compromising less-dense, car-orientated suburban lifestyles, is approximately two times more energy-or GHG-intensive than inner-city living (Brown et al., 2004; Hoornweg et al., 2001; VandeWeghe & Kennedy, 2007; Ewing & Rong, 2008; Norman et al., 2006). The determinants of urban production/construction, building energy consumption and fossil fuel-based transport contribute to emissions. For example, regarding urban production and construction:

Direct emissions and indirect emissions from the building sector in Saudi Arabia account for 0.95% and 16.60% of total energy-related CO_2 emissions, respectively. Per capita emissions from the building sector are almost double the G20 average. Saudi Arabia's policies are not sufficient for a 1.5°C pathway. (KSA Climate Transparency Report 2021)

Compared to 2018 data, KSA's population is projected to increase 32% by 2050 and become more urbanised, with 90.4% of the population living in cities (United Nations, 2019; United Nations, 2018; UN DESA, 2019 in Climate Transparency Report 2021). Therefore, without urban adaptation and mitigation policies to decarbonise the built environment, population growth and urbanisation will continue to impact natural resources and climate.

Further, the context-specific impacts of rapid urbanisation in KSA have been researched and several issues continue to emerge in these studies, including expanding urban sprawl (Aina et al., 2008; Mubarak, 2004); high energy consumption (Lahn and Stevens, 2001); unaffordable housing (Struyk, 2005); shortage of infrastructure and basic services due to the cost burden of poor sequencing or 'leap-frog' style development (Al-Hathloul & Mughal, 2004; Garba, 2004; Al-Shihri, 2016); and traffic congestion and environmental problems (Abou-Korin, 2011; Alhowaish, 2015; Alshuwaikhat and Aina, 2006; Bahaydar, 2013).

In addition to GHG emissions, five other major environmental problems of KSA's rapid urbanisation have been identified by previous studies:

a) unfettered urban sprawl into KSA's watersheds that has increased the risk of flood hazards and the vulnerability of urban communities in Jeddah City (Bahaydar, 2013; Azzam and Belhaj Ali, 2019); and Makkah City (Al-Ghamdi, K., et al. 2012);

b) the increased "Urban Heat Island Effect" of expanding cities such as Riyadh (Aina, et al., 2017);

c) increasing air pollution ($PM_{2.5}$ carbonaceous aerosol and particulates within cities such as Riyadh (Aina, Van der Merwe, and Alshuwaikhat, 2014; Bian et al., 2018);

d) the loss of marine biodiversity due to coastal land reclamation (Al-Shihri, 2016); and

e) the loss of agricultural land surrounding cities (Al-Hathloul and Mughal, 2004).

Research shows a poor social mix in gated, large scale, low density urban sprawl in KSA, producing social polarisation (Al-Shihri, 2016) within the city. This contributes to unaffordable and poor housing choice, digital divides and urban apartheid, as a result of capitalist modes of globalised urban development and the *informational, networked society* (Castells, 1989, 1999 and 2002, p.349, cited Blakely and Synder, 1997; Graham and Marvin, 2001; Sassen, [1994] 2000).

More broadly, social urban studies have established the causal relationship between the detrimental impact of suburban sprawl (space-waste) on the declining social capital of a suburban community, due to spatial segregation and the time-waste of daily commutes (Putnam, 2000, Leyden, 2003).

The urban vision and qualities of Arcologies

In this second part of the literature review, the focus is on the concept and urban vision of the *Arcology*. The original term *Arcology* calls for an integrated design synthesis of the architecture of a city with its surrounding ecology (Soleri, 1969). Soleri argued that urban sprawl threatened social progression and was counter-evolutionary to the process of human civilisation.

The main characteristic of the vision of *Arcology* relies on the convergence of two phenomena, namely complexity (ecological and social) and the miniaturisation (reduction) of urban sprawl, which enables radical conservation of land, energy and resources (Soleri, 2005). "Arcology recognizes the necessity of the radical reorganization of the sprawling urban landscape into dense, integrated, three-dimensional cities in order to support the diversified activities that sustain human culture and environmental balance." (Consanti Foundation, 2020).

The key design principles of *Arcology*, laid out by Soleri (Consanti Foundation, 2020) are:

• urban scale as human scale (walkable, pedestrian environment, car-free);

• food and & energy nexus (urban agriculture);

• marginalise consumption (embodied efficiency where *arcology* strives for reduction of material and energy consumption and an increased quality of life);

- urban effect (proximity and vibrancy of activities and mixed-use spaces);
- bounded density (ecological envelope to provide robust qualities of life); and
- elegant frugality (creative resourcefulness – "do more with less").

As a result, *Arcology* inherently demands a transformation from sustainable urban development to regenerative urban development. The UN-Habitat's Urban Agenda and definition of sustainable urban development is used here in context with the Sustainable Development Goal (SDG) no.11: "make cities and human settlements inclusive, safe, resilient and sustainable" and the associated SDG 2030 targets (https://sdgs.un.org/goals/goal11). Regenerative development as defined by Bill Reed (2007), aims to design human systems that co-evolve with ecological systems to generate mutual benefits and greater expression of life and resilience; and is discussed further in the FW analysis.

As cities are socio-ecological systems (Moffat and Kohler, 2008), a political paradigm shift is also required towards a governance framework focussed on the urban resilience of socio-ecological systems. *Arcology* remains however, an urban vision at the margins of the urban planning discourse, as no *Arcology* has yet been completed.

Briefly, whilst pre-industrial Arabic urban morphologies exist—the Islamic medina—based on social organisation and a spatial structure of hierarchical degrees of privacy (Dostal, 1984; Kennedy, 1985; Stefano, 2001), there is insufficient evidence that these car-free, walkable urban antecedents inspired Soleri's vision of *Arcology*. They may, however, inspire future Arabic *Arcologies*.

Methodology and Conceptual Framework

The methodology was designed to achieve the following research objectives:

a) Identify the systemic impacts of the transformation of KSA cities into *Arcologies.*
b) Identify potential threats and opportunities arising from the transition to *Arcologies*.
c) Propose urban policy/governance recommendations.

The research methodology applied several strategic foresight tools, mainly Causal Layered Analysis (CLA) (Inayatullah and Milojević, 2015); the Futures Wheel of Consequences (Futures Wheel, 2020); and Teilhard de Chardin's Macrohistory (Galtung & Inayatullah, 1997). The process (Figure 2) uses the multi-layered, discourse organising framework of CLA, to integrate both the Futures Wheel (FW) analysis, which focusses on anticipating short-term future impacts (Inayatullah, 2008, 8) with Macrohistory (MH), thus focussing on the timing of long futures to glean socio-cultural patterns (Inayatullah, 2008, 10). In this study, the city was chosen as a practical and effective spatial scale at which to integrate the methods and their systemic impacts. Two scenarios are generated, contrasting (1) KSA's probable continued urban growth with (2) the research proposition explored by the FW.
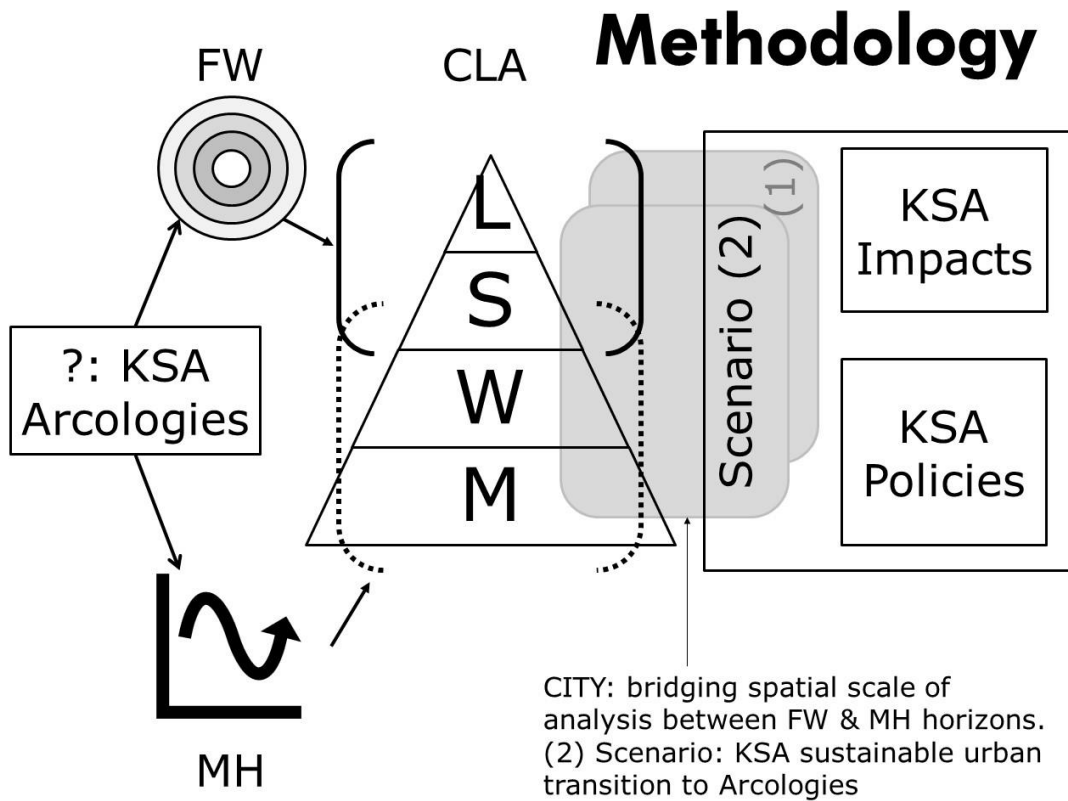
Fig 2. Research Methodology

CLA unpacked the multi-layered dimensions of reality of KSA cities in transition towards *Arcologies* at the Litany (L), Systemic Causes (S), Worldview/discourse (W) and Myth/metaphor (M) levels of reality. Firstly, the litanies of KSA urban sprawl and the *Arcology* vision are contrasted, drawing on the literature review.

Secondly, at the systems level of reality, the FW is applied to identify the systemic impacts of an *Arcology* transition within KSA.

Table 1 illustrates the multi-factorial thematic structure generated for the FW impact analysis, that nested the core dimensions of the *New Urban Agenda* (UN-Habitat, 2020) within the STEEP categories within the *Integral City Model* (Daffara, 2006). This comparison of factors resulted in the addition of a sixth systemic category "spatial sustainability" into the FW framework that elicited impacts on urban design, density and equity. The comparison of the *Integral City Model's* qualities with that of the *New Urban Agenda*, ensured that metaphysical aspects were considered in the CLA methodology and explored in the MH discussion.

Table 1. Futures Wheel Categories

INTEGRAL CITY MODEL (Daffara, 2006)	STEEP +	THE URBAN AGENDA (UN-HABITAT, 2020)
Psychosocial qualities of the city	SOCIAL	Empowerment of marginalized groups
		Gender equality
		Planning for migrants, ethnic minorities, and persons with disabilities
		Age-responsive planning
		Urban safety
		Culture & Identity
Material qualities of the city	TECHNOLOGY	Transport and mobility
		Energy
		Solid waste
		Water and sanitation
		Construction and building technology
Bio-ecological qualities of the city	ENVIRONMENT	Biodiversity and ecosystem conservation
		Resilience and adaptation to climate change
	Urban Farming**	Climate change mitigation
Psychosocial qualities of the city	ECONOMY	Job creation and livelihoods
		Productivity and competitiveness
		Municipal finance.
	POLITICAL	National urban policies.
		Urban legislation and regulations
		Urban governance
	SPATIAL SUSTAINABILITY	Equity
		Urban Density
		Urban Design
		Mapping and spatial data
Metaphysical qualities of the city	Not covered by the FW	Not covered by the Urban Agenda

Note: ** Subcategory added by Author as it was not covered in the Urban Agenda.

Figure 3 illustrates the FW framework used in the impact analysis. It was expected that this model would enable a comprehensive scenario to be developed of what KSA's urban transition toward *Arcologies* would look like.
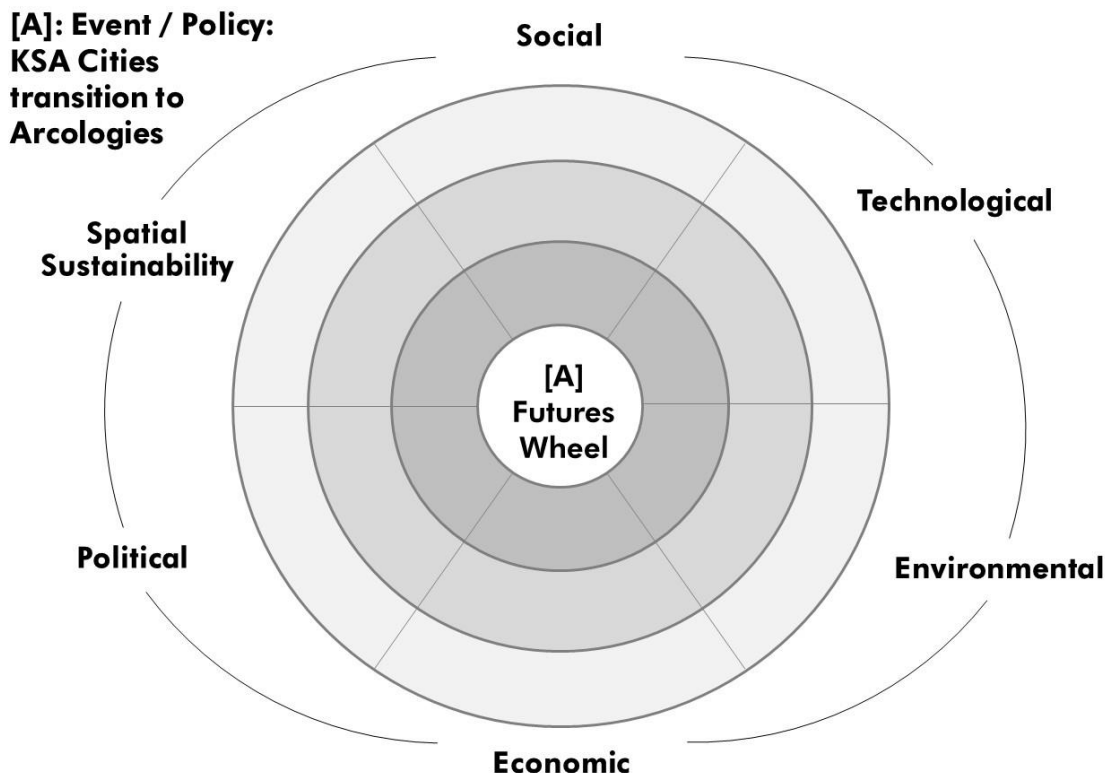

Fig 3. Framework for the FW impact analysis

Thirdly, the application of Macrohistory to KSA's urban transition towards *Arcologies* seeks to reveal the deeper worldviews and myth/metaphors that may hinder or inspire this regenerative urban transition.

Fourthly, this paper identifies the potential threats and opportunities for KSA's sustainable transition towards *Arcologies*, revealed by both the FW impact analysis and the macro-historical analysis.

Finally, based on the assumption that the implementation of the *Arcology* vision best describes KSA's preferred urban future, this paper proposes urban policy/governance recommendations to manage this urban transition.

This research method provides a low risk, low-cost process of prototyping an urban development scenario—in this case, KSA's complex urban system transitioning towards *Arcologies*—compared to building a real-world development prototype in a city.

Discussion Using CLA's Structure

Following are the FW and MH analyses using CLA's four levels of reality to generate and compare two KSA scenarios. The first urban scenario is based on the *Urban 20 Communique* to the G20 Leaders' Summit at Riyadh

(2020). The second scenario is based on the FW impact assessment of KSA cities' transition to *Arcologies*. Table 2 provides an overview of the CLA comparison of scenarios, before each layer of reality is discussed.

Table 2. CLA comparison of scenarios

Scenario	1: *Urban 20 Communique* to G20 Leaders' Summit, Riyadh (2020)	2: KSA transition to *Arcologies*
Litany	Continued spatial growth through smart urbanisation and sustainable development	Shift to regenerative urban development and reduction of urban sprawl
Systems Causes	Technology-led transition to circular, carbon-neutral econo-socio-ecological systems. Globalisation entrenches 'splintering urbanism'.	Integral (holistic) transition to eco-positive, carbon-negative econo-socio-ecological systems, where conditions for all life flourishes.
Worldview	Individualism and Ethnocentric worldview – National Policy priorities take precedence over global commitments to respond to global crises and the Urban Agenda.	Collectivism and Worldcentric worldview – Nations and Cities transform to safeguard our planet and respond to global crises.
Myth	Competitive cities and the Planet on life support. Humanity's species purpose is disassociated from our urban habitats.	Cooperative cities and a healthy Planet. Humanity's species purpose is grounded in our intentional *Arcologies*.
City Metaphor	Degraded, fragmented, body and nature (Soleri, 1969).	Whole organism: "neo-nature" (Ibid, 1969).

The litanies of urban sprawl vs Arcologies

Urban sprawl is characterised by:

- single use development whether residential, commercial, industrial, segregated from one another;
- low-density;
- out-of-sequence or leapfrog development; and
- conversion of agricultural land (Chin, 2002).

Urban sprawl can occur incrementally over generations, or in the case of KSA, rapidly, with multiple shocks to socio-ecological systems, as discussed in the literature review.

The *Urban 20 Communique* (2020) to the G20 Leaders at the Riyadh Summit, endorsed by 39 city leaders, did not mention the containment of urban sprawl in order to benefit the planet's biodiversity and natural ecosystems or conserve agricultural land. This seems to be an obvious policy oversight and suggests an acceptance of the dominant view of managing development sprawl to accommodate rapid growth and urbanisation. This approach is labelled as 'smart urbanisation/growth' by the city leaders at the G20 Riyadh Summit and exemplifies the litany of scenario 1.

UH Urban Agenda (2020) does recognise the challenges of rapid urbanisation in the form of sprawl, and continues the argument fostered by the advocates of "New Urbanism" and "Smart Growth": that inefficient sprawl is the result of inadequate land-use planning and management. The Urban Agenda includes a new dimension—"Spatial Sustainability"—to encourage the physical forms of cities through intentional planning and development, in order to improve urban social, economic and environmental well-being. Urban growth boundaries, polycentric form and urban regeneration are three strategies cited by Urban Habitat to shift from urban sprawl to "compact growth" (UH Urban Agenda, p.59).

The vision of *Arcology* is the antithesis of urban sprawl. *Arcology* is the complexification of the built environment

to provide hyper-compact growth and wholistic development of the material, bio-ecological, socio-cultural, and spiritual qualities of urban life. To build an *Arcology* is to deliver urban regeneration within a specific area on a mega-scale to rehouse communities, businesses, and cultural activities and to reduce the extent of obsolete urban sprawl (miniaturisation), converting it back to wilderness.

> The vision of *Arcology* critiques both the probable futures of a 'splintering urbanism' (Graham and Marvin, 2001), manifested by the informational, networked society's *Global City* image or the planetary megalopolis forecast by the vision of *Ecumenopolis*. It remains an alternative image of city futures on the margins. (Daffara, 2006: 195)

Systemic causes revealed by the FW analysis
At the systems level of reality, the CLA of the KSA transitioning toward *Arcologies* from scenario 1, reveals the necessary shift in urban policy. Whilst scenario 1 relies on a technology-led transition to circular, carbon-neutral econo-socio-ecological systems, scenario 2 relies on an integral or holistic transition to eco-positive, carbon-negative economies and econo-socio-ecological systems. In the FW analysis, KSA cities move beyond sustainable urban development, towards regenerative development (Reed, 2007). KSA cities as restorative systems in the form of *Arcologies*, would contribute to carbon drawdown and the reduction of GHG levels in the atmosphere.

Figure 4 (overleaf) illustrates the systemic consequences of KSA cities transitioning towards carbon-negative, regenerative *Arcologies*. There is insufficient space to describe every causal impact or chain of consequences within the complex system here.
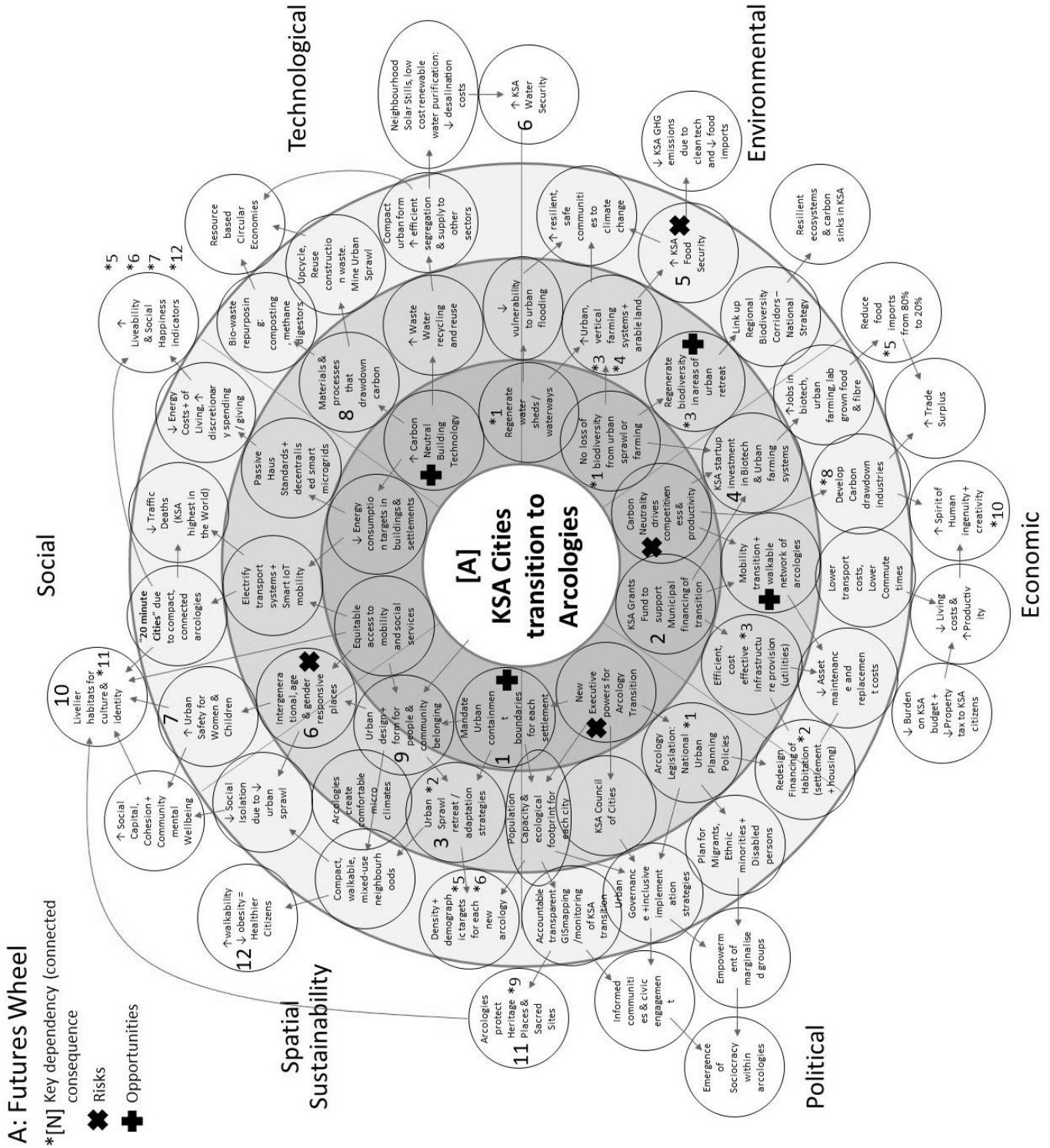
Figure 4. KSA transition to Arcologies FW of Consequences (Daffara, 2021)

Worldviews and myth/metaphor revealed by MH analysis

Paolo Soleri's formulation of Arcology ideology was greatly influenced by Jesuit paleontologist and philosopher Pierre Teilhard de Chardin's evolutionary macrohistory (*The Phenomenon of Man*, 1961) that sought a synthesis of matter and spirit. "Teilhard de Chardin's (1961) proposition that the evolutionary process of civilisation tends towards greater socialisation, complexification (synthesis) and centricity (convergence) is clearly expressed in Soleri's ([1969] 1977, 1985) urban proposals" (Daffara, 2006).

For this reason, Teilhard de Chardin's MH is used in this research to examine the worldview and myth/metaphor layers of reality operating within each scenario. In addition, Muslim Arab sociologist, philosopher and historian Ibn Khaldun (1332-1406), who wrote about the rise and fall of Islamic dynasties and cities, will be used to provide Arabic metaphors for urban transformations.

Teilhard de Chardin argued that evolution is converging towards the spirit; towards pure radial energy (love or the 'Omega point'). He recognised within his model the continual tension of the universe with its increasing entropy (disorder) and noted that at times the socialisation process (noogenesis) is counter-evolutionary. When this happens, society succumbs to entropy, individualism and depersonalisation, and falls away from the spiritual (Figure 5). On this basis, Soleri draws the conclusion that urban sprawl is a manifestation of counter-evolutionary social progress (Soleri, [1969] 1977, p.8, p.14), tending away from being the vital physical container for our species-purpose and the fulfilment of humanity.
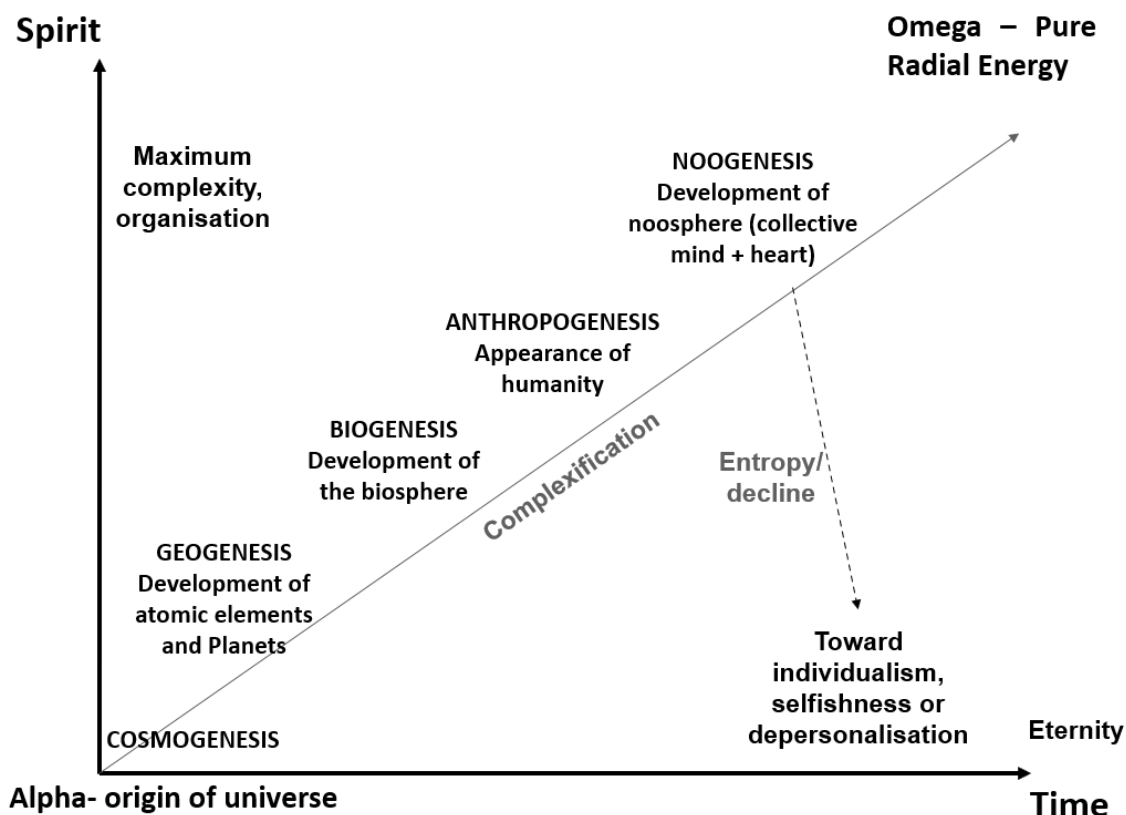

Figure 5. Teilhard de Chardin's Macrohistory (Galtung & Inayatullah, Eds., 1997, p.256)

From Teilhard de Chardin's macrohistory, another central idea that emerges for Soleri, is the evolution of the city through the process of complexification of urban form/design; maximising synthesis and biomimicry.

The concept of complexification—the idea that social organisations tend towards greater complexity in their

evolution—is not uncommon in biology, social theory, or world history (Christian, 2005). From Teilhard de Chardin's macrohistory, Soleri saw that if the city acts congruently with evolution, the city becomes more complex and organised, and will tend to synthesise and converge in space and energy. When the city reaches its point of maximum synthesis, it attains a new different level and organisation of its wholeness. In a practical sense it becomes more multi-layered, dense and compact. Urban sprawl is transformed or rewilded for more energy-efficient organisational forms. This process of spatial synthesis, done to bio-mimic nature's systems and regenerate surrounding regional ecosystems, has the potential to create identifiable, beautiful, inspirational places and fecund habitats for people and wildlife.

At the worldview level of reality, the duality of individualism vs collectivism reveals itself within the urban dynamic. Urban Sprawl prejudices the expression of individual needs and consumption (material growth is good), whilst *Arcology* prejudices the expression of human purpose and community needs (civilisational transformation). This is not a dichotomy, where prejudices and needs are mutually exclusive. Drawing on Ibn Khaldun's macrohistory (Galtung & Inayatullah, Eds., 1997), the rise of dynasties and cities corresponds with a rise in *asabiyyah*; social cohesion with a shared sense of purpose, group consciousness and unity. The fall of cities corresponds with a loss of *asabiyyah* with an increase in factionalism and individualism. Both macro-historians reveal a similar social dynamic at the worldview level.

At the myth/metaphor layer of reality, Soleri refers to *Arcology* as "neo-nature" (1977, p.26), a new form of human habitat in symbiotic relationship with the Planet's ecosystems that extends the potential of individuals and cultures (Ibid, p.12). Soleri envisioned a one-structure system with the functional and metaphorical wholeness of a biological organism.

In contrast, the myth/metaphor that encapsulates scenario 1 cities' current reality is 'degraded, fragmented nature'. Humanity continues to make cities as fragmented organisms: "islands, barriers and scattered limbs" (Soleri, 1977 p.13). As such, cities are predatory towards the Earth's resources, socio-cultural systems and people.

Here then, are the competing metaphors for planetary cities of the future: Cities as "fragmented, decaying body parts" vs Cities as "whole neo-natures". From Teilhard de Chardin's MH the dualism is expressed as "Fragmentation vs Unification". Strikingly, Ibn Khaldun described the same cyclic story during the Middle Ages, noting that it underpinned the rise and fall of Islamic cities. These metaphors are relevant for KSA's cities.

Scenario impacts - threats and opportunities

Table 3 lists some threats and opportunities arising from the FW of consequences and MH discourse. CLA's layers of reality are used to organise the threats. The opportunities are not always a direct corollary in response to the identified threat, but policy relationships are apparent.

Table 3: Threats and Opportunities to the KSA transition towards Arcologies

CLA Layer	Threats / risks	Opportunities
Litany of Urban Governance	New "whole of government" Executive powers and oversight for a national Arcology Transition may be a threat to the Ministry of Municipal and Rural Affairs (MOMRA) and other existing Ministries with a stake in Urban Planning and development.	Mandate Urban containment boundaries for each settlement – Arcology Legislation & National Urban Planning Policies for complexification, miniaturisation and regeneration.
Systemic Drivers	Carbon Neutrality drives competitiveness & productivity and threatens the Oil industry. E.g., transition away from the inefficient use of oil as an energy source of electricity generation and cooling/heating of buildings.[1] KSA Oil/Fossil fuel Subsidies' negative ecological impact.	Mandate targets for Carbon Neutral Building construction and materials manufacturing technologies, and materials resource recovery to stimulate economic diversification towards carbon drawdown and regenerative industries.
	Necessary intergenerational, age & gender responsive places and inclusive urban design programmes may be a threat to KSA Patriarchy.	Transition towards equitable access to multi-modal mobility options between a network of walkable *Arcologies*.
	Decreasing KSA Food Security – threatened by climate change impacts to global supply chains (80% of KSA's food supply is currently imported).	Regenerate biodiversity in areas of urban retreat and adaptation. Increase food and fibre production through urban, vertical farming systems, lab-grown clean meats, and regenerated arable land.
	Delivery of urban miniaturisation, i.e. reduction of sprawl and resettlement of communities.	Transparent Arcology transition plans + demonstrated benefits of resettlement done with social justice and dignity.
	Declining social capital and depersonalisation due to rapid, sprawling urbanisation	Foster human and cultural development via life in *Arcologies*.
Worldview	Individualism – continued growth is good	Collectivism – civilisational transformation
Myth/Metaphor Arabic Perspective	Fragmentation: Disintegrating Cities	Unification: Cities of rising Asabiyyah

From the FW analysis, KSA has an opportunity to shift its urban governance approach to transform its cities as

---

[1] Fossil Fuels make up 100% of KSA energy mix (CLIMATE TRANSPARENCY REPORT - SAUDI ARABIA, 2021)

regenerative *Arcologies* and lead the World in a regenerative transition. A global transition to a sustainable urbanised World, toward living, working, and playing in carbon-negative *Arcologies*, will arguably regenerate the future resilience of the planetary biosphere, particularly when *Arcologies* are implemented as (1) a critical carbon drawdown strategy beyond nett-zero greenhouse gas emissions; and (2) to increase biodiversity reserves in lieu of urban sprawl.

An additional threat to KSA, revealed through Teilhard de Chardin's MH, is the worldview of individualism, and the continued social decline and depersonalisation within society due to rapid, sprawling urbanisation with concurrent ecological crises. The countering opportunity for KSA is to foster human and cultural development via collective life within *Arcologies.* Moreover, Arcologies metaphorically are vessels for *asibiyyah*; a shared social purpose and consciousness. In this endeavour, the KSA needs to look to Arab cultural and spiritual stories to offer a greater, wholistic worldview; that of civilisational transformation moved by *asibiyyah.*

As a result, Arab thought and creativity may transfer knowledge back to, and influence, Western urban development. Historical precedents exist such as the "House of Wisdom" (Beit al-Hikmah) built by Caliph Al-Mansur as a knowledge incubator, library, translation bureau and think tank (Lyons, 2010) during the eighth century in Baghdad. Lyons showed how the House of Wisdom transformed Western civilisation through intellectual thought in philosophy, mathematics, astronomy, medicine and pharmacy. KSA's transition towards *Arcologies* would likewise provide prototypes for the rest of the World to learn from.

The next section will discuss further some of these transition opportunities, providing context for the policy recommendations.

KSA transition implications

KSA policies to manage the Arcology transition
The governance of *Arcologies* (hyper-dense megastructures) is an area for further investigation and social innovation, as few practical case studies exist. Soleri founded the development of Arcosanti in Arizona; a prototype Arcology under construction since 1970. Arcosanti is far from complete, though planned to house a population of 5000 people, it has varied between 50 to 150 residents due to a lack of development finance. It is managed as an urban laboratory by the Cosanti Foundation, a non-profit organisation. Based on Soleri's argument of a governing superorganism of a thousand minds (1977, p.12) within an Arcology, it is assumed that future *Arcologies* will require intentional communities with a high capacity to self-organise.

Though it tests many eco-design principles, Arcosanti however, is not a registered ecovillage or intentional community with the Global Ecovillage Network (GEN). In retrospect, past master planning and development projects have been driven top-down by the Foundation, with Soleri as CEO and President up to his retirement in 2011. In this respect, at the prototyping phase of developing *Arcologies*, KSA's top-down planning regime may be advantageous, when backed by investment funds, which Arcosanti lacked.

KSA is not a democracy, rather an absolute Islamist Monarchy. Democracy emerges at the local level of municipal council elections (Al-Shayeb, 2008), but these councils have few powers to manage a transition towards *Arcologies*. Currently, their urban planning powers and autonomy are embryonic, after a generational period (1975-2014) of centralised planning controls from the Ministry of Municipal and Rural Affairs (MOMRA).

Based on research on top-down frameworks for urban sustainability (Aina et al., 2019; Cowley, 2015), top-down, centralised regimes, such as exist in KSA, may play a valuable role in urban sustainability governance and by extension, regenerative and resilient urban planning and development in the form of *Arcologies*. Aina et al., (2019) conclude that "the top-down approach provides the needed leadership and political will to "make things happen"". KSA's political context is favourable, due to the KSA Vision 2030 that provides a vision of urban sustainability and a set of goals to be implemented by the Council of Ministers and their respective National government ministries. I agree with Patterson et al., (2017) and Aina et al., (2019) that an effective, socially inclusive, and just transformation towards sustainable urban governance, needs both "top-down steering and bottom-up self-organisation".

The proposed future city "Neom", as a Saudi Vision 2030 Project, is an example where the Monarchy and top-down governance framework within the KSA can decide to build a new city state for one million residents

(https://na.vision2030.gov.sa/v2030/v2030-projects/neom/). KSA intends to build a new model of urban sustainability and it will be funded through the Public Investment Fund. However, Neom is not intended to be a compact, dense Arcology minimising its site cover and impact on its virgin coastal ecology. Contrary to *Arcology* principles, its form is conceived as a 170-kilometre linear city along the Red Sea that will cover an area the size of Belgium (Avery, 2021; Michaelson, 2020). Imagine if the same leadership was applied to an Arcology transition.

It is not the aim of this paper to outline extensive multi-tiered, multi-agency KSA governance reform, but to apply the FW to map key national urban policy changes to manage a transformation of the built environment towards regenerative, resilient *Arcologies*.

Policy changes arising from the FW analysis include the following.

a) New Executive powers steered by the Council of Ministers for *Arcology* Transitions, with outcomes linked to the KSA *Vision 2030* (https://www.vision2030.gov.sa/) or next iteration thereof (e.g., *Vision 2050*).

b) Establishment of Legislation mandating urban sustainability in the broader context and *Arcology* Transition Plans, including:

    1. National Urban Planning Policies guiding both State Agencies and Municipal Councils to collaborate towards a shared framework of regenerative development;

    2. Standards for Strategic Environmental Assessments;

    3. Public Participation Guidelines for the design and delivery of *Arcologies* in contrast to privately planned mega-projects; and

    4. a framework for Place-based community visioning and environmental performance outcomes at the local Municipal level.

c) A key strategy of the new urban planning legislation and framework mandates "urban containment boundaries" for each settlement to:

    1. manage the population capacity & ecological footprint for each city;

    2. deliver human centred urban design and form for people, community belonging and place identity, reimagining KSA's vernacular desert architecture;

    3. implement biome regeneration through urban sprawl retreat / adaptation strategies (miniaturisation).

d) The creation of a KSA Council of Cities to accelerate social intelligence through collaboration, research and sharing of knowledge to implement the transformation of urban sprawl to *Arcologies*, with a research focus on:

    1. the application of public-private partnerships and development authorities to plan and construct *Arcologies*;

    2. "Build to Lease" models of affordable housing; and

    3. resilient and regenerative development guidelines for KSA (e.g., The Living Building Challenge, https://living-future.org/lbc/).

This Council, as a peak body, needs to connect with and learn from the findings of the partnership between MOMRA and the UN-Habitat on the Future Saudi Cities program (https://www.futuresaudicities.org).

Arcology transition as leverage for Saudi Vision 2030

From the FW analysis, it is obvious that KSA's urban transition toward *Arcologies* leverages the realisation of several vision goals and creates strategic linkages to the following 2030 Vision Realisation Programs: (a) Housing, (b) National Transformation, (c) Quality of Life, (d) Human Capability Development, and (e) Public Investment Fund. Further policy and governance integration would be needed across these programs to improve the efficiency and effectiveness of implementing *Arcology* transitions.

Cities are complex socio-ecological systems and microcosms of a national psyche and therefore influence all three themes of the Saudi Vision 2030: (a) A vibrant society; (b) A thriving economy; and (c) An Ambitious Nation. Table 4 illustrates the strategic alignment between the KSA's transformation of its cities into *Arcologies* with the following KSA vision goals and realisation programs.

Table 4: Linkage of Arcology Benefits to Saudi Vision 2030

1. Vision Theme	2. Vision Goal	3. Arcology Impact Linkage	4. Arcology / 2030 Program Linkage
A Vibrant Society	With fulfilling lives - To have 3 Saudi Cities be recognised in the top ranked 100 cities in the World.	Cities as humane habitats are catalysts for cultural development and social vibrancy. *Arcologies* intensify the socialisation process and human / social intelligences.	Human Capability Development. Quality of Life. Housing (accessible and affordable).
A Thriving Economy	Open for Business – To rise from our current position of 25 to the top 10 countries on the Global Competitiveness Index	Cities are the creative engines within a national economy; and compact, efficient, liveable cities in the form of *Arcologies* will drive innovation and increase global competitiveness.	National Transformation. Fiscal Sustainability. Privatization – e.g.: Development Authorities construct *Arcologies.* Housing (energy efficiency measures).
An Ambitious Nation	Effectively Governed – To raise our ranking in the Government Effectiveness Index from 80 to 20.	The transformation of KSA cities into *Arcologies* requires innovative forms of urban governance and a leap forward in multi-tiered, multi-stakeholder effectiveness in decision-making and service delivery. The "*consultative principle*" (Dekmejian, 1998) that currently operates at all levels of KSA government is critical to the development of *Arcologies*.	National Transformation. Public Investment Fund. Housing (socially just, inclusive provision).

If widely adopted in the KSA, the research findings and urban policy recommendations would accelerate the achievement of select KSA *Vision 2030* Goals and Vision Realisation Programs with significant beneficial impacts on the society and urban quality of life; as well as demonstrate prototype *Arcologies* to the World. The research linkages (Table 4), between the Saudi *Vision 2030* themes (Column 1) and the inherent characteristics of *Arcologies* (Column 3) reveals how the potential impacts of *Arcologies* can accelerate the achievement of select Vision Goals (Column 2), necessitating governance integration of strategic outcomes across the Realisation Program's (Column 4) multiple stakeholders and Government agencies.

Conclusion

Using CLA as a framework to summarise this research, the key threats and responses are restated for each of the four levels of reality: litany, systems, worldview and myth.

At the litany level, the main obstacle or threat to the successful transition of urban sprawl to *Arcologies* is the shift in urban governance goals, beyond continued spatial growth through smart urbanisation and sustainable development, towards regenerative urban development and the reduction of urban sprawl.

This plays out at the systems level where KSA would transcend a technology-led transition to achieve the UN-Habitat's Sustainable Development Goals, to encompass a systems-led redesign of human habitation that mutually benefits life on the planet. A further systemic threat is the resistance towards the delivery of urban miniaturisation. Community and stakeholder resistance is expected when it is necessary to reduce existing sprawl and resettle communities with social justice and dignity. The National Government and Municipal Councils may find it difficult

to aggregate land parcels or resume land in developed areas of sprawl to construct *Arcologies*, without resorting to fair land resumptions based on transparent *Arcology* plans.

To counter the above resistance, multi-sector leadership and governance systems need to practice social inclusion in decision-making (sociocracy) and understand the wholistic imperative for environmental (natural and built) regeneration over and above sustainable development. Key *Arcology* policy initiatives to guide the transition include: (a) urban containment boundaries linked to population capacity and ecological footprints; (b) human centred urban design and form that nurture community belonging and place identity (e.g.: compact 15-20min accessibility/walkability); (c) biome regeneration through urban sprawl retreat /adaptation strategies (miniaturisation); and (d) new public-private partnerships and modes of collective production.

At the worldview level of reality, the duality of individualism vs collectivism reveals itself within the urban dynamic. Urban Sprawl prejudices the expression of individual needs and consumption (continued growth is good) whilst *Arcology* prejudices the expression of community needs and human purpose (civilisational transformation). Further, at the level of technical urban planning capacity, a paradigm shift is required away from the modernist planning paradigm's political economy model towards a radical planning paradigm's (Sandercock, 1998) regenerative economy model with embedded sociocracy.

The dominant urban worldview and planning paradigm in KSA has been imported from Western civilisation to focus on material development. Alternatively, KSA needs to look to Arab cultural and spiritual stories to offer a greater, wholistic worldview; that of civilisational transformation. As a result, Arab thought and creativity may transfer knowledge back to, and influence, Western urban development. This creativity is driven by the *Arcology*'s "Urban Effect" and its principles of proximity and vibrancy (Consanti Foundation, 2020). KSA's transition to *Arcologies* has the potential of sparking a creative Arabic renaissance in the 21st century as significant as that which shaped Western civilisation during the Middle Ages (Lyons, 2010).

At the Myth / Metaphor level of reality, the competing metaphors for future planetary cities are *Cities as predatory, fragmented bodies* vs *Cities as neo-nature; symbiotic organisms*. A shift in narrative from predatory cities to symbiotic cities is required to align with the transition from urban sprawl to *Arcologies* at the previously discussed upper levels of reality. Here the response to any resistance is the rollout of urban observatories, to collect data at all levels (litany, systems, worldview and metaphor) and particularly the socio-ecological system impacts to monitor and publish the environmental indicators of current rapid urbanisation in KSA. This would show how KSA cities are predatory—importing resources and food globally to sustain them—and the case for symbiotic cities in the form of regenerative *Arcologies* can be mounted and contrasted. In addition, a deeper Arabic metaphor of cities transitioning from disintegration to rising *asibiyyah* that heals the planet would support the shift in worldview described above.

Finally, a global transition to a sustainable urbanised World—toward living, working, and playing in *Arcologies*—will arguably regenerate the future resilience of the planetary biosphere, particularly when *Arcologies* are implemented as (a) a critical carbon drawdown strategy going beyond nett-zero greenhouse gas emissions; and (b) to increase biodiversity reserves in lieu of urban sprawl.

This research starts to explore the key multi-dimensional impacts of the transition of KSA cities into *Arcologies*. The illustration of the regional benefits to KSA may influence the current discourse about future human habitation and planetary city futures. To progress the discourse, further applied research is required at the scale of a proposed *Arcology* prototype within a Saudi city, with an existing urban observatory to continue to contrast the urban metaphors (predatory vs symbiotic cities) and their systemic, multi-layered levels of reality.

Acknowledgements

References

Abou-Korin, A. A. (2011*). Impacts of rapid urbanisation in the Arab world: The case of Dammam Metropolitan Area, Saudi Arabia*. 5th Int'l Conference and Workshop on Built Environment in Developing Countries (ICBEDC 2011), Universiti Sains Malaysia. 6th – 7th December 2011.

Aina, Y. A., Merwe, J. H. V., & Alshuwaikhat, H. M. (2008, September). (2008, September). Urban Spatial Growth and Land Use Change in Riyadh: Comparing Spectral Angle Mapping and Band Ratioing Techniques. In *Proceedings of the academic track of the 2008 Free and Open Source Software for Geospatial (FOSS4G) Conference*, *incorporating the GISSA 2008 Conference.* (pp. 51-57).

Aina, Y. A., Adam, E. M., & Ahmed, F. (2017). Spatiotemporal variations in the impacts of urban land use types on urban heat island effects: The case of Riyadh, Saudi Arabia. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XLII*-3/W2, DOI: 10.5194/isprs-archives-XLII-3-W2-9-2017

Aina, Y. A., Van der Merwe, J. H., & Alshuwaikhat, H. M. (2014). Spatial and temporal variations of satellite-derived multi-year particulate data of Saudi Arabia: An exploratory analysis. *International Journal of Environmental Research and Public Health, 11*(11), 11152–11166.

Aina, Y. A., Wafer, A., Ahmed, F., & Alshuwaikhat, H. M. (2019). Top-down sustainable urban development? Urban governance transformation in Saudi Arabia. *Cities, 90*, 272-281.

Ala-Mantila, S., Heinonen, J., & Junnila, S. (2013). Greenhouse gas implications of urban sprawl in the Helsinki metropolitan area. *Sustainability*, *5*(10), 4461-4478.

Al-Ghamdi, K., Elzahrany, R., Mizra, M., & Dawod, G., (2012). Impacts of urban growth on flood hazards in Makkah City, Saudi Arabia. *International Journal of Water Resources and Environmental Engineering*, *4*(2), 23-34. DOI: 10.5897/IJWREE11.128

Al-Hathloul, S., & Mughal, M. A. (2004). Urban growth management - the Saudi experience. *Habitat International, 28*, 609–623.

Alhowaish, A. K. (2015). Eighty years of urban growth and socioeconomic trends in Dammam Metropolitan Area, Saudi Arabia. *Habitat International*, *50*, 90-98. DOI: 10.1016/j.habitatint.2015.08.019

Al-Shayeb, J. (2008). *Saudi Municipal Councils and Political Reform*. Carnegie Endowment for International Peace. https://carnegieendowment.org/sada/21087

Al-Shihri, F.S. (2016). Impacts of large-scale residential projects on urban sustainability in Dammam Metropolitan Area, Saudi Arabia. *Habitat International*, *56*, 201-211. DOI: 10.1016/j.habitatint.2016.06.001

Alshuwaikhat, H., Aina, Y., & Rahman, S.M. (2006). Integration of urban growth management and strategic environmental assessment to ensure sustainable urban development: The case of Arabian gulf cities. *International Journal of Sustainable Development and Planning*, *1*(2), 203-213.

Avery, D. (2021, January). Saudi Arabia building 100-mile-long "linear" city. *Architectural Digest.* https://www.architecturaldigest.com/story/saudi-arabia-building-100-mile-long-linear-city

Azzam, A., & Belhaj Ali, A. (2019). Urban sprawl in Wadi Goss watershed (Jeddah City/Western Saudi Arabia) and its impact on vulnerability and flood hazards. *Journal of Geographic Information System*, *11*, 371-388. https://doi.org/10.4236/jgis.2019.113023

Bahaydar, M. (2013). *Urban Sprawl and its negative effects on Jeddah*. Ball State University.

Behboudi, M. (2019). *Futures Wheel, Practical Frameworks for Ethical Design*.

Bian, Q., Alharbi, B., Shareef, M. M., Husain, T., Pasha, M. J., Atwood, S. A., & Kreidenweis, S. M. (2018). Sources of $PM_{2.5}$ carbonaceous aerosol in Riyadh, Saudi Arabia. *Atmospheric Chemistry and Physics, 18*(6), 3969–3985.

Brown, M. A., Southworth, F., & Sarzynski, A. (2009). The geography of metropolitan carbon footprints. *Policy and Society, 27*(4), 285-304.

Castells, M. (1989). *The Informational City: Information Technology, Economic Re-structuring and the Urban-Regional Process*. Blackwell.

Castells, M. (1999). *The Rise of the Network Society, The Information Age: Economy, Society and Culture, Vol 1.*

Oxford, Blackwell Publishers. (Originally published 1996)

Castells, M. (2000). Conclusion: Urban Sociology in the Twenty-first Century. In I. Susser (Ed.), *The Castells Reader on Cities and Social Theory*. (pp. 390-406). Blackwell Publishing.

Chin, N. (2002). Unearthing the roots of urban sprawl: A critical analysis of form, function and methodology. *University College London Centre for Advanced Spatial Analysis Working Papers Series*. 47. ISSN 1467-1298. https://discovery.ucl.ac.uk/id/eprint/249/

Christian, D. (2005). Macrohistory: The play of scales, *Social Evolution & History, 4*(1). 22-59.

Consanti Foundation (2020). *What is an Arcology*, www.arcosanti.org/arcology

Cowley, R. (2015). In defence of top-down sustainability planning: The case of Sejong City. In J. Condie, & A. M. Cooper (Eds.), *Dialogues of Sustainable Urbanisation: Social Science Research and Transitions to Urban Contexts (pp. 36–40)*. University of Western Sydney.

Daffara, P. (2004a). Macrohistory and city futures. *Journal of Futures Studies: Epistemology, Methods, Applied and Alternative Futures 9*(1), 13-30.

Daffara, P. (2004b). Sustainable city futures. In S. Inayatullah (Ed.), *The Causal Layered Analysis (CLA) - Reader Theory and case studies of an Integrative and Transformative Methodology* (pp. 424-438). Tamkang University Press.

Daffara, P. (2006). *Glo-cal Visions of Human Habitation for 2100 and their defining Cultural Paradigms*. University of the Sunshine Coast.

Dekmejian, R. H. (1998). Saudi Arabia's Consultative Council. *Middle East Journal*, *52*(2), 204–218. http://www.jstor.org/stable/4329186

Dostal, W. (1984). Towards a model of cultural evolution in Arabia. *Studies in the History of Arabia. 2,* 188-189.

Ewing, R.; & Rong, F. (2008). The impact of urban form on U.S. residential energy use. *Housing Policy Debate*, *19*(1), 1-30.

Fishman, R. (1987). Beyond suburbia: The rise of the technoburb. In R. T. LeGates & F. Stout (Eds.). *The City Reader* (pp. 77-86). Routledge.

Futures Wheel. (2020). Retrieved from https://en.wikipedia.org/wiki/Futures_wheel

Galtung, J., Inayatullah, S. Eds. (1997). *Macrohistory and Macrohistorians, Perspectives on Individual, Social, and Civilisational Change*. Praeger Publishers.

Garba, A. B. (2004) Managing urban growth and development in the Riyadh metropolitan area, Saudi Arabia. *Habitat International, 28*(4), 593-608. DOI: 10.1016/j.habitatint.2003.10.008

Geddes, P. (1968). *Cities in Evolution*. Ernest Benn Ltd. (Originally published 1915)

Hall, P. (1996). *Cities of Tomorrow*. Blackwell Publishers. (Originally published 1988)

Hall, P. (1998). *Cities in Civilization*. Weidenfeld & Nicolson.

Harvey, D. (2000). *Spaces of Hope*. Edinburgh University Press.

Hoornweg, D., Sugar, L., & Gómez, C. L. (2007). Cities and greenhouse gas emissions: moving forward. *Environment and Urbanization, 23*(1), 207-227.

Inayatullah, S. (2008). Six pillars: futures thinking for transforming. *Foresight*, *10*(1), 4-21. DOI 10.1108/14636680810855991

Inayatullah, S. & Milojević, I. (2015). *CLA 2.0: Transformative Research in Theory and Practice*. Tamkang University Press.

Kennedy, H. (1985). From Polis to Madina: Urban change in late antique and early Islamic Syria, *Past & Present, 106*, 3–27.

Lahn, G., & Stevens, P. (2011). *Burning Oil to keep cool: The hidden energy crisis in Saudi Arabia*. Chatham House (The Royal Institute of International Affairs). Retrieved from Chathamhouse.org

Leyden, K. M. (2003). Social Capital and the Built Environment: The importance of walkable neighbourhoods. *American Journal of Public Health, 93*(9), 1546-1551.

Lyons, J. (2010). *The house of wisdom: How the Arabs transformed Western civilization*. Bloomsbury Publishing.

Michaelson, R. (2020, May). 'It's being built on our blood': the true cost of Saudi Arabia's $500bn megacity. *The*

Guardian. https://www.theguardian.com/global-development/2020/may/04/its-being-built-on-our-blood-the-true-cost-of-saudi-arabia-5bn-mega-city-neom

Moffat, S. & Kohler, N. (2008). Conceptualizing the built environment as a social–ecological system. *Building Research & Information, 36*(3), 248–268.

Mubarak, F. A. (2004). Urban growth boundary policy and residential suburbanization: Riyadh, Saudi Arabia. *Habitat International, 28*(4), 567–591.

Mumford, L. (1989). *The City in History, Its Origins, Its Transformations and its Prospects*. Harcourt Inc. (Original published in 1961)

Norman, J.; MacLean, H.L.; & Kennedy, C.A. (2006). Comparing high and low residential density: life-cycle analysis of energy use and greenhouse gas emissions. *Journal of Urban Planning and Development*, *132*(1), 10-21.

Putnam, R. D. (2000). *Bowling Alone: The Collapse and Revival of American Community*. Simon & Schuster.

Reed, B. (2007). Shifting from 'sustainability' to regeneration. *Building Research & Information*, *35*(6), 674-680. DOI: 10.1080/09613210701475753

Ritchie, H & Roser, M. (2020).*CO₂ and Greenhouse Gas Emissions*. OurWorldInData.org. Retrieved from: https://ourworldindata.org/co2/country/saudi-arabia

Sandercock, L. (1998). *Towards Cosmopolis: planning for multicultural cities*. John Wiley & Sons Ltd.

Sarkodie, S. A., Owusuandi, P. A., & Leirvik, T. (2020). Global effect of urban sprawl, industrialization, trade and economic development on carbon dioxide emissions. *Environmental Research Letters*, *15*(3), 034049. DOI: 10.1088/1748-9326/ab7640

Sassen, S. (1994). A new geography of centres and margins: Summary and implications from cities in a world economy. In R. T. LeGates and F. Stout (Eds.), *The City Reader* (pp. 209-212). Routledge.

Soleri, P. ([1969] 1977). *Arcology: The City in the Image of Man*. The MIT Press.

Soleri, P. (2005). *Arcology Theory*. Cosanti Foundation. Retrieved January 1, 2003, from webmaster@arcosanti.org.

Stefano, B. (2001). The town seen as a house. In C. H. Beck (Ed.), *Atrium House and Paradise Garden. Architecture and Way of Life in the Islamic World* (pp. 244-255). München.

Struyk, R. J. (2005). Housing policy issues in a rich country with high population growth: The case of Riyadh, Saudi Arabia*. Review of Urban and Regional Development Studies 17*(2), 140-161. DOI: 10.1111/j.1467-940X.2005.00099.x

UN-Habitat. (2020). *The new urban agenda*. United Nations Human Settlements Programme.

UN-Habitat. (2020). *World cities report – The value of sustainable urbanization*. United Nations Human Settlements Programme.

VandeWeghe, J.R., & Kennedy, C. A. (2007). Spatial analysis of residential greenhouse gas emissions in the Toronto census metropolitan area. *Journal of Industrial Ecology*, *11*(2), 133-144.

Williams-Ellis, C. Ed. (1937). *Britain and the Beast*. J.M. Dent.