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The social imperative in sustainable urban development

The case of Masdar City in the United Arab Emirates

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Abstract

Purpose – The purpose of this paper is to examine social sustainability effectiveness of eco-cities through the case of Masdar City's strategy for urban sustainability in Abu Dhabi, United Arab Emirates.
Design/methodology/approach – Using a case study approach, the paper is an exploratory, qualitative analysis, which investigates the social, environmental and economic performance of Masdar City, a purported carbon-neutral, zero-waste urban development.
Findings – Though Masdar City substantively contributes to innovation in sustainable urban development within environmental and economic contexts and has been effective in capital circulation in green technology markets, the impetus as a commercially driven enterprise is most evident. Successful sustainable urban development requires greater consideration for the social imperative.
Practical implications – Eco-city mega-projects, such as Masdar City, have the potential to fuse achievements in innovation, technology and economic enterprise with the social imperative of functional urban habitats.
Originality/value – Eco-cities are of increasing interest given the growing need for sustainable, energy-efficient living. This paper contributes through a novel case study, exploring how the concept of the eco-city has been developed and understood in the Masdar City context and discusses successes and deficits in its strategic implementation.

Keywords United Arab Emirates, Sustainability, Abu Dhabi, Eco-city, Urban development, Masdar City
Paper type Research paper

1. Introduction

Though the concept of ecologically healthy cities has been discussed for more than 30 years (Register, 1987), eco-cities have entered into more mainstream discourse in the new millennium, largely due to two global phenomena, those of climate change and urbanisation. In terms of climate change, there is widespread recognition for the need to re-orient urban development towards low-carbon infrastructure and the requirement for cities to be ever-greener in environmental functionality and ethical terms, as city carbon emissions represent the single largest human contribution to climate change (Duren and Miller, 2012).

Urbanisation is negatively viewed by some as causing environmental degradation, social inequality and sprawling infrastructure. Eco-city supporters contend that these drawbacks could be countered through ethical and sustainable environments through the eco-city offering. Urbanisation is a fast-growing challenge to human civilisation, with over half of

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the world's population now living in cities and is forecasted to reach 80 per cent by 2050 (United Nations, 2015).

Eco-cities or smart cities are terms often used synonymously to describe cities sharing common traits, such as the use of renewable energy, the presence of smart buildings with green and covered spaces, carbon-neutral or smart transportation and state-of-the-art IT systems. In reality, models for these cities are diverse, ranging from demonstrations of future urban development to educational tools that research sustainable living. Consequently, many new city developments "from minor retrofits to large-scale new-towns" (Rapoport and Vernay, 2011) become labelled as eco-cities. More recent discourse on eco-cities has moved from focussing on analytical perspectives of sustainable cities, to more socially constructed understandings, adding to the subjective nature of what does or does not constitute an eco-city, formed as the outcome of a social process. To demonstrate this diversity, in addition to our case example, Masdar City in Abu Dhabi, examples of eco-city projects include Songdo IBD and Dongtan Eco-City, two cities in South Korea; PlanIT Valley in Portugal, SmartCity, located in Malta (Washburn and Sindhu, 2010); Sonoma Mountain Village and Eco-village Ithaca, two cities in USA; and Hammarby Sjöstad and Malmö bo01, two cities in Sweden; (Rapoport and Vernay, 2011).

Though the eco-city remains a vexed construct, endeavouring to qualify and understand the nature of Masdar City as an eco-city is meaningful. Joss (2010) highlights three criteria for qualification as an eco-city: that a candidate for eco-city should be large-scale, sector-diverse and, from a governance perspective, be policy embedded. These measures place Masdar City squarely within the scope of being a recognised eco-city. Joss (2010) further proffers three key indicators to ascertain the nature of an eco-city, outlined here within the context of Masdar City: type of development – in the case of Masdar City, it is considered a new development, with the creation of new urban infrastructure in a new setting, as opposed to an expansion of an existing urban area or a retro-fit development within an existing city; phase of development – Masdar City is within the construction phase, rather than at an earlier planning stage or having been fully and successfully realised; and implementation focus – the implementation focus can be of three kinds – technological innovation, integrated sustainability planning or civic empowerment. In the case of Masdar City, technological innovation is at the heart of its vision.

Drawing on the Dempsey *et al.* (2011) exploration of the social aspect of sustainable development, we define the social imperative in relation to eco-city development as the imperious need for social sustainability in eco-city development, composed of both equitable access and sustainability of community. In United Arab Emirates (UAE) society at large, these factors are of significant concern given, for example, the relationship between citizenry and migrant (Randeree, 2012). This case study, thus, investigated the social, environmental and economic performance of Masdar City to ascertain its contribution to sustainable development and provide analysis of the social imperative in sustainable urban development.

2. Methodology

The research methodology is an exploratory case study of Masdar City based on literature review, surveying the social, environmental and economic performance of the eco-city. The methodology is best suited to this enquiry, as exploratory research is conducted qualitatively in order to identify and establish primacies and operational characterisations of a given case (Stebbins, 2001). Here, it aims to chart Masdar City's contribution to sustainable development (primacies) and draw lessons from experiences of the challenges faced and assess consequential impact on social sustainability (operational characterisations).

3. Masdar City within context

3.1 The national context

The UAE has a high growth economy, which has rapidly diversified into areas of tourism, manufacturing, logistics, banking and finance (Randeree and Ninan, 2011; Randeree and Al Youha, 2009). In support and promotion of these industries, a visible construction boom has been experienced in the UAE, particularly in the city of Dubai (Randeree and Chaudhry, 2012). The shortage of indigenous manpower, particularly in the construction industry attracted a large influx of foreign workers (Randeree and Chaudhry, 2007). The UAE workforce is mostly dependent on such migrant labour, particularly from South Asia, other Arab countries and European nations (Randeree, 2008a). Similar demographics exist across other countries in the GCC region but to significantly lesser degrees (Randeree, 2012). After the discovery of oil in the UAE and ensuing economic development, infrastructure growth meant investment companies immigrated employees from outside the UAE due to a low internal population (Randeree, 2009). Throughout the 1990s and the early 2000s, the UAE followed a relatively laissez-faire employment policy. As a result, the population of the UAE reached 4.5m in 2004; of this figure, only 20 per cent was made up of UAE nationals and the rest comprised of other Arabs, South and Southeast Asians, Europeans and Americans, among others (Al-Ali, 2008). By 2015, the UAE's workforce comprised 85 per cent foreign expatriates holding only temporary visas, with 15 per cent Emirati citizens (Ryan, 2016). Due in part to the advanced and comparatively open nature of the UAE's economic development model in relation to most other GCC states, the international community looked to the UAE as a model for a new, prosperous Middle East in economic terms (Randeree, 2008b).

3.2 The Abu Dhabi context

Abu Dhabi represents a region that has undergone spectacular change over the last 50 years, from a village with fewer than ten thousand people (Cugurullo, 2013a), to a thriving modern city exceeding 1m inhabitants (Crot, 2013). However, this "rags to riches" (Crot, 2013) transformation is no miracle and can be directly attributed to the discovery of vast oil reserves in the emirate in the 1960s. Abu Dhabi state is the largest of all seven emirates making up the UAE and has a total land mass greater than all other six emirates combined. Much of Abu Dhabi emirate is unpopulated, though it is home to significant oil reserves, amounting to 95 per cent of the nation's fossil fuel reserves (Reiche, 2010), which equates to 10 per cent of global oil and 5 per cent of global gas reserves (Madichie, 2011). Abu Dhabi is, thus, a key part of the UAE, the nation having the world's sixth-largest proven oil reserves, meaning that not only does it hold a prominent position within the UAE, but also within the global oil industry.

Under the previous ruler, change was cautious and slow. In contrast, under the current leader, Sheikh Khalifa bin Zayed Al Nahyan, development has become significantly more ambitious, aimed at globally marketing the UAE as an advanced, modern state (Cugurullo, 2013b). However, whilst Abu Dhabi escaped relatively unscathed from regional political and economic instability, most specifically in respect of the "Arab Spring" and the global financial crisis, this may not remain the case. Projections estimate Abu Dhabi's population to be 3 million by 2030 which will place increasing pressure on the country's limited natural resources and scarce water supplies. Furthermore, although the UAE is not prone to hazards and disasters, it has been highlighted that Abu Dhabi emirate could be affected by climate change through higher temperatures, lower rainfall and reduced moisture. Furthermore, this would impact migration from poorer, more hazard prone countries, affecting the internal employment market and dependency on food importation (Cugurullo, 2013a).

3.3 Masdar City in context

The 1,483-acre site of Masdar City (Rapoport and Vernay, 2011) was designed to eventually host a residential capacity of 50,000 people. It is set within a broader existing population of 470,000 inhabitants and located 17 km south east of Abu Dhabi's urban centre (Schuler, 2009).

Masdar, aptly named as it is the Arabic word for "source", is a subsidiary of government-owned Mubadala Development Company, consisting of business units including Masdar City, Masdar Power, Masdar Carbon, Masdar Venture Capital and Masdar Institute of Science and Technology (Madichie, 2011).

Masdar City, unveiled in 2006, had an initial expectation to be completed a decade later (*The Economist*, 2013). Designed by Foster and Partners, the project launched in Spring of 2008 and Masdar City's initial publicity did much to gain it high profile visibility, with the project managing to attract prestigious companies to what promised to be the epicentre for the development of leading green technology. The patrons of the project were the Government of Abu Dhabi and Abu Dhabi Future Energy Company.

The aspiration for world recognition and prestige through undertaking unique large-scale projects was a desire reminiscent of Arabian Gulf development over the past 20 years, with the UAE and Qatar leading through construction projects such as Emaar's world's tallest building, the Burj Khalifa and Nakheel's Palm Island, an offshore residential and tourism development built through reclaimed land in the shape of a date palm tree, both of which are located in the city of Dubai. Abu Dhabi, for its part has developments such as the Guggenheim Museum, Ferrari World theme park and the Formula 1 motor racing circuit on Baniyas Island. It is, therefore, unsurprising that Abu Dhabi's venture into building Masdar City was purported as the "world's first carbon-neutral city" (Reiche, 2009).

4. Discussion

4.1 Masdar City as an eco-city

Masdar City, promoted as a "carbon-neutral, zero-waste" urban community, was intended to showcase to the world that it is possible to live comfortably with minimal environmental impact using renewable energy technologies and sustainable living principles (Nader, 2009). The intent was that Masdar City could function entirely without the need for fossil fuels and would provide energy through the use of a combination of renewable sources including solar, thermal, photovoltaic, wind and later the inclusion of geothermal energy and hydrogen energy (Premalatha *et al.*, 2013). The significance was particularly important since the UAE has the poorest carbon footprint in the world (Afshari *et al.*, 2014; Crot, 2013). The goal was an 80 per cent reduction in energy demand in relation to Abu Dhabi's baseline usage (Kansara and Ridley, 2012) through intelligent design (40 per cent), optimisation and efficiency of supply (35 per cent) and renewable energy and recycling (25 per cent) (Schuler, 2009). Projected infrastructure requirements to facilitate these outcomes included rooftop photovoltaic panels, concentrated solar thermal collectors, evacuated tube solar thermal collectors, geothermal sources and a waste-to-energy facility (Sgouridis and Kennedy, 2010). It was also planned that all fossil fuel powered vehicles would remain outside the city, favouring electrified Light Rail Transit for inter-city travel and a battery powered, auto-piloted, "personal rapid transit" system, combined with walking and cycling schemes for intra-city mobility (Sgouridis and Kennedy, 2010). The master plan for Masdar City included a requirement that no inhabitant or visitor be more than 250 metres from public transport access. Furthermore, water within Masdar City was planned to be fully recycled, with remaining by-products converted into energy through a gasification process to be later incorporated into building materials (Premalatha *et al.*, 2013).

In addition, Masdar City uses a fusion of technological intelligent design and traditional Arab architecture to achieve minimal energy and material use. Additionally, Masdar City created synergy with various world-class organisations such as educational, research and

consultancy to become a hub for green technology innovation and, most importantly, business (Premalatha *et al.*, 2013). To ensure that targets for carbon efficiency are met, Abu Dhabi's Urban Planning Council developed the Pearl Rating System, legislated to evaluate buildings for adherence to design and construction targets and, two years after commission, undertake post-occupancy evaluation to quantitatively measure compliance through performance measures in relation to occupant usage and experiences; such as resource use per capita, volumetric measures on waste production and transport utilisation (Kansara and Ridley, 2012).

The eco-city design includes a solar-powered headquarters, which purports to generate a net surplus to its own electricity needs. The city is also home to Masdar Institute, a research and development centre of excellence in the utilisation of renewable energy resources (Schuler, 2009), which has close ties to the Massachusetts Institute of Technology in the USA (Madichie, 2011) and welcomed its first cohort of students in 2010 (Kansara and Ridley, 2012). Masdar Institute is the world's first university dedicated to the study of sustainability and renewable technologies. Also present is the global headquarters of the International Renewable Energy Agency, composed of 138 member countries and dedicated to the promotion of renewable energy.

Though Masdar City is designed to be the first modern city powered solely by renewable energy (Ishowo-Oloko *et al.*, 2012), it is clear on further examination that its *raison d'être* is based not on a singular purpose, but rather on a blend of strategic needs for a modern Gulf state. This blend encompasses climate change and urbanisation, economic diversification, socio-economic regeneration, socio-technological innovation, political and socio-economic governance, policy, the knowledge-based economy (Randeree and Gaad, 2008), public and private sector partnership (Randeree and Iqbal, 2009), social learning, education (Randeree and Narwani, 2009) and research (Joss, 2010). Thus, the examination of the case of Masdar City resonates across eco-city developments worldwide and, even in challenging physical environments, eco-city development can occur to address contemporary urban development issues.

4.2 Masdar City and the sustainability promise

At the heart of Masdar City's sustainability promise was the assurance to exceed the World Wildlife Fund's (WWF) One Planet Living Sustainability Standard, which includes ten sustainability principles, namely, "zero-carbon, zero-waste, sustainable transport, sustainable materials, sustainable food, sustainable water, habitats and wildlife, culture and heritage, equity and fair trade, health and happiness" (Schuler, 2009). Consequently, WWF promoted Masdar City as "a global benchmark for sustainable urban development" (Cugurullo, 2013b).

Circumstances changed rapidly from 2008 amid the turmoil of the financial crisis. One of the first and most fundamental changes was to the eco-city's master plan, downgrading Masdar City's initial aim of being "zero-carbon" (no carbon dioxide emission) to "carbon-neutral" (no net release of carbon dioxide into the atmosphere), indicating Masdar's environmental ambitions had been scaled back.

Furthermore, Masdar turned to acquiring energy from offsite locations due to the insufficiency of its photovoltaic and concentrated solar power energy sources (Cugurullo, 2013b). With water desalination also expected to have been powered by solar energy, this process had to be outsourced to an energy intensive gas-powered desalination plant in Abu Dhabi.

This was not the only process outsourced. Masdar Initiative outsourced construction to third-party developers in an attempt to diffuse financial risk, making it unlikely the construction process adhered to the sustainability principles initially targeted (Crot, 2013). The issue of outsourcing construction was further scrutinised by environmental lobbyists

and scientists who placed a spotlight on Masdar City's claims of carbon neutrality and zero-waste. This is highlighted through three areas; the carbon footprint, waste management and e-waste.

It is argued that the carbon debt of Masdar City in the form of greenhouse gas emissions will be high, primarily through the offsite planning, design and commissioning of the city and further through procuring solar panels, wind and geothermal energy equipment and technology required. Consequently, Masdar City's aspiration for becoming a zero-carbon habitation is only realised through excluding contributory factors from outside the city.

Similarly, exporting waste becomes a key concern in validating the desire for carbon neutrality, as incineration, plastic reuse, recycling metal and composting are all net energy consumers or have resultant pollutants.

Finally, e-waste could potentially be challenging as Masdar City is a technology intensive environment. An example is both business and domestic usage of mobile phones, computers and a multitude of other electronic gadgets, which result in both high-energy consumption and recycling demand once products become broken or obsolete. Again, exporting waste becomes necessary for Masdar City to receive carbon credits, by transferring its own carbon emissions to external recipients.

At the core of environmentalist concerns is that claiming Masdar City is a zero-waste, carbon-neutral city results in a false hope that global warming can be legitimately contained whilst maintaining or even increasing consumerist lifestyle dependent on high energy and waste environments (Abbasi *et al.*, 2012).

There is, however, little reliable evidence for the claim that any eco-city is carbon-neutral given the lack of agreed standards. Carbon accounting practices have long been purported as the arbiter, which involves precisely calculating carbon emissions and eco-cities could be classified as carbon-neutral by achieving permissible and globally agreed standards. Scholars have proposed evaluation tools; for example, Kennedy and Sgouridis (2011) suggest emission categorisation on three levels, namely, geographical boundary constrained internal emissions; core municipal activities that result in external emissions; and any further emissions, internal or external, resulting from other (non-core) activities. They proffer that to achieve a carbon-neutral designation, each level would denote a distinctive carbon management strategy – eliminate, balance or minimise. However, it remains that in the absence of an agreed definition for carbon-neutral eco-cities, claimed performance cannot yet be ubiquitously substantiated.

As a result, with downgrading Masdar's environmental ambitions, what has essentially survived is the emphasis on the city as a "living lab" or "permanent showroom", aimed at incubating and displaying new "smart" environmental technologies (Joss *et al.*, 2013). This technological emphasis has the potential to crowd out an appreciation of social aspects of sustainability. This could lead to a perceived move away from what was advertised as a balanced approach to sustainable development with a potential for ecological consciousness (Devall and Sessions, 2015), to either uneven "eco-modernisation" (Connelly, 2007), which argues for the use of technology to solve environmental problems (Davison, 2001); or technocracy, with a focus on technological and economic imperatives (Cugurullo, 2013b) at the expense of social sustainability. This marginalisation of the social imperative can be framed in terms of the triple bottom line (TBL), which is normatively used to direct organisations to accounting practices using three distinct, separate considerations: social (people), environmental/ecological (planet) and economic/financial (profit). The resultant framework has led to many organisations adopting its framework to evaluate sustainable development performance (*The Economist*, 2009). Masdar City, using the TBL approach to sustainability, a definition ratified by the United Nations in 2007, had initially professed to be a comprehensive approach to sustainability based on these three considerations. However, the subsequent demoting of Masdar's original aspiration can be inferred to mean

that Masdar has adopted a two-dimensional interpretation of the TBL approach, leading to trade-off the social imperatives of the model and prioritise economic and, to lesser effect, environmental aspects (Cam, 2011). Alternative instruments include Life Cycle Analysis (Afshari *et al.*, 2014), which offers long-term assessment, particularly pertinent for social considerations of new eco-city projects, where life-cycle value becomes emphasised over the economic focus found in the TBL approach.

4.3 Motivating factors in eco-city development

At the strategic level, the motivations for "conspicuous urbanism" (Caprotti, 2014) projects, including eco-city developments, could be the need for utilising excess energy capital and a desire for entry into green markets. For Abu Dhabi, absorbing oil wealth is viewed as a strategic entry point into investment in environmental technology markets.

As for project motivations, these were outlined through four objectives – economic diversification, expansion of the UAE's global energy market, incubation of renewable technologies and contribution to sustainable development. Economic diversification and energy market expansion formed the case for the financial incentives of the project, expounded to deliver tangible savings of $2bn and an economic injection of an additional 2 per cent to the Emirate's GDP over the next quarter of a century (Schuler, 2009). As for technology and sustainability pledges, these are actionable through urban densification, which has been demonstrated to have a positive impact on reducing energy usage (Camagni *et al.*, 2002), particularly in more extreme climates (Simon, 2010), such as the hot, humid environments found in Abu Dhabi. This creates more compact communities, in this case with a population density of 135 people per hectare (Hayek *et al.*, 2010), compared, for example, to London, which has a much smaller density of 52 people per hectare (OCSI, 2015). However, the downside of putting up high rise towers in order to achieve this can be avoided through intelligent planning, which has the potential to preserve communities and public spaces, arguably lost through the increasing dominance of tall buildings. Ali and Al-Kodmany (2012) highlight that these drawbacks include a number of economic, environmental, civic and socio-cultural factors. Densification is, therefore, not about taller, narrower environments, but rather about better organisation. A good example of this is urban agglomeration, where tall buildings combined with the benefits of the digital revolution, facilitate much closer proximity of activities for residents' professional and personal lives. The key advantage for Masdar City is that higher urban density means the city would use less energy per capita and the resulting ecological footprint per person will be smaller than normative city habitations (Schuler, 2009). The cost efficiency of constructing and coordinating supply chains is improved substantially when people live in increasingly dense communities (Echenique *et al.*, 2012). Resources required in initially providing urban infrastructure and subsequently in transporting goods and resources around urban environments all require tremendous energy. As smaller spaces require fewer resources to construct and use less energy to cool once built, ultimately smaller spaces mean less waste in comparison to their more dispersed urban counterparts (Roseland, 1997).

4.4 The social imperative

Whilst Masdar may be a commercially driven enterprise, at its heart is a commitment to sustainable development. Thus, the question remains, where is social sustainability in this "vortex of high-tech capitalism?" (Cugurullo, 2013b). The dimensions introduced earlier by Rapoport and Vernay (2011) indicate that Masdar City's ambitions venture into a hybrid of both educational tool and presenting a new model of sustainability, though the latter is dominant. Haughton (1999) emphasises the importance of social considerations in sustainable development, believing that an excessive society is unlikely to be either sustainable in environmental or economic terms, eventually leading to "environmental

degradation and ultimately to political breakdown". Though symbolic attempts at social cohesion are evident in Masdar City's plan, such as the development of a "cultural district" (Ponzini, 2010), changes in the behaviour of inhabitants, reduced material consumption and decreased demand for resources (Rapoport and Vernay, 2011) do not feature significantly in the model.

Issues in social cohesion exist more generally within UAE society, with much being published in regards to the dynamics between the minority autochthonous population and the majority migrant labour force in the country (e.g. Randeree, 2008a, 2009, 2012), resulting in "splintering urbanism", manifested through distinction and informal partition on the basis of class, ethnicity and nationality (Mohammad and Sidaway, 2012). Crot (2013) also points to this disregard for the social dimension of sustainable development as a motivation towards Abu Dhabi's particular brand of sustainability. He states that Masdar's focus on high-tech, low-carbon solutions not only fits well with the dominant global approach to urban sustainability, but allows Abu Dhabi to concentrate on "techno-economic" solutions over social and institutional ones, thus circumventing what may be more sensitive aspects of the pursuit of sustainability in the UAE. In particular, Abu Dhabi's poor treatment of low-skilled workers made reconciling Masdar Initiative's relationship with the One Planet Living principles it had subscribed to difficult because of its focus on the social dimensions of sustainability, such as fair wages and working conditions for all workers. However, Crot (2013) notes that later the framework was amended to remove the problematic issue of labour standards and accommodate local agendas and practices in Abu Dhabi.

Could, therefore, Masdar City ever become a model for urban sustainability including the social imperative? Masdar's reduced ambitions have led towards a narrower "techno-economic" form of sustainability. However, Connelly (2007) believes that it is necessary to acknowledge the intellectual legitimacy of alternative interpretations of sustainability because, as Jacobs (1995) pointed out, "sustainable development" is not merely ambiguous, but essentially contested. Thus, whilst Abu Dhabi's approach to the Masdar City development is "techno-economic" in focus, it would still fall within the "eco-modernisation" realm of Connelly's (2007) "continuous triangular field", which represents all forms of contested interpretations of sustainability, with the central area representing the ideal.

Within the "ecological modernisation" model, economic and technological development is generally seen as a bringer of growth and distributive justice, but how this approach would bring consistency in terms of social sustainability remains debateable (Cugurullo, 2013b). Furthermore, Haughton (1999) warns that if equity principles are not taken into account, inevitably the ability to move towards sustainable development will be undermined. Since most scholars agree that any truly successful attempt at sustainable development requires consideration of social justice and equity (e.g. Connelly, 2010; Crot, 2013; Cugurullo, 2013a, b; Haughton, 1999; Premalatha *et al.*, 2013) it follows that changes in human practices in terms of the impact of development on local, national and global environments should be heightened in Masdar City. If the eco-city's deficiency as a form of sustainable development is that it does not match the local policy and value system within Abu Dhabi, then perhaps it is Abu Dhabi that needs to change to accommodate sustainable development more holistically and not articulated merely for Masdar City. However, it is understood that this remains aspirational and that these value changes and the public participation necessary to achieve them would be immensely difficult to achieve.

5. Conclusion

Charting the course of Masdar City's contribution to sustainable development encompasses the early expectation of becoming "one of the world's most sustainable urban developments", presented as "a global benchmark for sustainable urban development" (Cugurullo, 2013b) to environmental circumstances requiring a scaled-back commercial enterprise. As one Masdar

representative conceded "Masdar City at the end of the day is a business" (Cugurullo, 2013b). Through viewpoints such as Connelly's (2007) "continuous triangular field", Masdar's trajectory from a development promising a balanced approach to sustainable development, adhering to the United Nation's TBL approach and conforming to the One Planet Living principles, to an "ecological modernisation" approach favouring technological and economic strategies to the detriment of social imperatives, were charted.

Indeed, balancing such variables should be at the heart of eco-city design, whether framed in terms of planet-people-profit, as in the TBL, or biological-cultural-material, as espoused by Wann. It follows then that the key lesson from Masdar City is for eco-cities to follow a balanced approach to their development with an emphasis on the social imperative. To achieve this, it is proffered, that for Masdar City to stand out as a successfully balanced eco-city, policy and value changes need to be encouraged in UAE society. This could include emboldening existing environmental practices, such as conservation zones for community wildlife sanctuaries, state regulation for more productive land use, land grants in the public interest and the strict protection of water resources, as Saniotis (2011) delineated. Implementation of these actions could contribute to making tangible, concepts such as biophilic urbanism (Littke, 2016) and bioregionalism (Hes and Du Plessis, 2014), which espouse regenerative sustainability through planning affably with nature. It is through such relationships with the environment that Masdar City could succeed, if it wishes to adopt a more efficacious approach to sustainable development encompassing the social imperative.

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