`To what extent can 'sustainable development' be a guiding principle for how we need to approach the future of cities? Please critique the term 'sustainable development' and use example(s) to illustrate your argument.

Abstract

This paper addresses the sustainable development of a state-led project Masdar City in Abu Dhabi and examines to what extent Masdar city has achieved sustainability. In 2008 the government of Abu Dhabi created a sustainable development agenda Vision 2030 in response to the global trend of sustainable development and both domestic and international pressure, this agenda encompasses multiple dimensions of national development projects around the key concept of diversifying its oil-based economy and expanding green-tech industry, the Vision 2030 also recognize that urban development as an arena to move toward sustainability, under this agenda Masdar city was created as a flagship of Abu Dhabi's initiative toward sustainability, to become the first carbon-zero city in the world. However as both unexpected political and economic issues have negatively impacted the project, Masdar City has failed to achieve initial ambitious prospects, and the result of the sustainable development of the city has raised public concern and critique, this paper will examine how successful has Masdar city lived up to Abu Dhabi's Vision 2030 and is it sustainable by analyzing the development of the project and presenting results of its sustainable development.

Methodology

My arguments are built upon a collective of previous researcher's work, I appreciate the works from those researchers, especially Federico Cugurullo[1] and Laurence Crot[2], their work greatly helped me understand the geopolitical context of Abu Dhabi and the development of Masdar City, Both researchers had conducted fieldwork in Masdar City, hence I recognize their data, photos, interviews, and written materials as valid.

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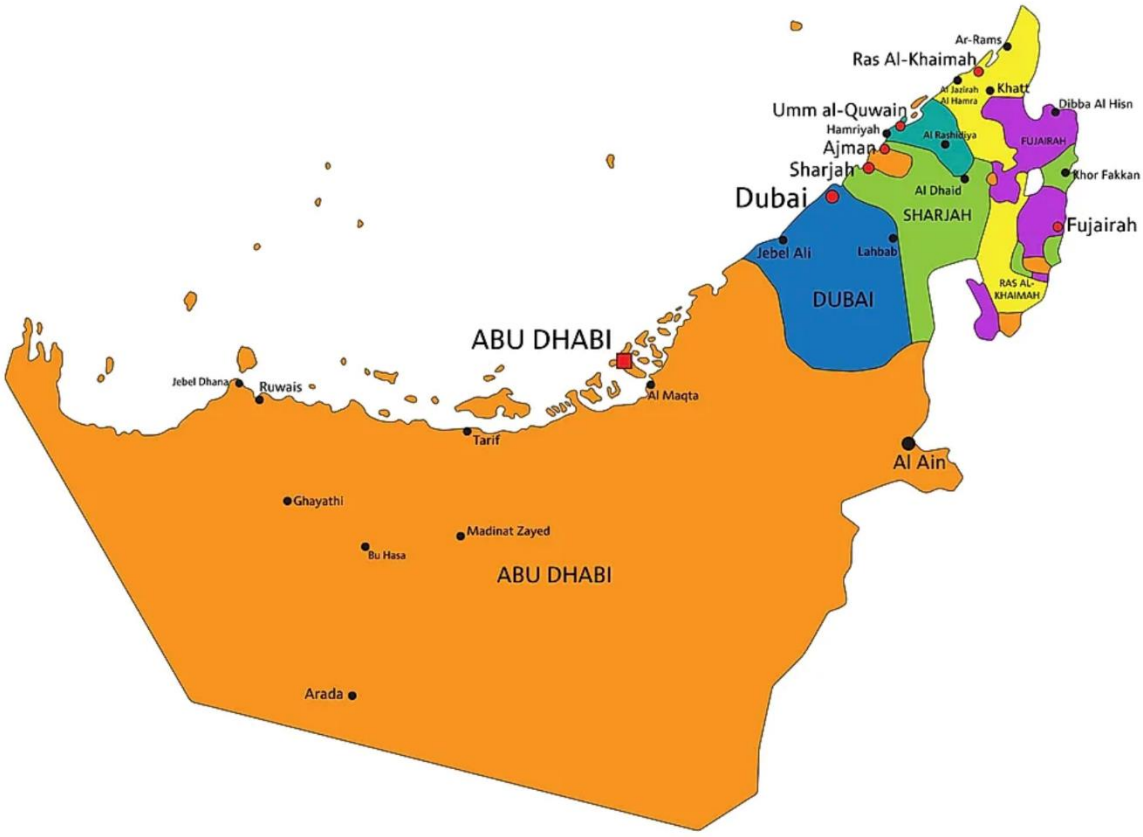
[1] Federico Cugurullo, an assistant professor in Smart and sustainable Urbanism at trinity college Dublin (TCD, 2019), his work 'Urban eco-modernisation and the policy context of new eco-city project: Where Masdar city fails and why' in 2016 and 'The business of Utopia: Estidama and the road to the sustainable city' had greatly contributed to my research.

[2] Laurence Crot is in the institute of geography, University of Neuchatel, Switzerland. (Crot 2013)

Masdar city: From Pero-urbanism to Urban Sustainability



Administrative divisions in UAE (WorldAtlas.com, 2023)

United Arab Emirates is sultanism country mixed with neo-patrimonialism,[3] the people give its ruler Sheik family unlimited power(Linz and Stepan, 1996; Cugurullo, 2016), Abu Dhabi is the largest and richest region in UAE, it has experienced rapid economic growth in the 70s due to its oil export business, the state-owned Abu Dhabi national oil company controls over 92 billion barrels of crude oil reserve, about 6% of total world oil reserve(OPEC 2021), making the state an average of 90 billion dollars per year (Abu Dhabi government 2008). With this tremendous profit from its oil industry, the state is able to support an extensive welfare system to provide a luxurious standard of living, securing endorsement, and popularity among the people (Crot 2013), therefore the Emirates

[3] Neo-patrimonialism defined by author Christopher Clapham of *The Nature of the Third World State* (1985), is a "...form of organization in which relationships of a broadly patrimonial type pervade a political and administrative system which is formally constructed on rational-legal lines", in this paper we will take the understanding of neo-patrimonial regime in Abu Dhabi as a system of social hierarchy where patrons use state resources to secure the loyalty of clients in the general population.

citizens have no incentives to go against the royal family as this might put their wealth at risk.

However, with a finite oil reserve, for a neo-patrimonial regime to retain its power in a post-oil era[4], many neo-patrimonial regimes have started to diversify their economy (Fasano and Iqbal, 2003), particularly in the investment on the renewable-energy industry and green-technology economy, this is a result of both political and economic pressures; In the latter half of the 20th century, as people started to realize the threat of climate changes and the importance of sustainability, given that UAE has one of the largest greenhouse gas emission per capita[5], externally the world is demanding Abu Dhabi to change its unsustainable lifestyle. Within the country, with a growing population receiving increasingly globalized ideas, which internally exerting democratization pressure on the government, the legitimacy of the regime, namely the Sheik family is facing an unprecedented situation, concluded by the ruling class, dictated by four key challenges, natural resource depletion, population growth, climate changes and Arab Spring (Curugullo 2016).

Within this context, previous researchers Albrecht and Schlumberger identify a set of four core principles to maintain stability in a neo-patrimonial regime (Albrecht and Schlumberger, 2004, pp. 375–376), this can be concluded in the following:

Elite change: Adapt economics and politics to Western standards.

Imitative institution-building: Establishment of Western-style institution.

Co-operation: Widen the regime's power and weaken opposition to the regime.

External influences and constraints: Transformation of threats to opportunities.

Despite all 4 principles could work in Abu Dhabi, two are directly in line with the adoption of environmental sustainability: imitative institution-building and External influences and constraints, both strategies are closely related, and Abu Dhabi could establish environmental agencies or institutions similar to the Western world, and also any related

[4] At current extraction rates, Abu Dhabi's oil reserves should last for another 90 years (Reiche, 2010).

[5] GHG emission per capita of UAE is 29.33kg in 2022, 7th highest emitter in the world, about 4 times the average EU27 countries. (EDGAR 2022)

engagement in sustainable development would strengthen the legitimacy of the regime. Therefore in 2008, the government of Abu Dhabi launched a long-term development agenda: vision 2030, which is constituted of two parts, the first part, Economic Vision 2030, focuses on developing a more sustainable economy, particularly on the diversification of the economy, and the second part: Urban planning Vision 2030, addressing Abu Dhabi's urbanization issue due to population growth and develop a new principle of urban development strategy which suits the emirate (Cugurullo, 2016).

There are many reasons why the Abu Dhabi regard the built environment as an arena to accomplish economic success and a future of sustainability, first we recognize the model of agglomeration economies[6], relocate people from over-congested cities or rural into a new urban area to generate more productivity and creativity, as discussed above Abu Dhabi is experiencing growing population issues, to prevent urban congestion, ineffective use of energy, and urban sprawling (Nystrom 1992), urban development and especial sustainable urban development is the antinode regarding to the context of Abu Dhabi (Cervero 2003)[7], under this circumstance, urban development is reflected in the Masdar initiative, the world's first truly sustainable city.

The confidence of the Abu Dhabi governments creating a carbon-zero city are supported by studies and theories from global network of researchers and urban planners, In the recent decades as more architects and urban planners realized the importance of implementing sustainability strategies in urban development, many principles or strategies has created; compact-city, New urbanism, smart growth, eco-city and ecological urbanism, those terms are often mixed used as the most concepts overlaps each other, but all of them shares similar concepts in approach to urban planning, those ideas not only address environmental issues, but also create a more economic and social friendly urban spaces, in conclusion those ideas include promotion of densely populated city, thus create more efficient public transport and resource allocation therefore reduces car-use, the buildings are designed to be a mix of commercial, business, and residential use, therefore makes the city more accessible by foot, creation of greenspace for better experience within the urban space, accommodate with various eco-friendly energies and advanced technologies

[6] Agglomeration economy suggest that the economy of a city is a result of urban cost and benefit, both scales with population (Combes et al 2011), the benefit of agglomeration are contributed by 3 main factors: input sharing, labour market and knowledge spillover (Rosenthal S. et al. 2020).

[7] Robert Cervero argues that to prevent urban spawl resulting waste of energy, ineffective land use and reduced social stability, a creation of compact city away from city centre would resolve this issue (Cervero, 2003)

both construction and operational energy can be low, and with use of passive house design, good insulation and sustainable materials, a net carbon-zero city is theoretically possible to achieve (Newurbanism.org, 2020).

This paper recognizes the impact of globalization on eco-city phenomena, eco-cities projects around the world have similar traits of ideas, architecture planning, and policy strategies, this is because the development of eco-cities is produced by a homogenous network of international engineers, architects, and urban planners, therefore cultivate a similar and consistent set of strategies in terms of approaching eco-city (Rapoport 2014a:4). Internationally speaking, Ecological modernization[8] appears to be a common sustainable development strategy used to develop eco-cities, as mentioned in a survey 'eco-cities are most often conceived of or delivered primarily in terms of technological innovations' (Joss et al., 2011: 4). Therefore, the sustainable development of Masdar city involves the heavy implementation of green-technology, such approach is perfectly in line with Vision 2030, provide opportunities for the growth of green-technology economy.

The Masdar City is designed heavily influenced by principles of ecological modernism and a compact city, with numerous technologies used and a densely populated city layout. The project was officially launched in May 2007 and ranges over an area of 6km2, 17km away from Abu Dhabi, the government expected Masdar City to entitle the world's first carbon-neutral, zero-waste, and car-free city. It is envisaged to become fully powered with renewable energies, with all waste recycled, and cars replaced by public transport and electric 'Podcars' known as personal rapid transit (PRT), Other sustainability features include reduced use of water, recycled grey water, reduced installed-power capacity, and urban planning adapted to the local culture and climate (Nader 2009).

[8] Ecological modernization theory contends that advancement in technological efficiency and adoption of market mechanisms would create economic competitiveness and environmentally benign outcomes (Dauda 2019).

Masdar city: The Interpretation of sustainable development

The interpretation of sustainability in Masdar City is a reflection of Vision 2030, the development of Masdar city follows the agenda set by Vision 2030, As mentioned before the economy of Abu Dhabi is based on the oil business, hence a clearer understanding of Vision 2030 under the context of the paper would be: development of additional economy sector, capable of sustaining the nation into a post-oil era, this objective is further translated into R&D in clean-energy technology and co-operation with multinational companies (Cugurullo 2016). Therefore sustainable developments are interpreted as financially viable and profitable, during an interview conducted by Cugurullo 2016 a spoke man from the Masdar initiative stated: '…the purpose of Masdar city is to make sustainability commercial'. As explained above this is achieved by developing and commercializing clean technologies via the city, during another interview, the manager of the project stated that behind every single step of the project, there are meticulous economic calculations and evaluations, so eventually nothing gets approved unless it is within the budget and remunerative, and this is why Masdar city is an example of 'sustainable urban development' (Cugurullo 2016). The city is designed to be an example of 'the future of all cities' this is commercially advertised to make revenue and expand the economic portfolio of Abu Dhabi. Therefore, as illustrated and explained, the interpretation of sustainable development in the case of Masdar city should be; developing and expanding renewable energy and green-technology economy via urban development.

Within this context, Masdar City is designed to be a clean-tech hub where emerging companies (e.g. Siemens, Schneider, and Mitsubishi) can establish cooperation and research centers to develop and launch new clean-teach products such as smart grid, photovoltaics, automated transport systems, and low carbon building materials, as the Masdar city will be implementing most of their sustainable technology product from those companies, therefore companies can assessing the performance of their new products in a real-life environment and build up competitive advantages over companies that test their product in traditional, indoor laboratories, also the Masdar city would become a showroom of their product as the flow of data is constant and companies can monitor their

prototypes in real-time (Curugullo 2016). Moreover, the establishment of the Masdar Institute of Science of Technology (MIST) Cooperating with the Massachusetts Institute of Technology (MIT) further consolidates Abu Dhabi's intention to attract foreign researchers and cultivates Abu Dhabi's own expertise in green technology (Luomi 2009; Nader 2009). Furthermore, to encourage international investors and companies to come to the city, Under Abu Dhabi law, the city of Masdar will be tax-free for all companies based in the city, 0% income and corporate tax. (Nader, 2009)

Under the guidance of Vision 2030, Masdar city has become an economic project rather than an urban development project, therefore when the Masdar plan was announced publicly in 2007, external voices have raised questions on the true intention of Masdar initiatives, the effort of branding Masdar as a 'sustainable city' by the government has been accused of greenwashing Abu Dhabi's unsustainable domestic lifestyle (Wigglesworth 2009). After the 2008 financial crisis, the true intention of Abu Dhabi's sustainable development shifted to diversify its economy, this is done by supporting a new economic sector making Masdar city a hub for international R&D and green-technology business. (Crot 2013;Luomi, 2015). In the Masdar initiatives, the term sustainability is extensively used to define the type of economic development, sustainable development has been capitalized on and became a new market to be economically exploited, it becomes a synonym for profitable and economically viable. Under such eco-political influences, the term sustainable development has been manipulated and translated into an economic development language to save Abu Dhabi's dilemma.

Masdar city: Development of the project

The development of Masdar City is led by Abu Dhabi's future energy company (ADFEC), owned by a state-owned co-operation called Mubadala Investment Company established by the Sheik in 2006, and the design and planning of the city are made by Foster and Partner. The Masdar initiative has committed to the 10 sustainability principles of the One Planet Living(OPL) program launched by WWF and BioRegional (WWF, 2008b), however the OPL schemes not only address environmental issues but also social issues, 5 of them contradict with Abu Dhabi's urban development in the past 40 years, and especially the principle number 9: Fair wages and working conditions for all workers, has been

concerning due to UAE's poor track record on the treatment of low skilled migrant workers. Therefore in 2010's brochure entitled' Why is Masdar City sustainable?' (ADFEC, 2010) the original OPL's program has been altered or avoided to accommodate local agendas and practices, and any reference to labour issues has been removed or vaguely mentioned, this issue not only concerns the social dimensions of Masdar's sustainability but also whether the project can be developed without further alterations.

The construction has experienced multiple issues, so far the initial master plan has been altered in several ways, and the project has fallen 4 years behind the anticipated completion of phase 1 in 2016, this is a consequence of multiple reasons, as with the 2008 financial crisis the government is no longer willing throwing money at the Masdar initiative, the government subsidies on renewable energies has not been approved until 2010 and now the project is expected to be commercially viable, as a result in an attempt to diffuse financial risks, the construction has been outsourced to a third party commercial developers, although the Masdar initiative remains the chief developer, however, it is unable to retain necessary oversight throughout the construction process to ensure compliances with sustainable principles. Secondly, due to confidence in technology at the beginning of master planning, some of the technology choices have been re-evaluated, further research suggests that the solar panel is 40 % less efficient due to local sandstorms, which is a primary energy source used in the construction of the city and groundwater desalination, therefore the city must import energy from off-site. Other than that, the sustainable transport design of the city including electrical vehicle PRT and mass transit networks such as railway and metro, has been either discarded or delayed. (Personal interview, 08 February 2010) (Crot,2013).

As mentioned in the previous chapter, the urban planning and technology of Masdar City is deeply intertwined with tech companies, developers, and investors, so the offices, infrastructure, and power systems are designed to accommodate them. For example, a company such as Siemens, their technology on smart grids (roof-mounted solar panels, meters, voltage regulators, sensors, optical fiber cables, automation systems, generators, and electrical substations) determines the structure and layout of Masdar city. This mode of urban development, where business and urbanism of the city are indistinguishable, leads the urban development of Masdar city to an ever-changing urban space, as the urban design constantly adapts to the agenda of business partners and the government's long-term goal, Vision 2030.(Cugurullo, 2016)

therefore, when an imported model is introduced into a new environment, it will be altered and adapted to the local agenda and rarely achieves what was meant to achieve, when western sustainable development was introduced to Abu Dhabi, what it meant to achieve

is that in urban development by implementing sustainable development principles, it can reduce energy and carbon footprint in a city, however, this scheme changes along with the undergoing of the project to comply with the Vision 2030 agenda, expanding a new sector of economy. This raises the question of whether this 'flexibility' of Masdar city development can commit to and comply with the world standard on sustainable development. Masdar city appears to be drifting away from its original aspiration of becoming the world's first truly sustainable city, as the city is now branded as 'carbon-neutral' rather than zero-carbon (Bsat 2010; Crot 2013)

Masdar city: The road to sustainability

The environmental aspect of sustainability in Masdar City is reflected in the practice and understanding of sustainable development, we will be demonstrating the sustainability aspect of the Masdar project from 3 perspectives, environmental, social, and economic, then at the end, I will demonstrate the financial result of Masdar city, to what extend has it achieved the governments expectation.

The economic aspect of Masdar city is questionable, the profitability of the project hasn't really paid off, at least not yet, And even the profitability of the city is concerning, considering that the budget for the project was $22Bn, then reduced to $19.8 Bn due to the financial crisis(worldconstrctionnetwork.com 2023 Oct), and the current resident population is around 5,000 people, which is roughly $5Mil investment per resident in Masdar city, and this inevitably raises a question, is it worth it? Furthermore, the economic benefit of Masdar city is solely concentrated on the small percentage of the population of Abu Dhabi, the revenue goes directly to the royal family and the native citizens, whereas the rest 85% of the migrants are left behind.

The economic success is reflected in the number of residents in the city, according to the director of Masdar's carbon management unit, the population of Masdar is expected to reach 40,000 in 2018, and when the city is complete there will be another 50,000 people commuting into the city(Nader, 2009), however in reality the population is only around 15,000 by 2023, with only 5,000 are resident, 10,000 commuting for work.

From a social perspective, the built environment has excluded the migrant workers, the city has been partitioned by a strict urbanistic rationale which leaves 80% of space for high-income workers and business partners, and the rest 20% is left for those vulnerable low-income workers, and there has little or attention to social housing. Other than this

unfair distribution of urban spaces, priority has been given to buildings for high-income workers. This socially unjust planning strategy in Masdar City would ultimately lead the project to the shorefront of public critique (Cugurullo, 2016).

The views on the environmental impact of the city are polarized, many people criticize the project for its huge carbon footprint and unsustainable energy source during the construction, but on the other side it has been proven that the practice of green technology and passive house design is capable of reducing energy consumptions and water usage, according to studies by Dan Zhu, et al in 2015, buildings in Masdar city use 54% less water and 56% less energy than conventional buildings, Masdar city implemented mix-use and low-rise buildings, and the buildings has been designed in several ways to implement the zero-energy system, 95% of the roofs have been installed solar panels, and 90% of the buildings have a green roof, and a great number of buildings have both. Those two components are used to generate electricity and regulate temperature[9], the solar panels are also used to provide shade, combined with the design of Masdar city where the buildings are designed to be close to each other, this allows more shading on the pedestrian, increasing thermal comfort for the residents (Dan Zhu, et al, 2015). However, it doesn’ t matter how environmentally sustainable one building is, if there is no one living in it, considering its low occupancy rate, it would still be seen as unsustainable.

According to the officials in Masdar, (Nader, 2009) all the power sources of the city are renewables, mainly solar power, Masdar city’s power infrastructure includes ranges of photovoltaic plants (PV), a concentrated solar thermal power plant (CSP), evacuated thermal tube collectors, and a waste-to-energy plant. The hot water is usually provided by PV, and on a hot day evacuated thermal tube collector is used to transport hot water generated by CSP to the demand. Moreover, geothermal heat has been tested as an optional power source in cold weather seasons. The power plants in Masdar city are connected to the national grid to save energy.[10] However, this is all vision that hasn’t been implemented, a planner from Foster and Partners stated that the city wouldn’t be able to sustain itself before the completion, so at this moment, Masdar city still relies on off-site energy sources. (Cugurullo, 2016) As of the most recent news, the city is set to be

[9] The transpiration process of plants suck in water absorbs surrounding thermal energy to release water as water vapour. (A-level Biology)

[10] When the power supply in a city produces more electricity than needed it gives excessive electricity to the national electricity grid, and when the power supply produces less than needed, the national grid feed back to the city, eventually save more energy.

completed in 2016, then, and now the target date has been pushed to 2030 (worldconstrctionnetwork.com 2023 Oct).

One of the most heavily criticized aspects of Masdar City is its water scarcity, Abu Dhabi is located in a region that suffers from water scarcity, over 90 % of the groundwater is salty and undrinkable, and the remaining isn't enough to support Abu Dhabi's growing population, thus Masdar city relies on a water purification process called desalination[11]. Furthermore, this process is planned to be powered by solar energy, but as explained above, the city is still in ongoing of construction, the energy used to power this process relies on off-site energy sources, ironically, driven by Abu Dhabi's oil (Cugurullo, 2016).

Has the development of Masdar city achieved what it intended to? The financial revenue of the project is hard to document as the economic benefits of Masdar initiatives are often diffused and entangled with other governmental projects. However, news released by the Abu Dhabi documents has suggested that the company Mubadala, which is responsible for the development of Masdar city, has signed a series of agreements with South Korea, Jordan, Morocco, France, and Japan to cooperate in research and development in green-technology and renewable energies (Luomi 2015). Furthermore, the Masdar initiatives have partnered with numerous global leading companies in the sustainable energy industry, such as Abengoa (Spain), SENER (Spain), DONG Energy (Denmark), E.ON (Germany), and Total (France),

During the year of 2009-2012. The UAE is ranked as the 11th largest market for solar PV cells, with a cumulative trade value of US$90.4 million (Luomi, 2015) and based on UN Comtrade (2013) statistics the UAE's trade flows of solar PV goods exceed US$71 million[12]. In terms of FDI[13], it is difficult to obtain the exact numbers which are related to green technology as they are mixed with other industries and businesses, but from a national level, UAE's total FDI outflow stood at t US$2.9 billion, and inflow of US$10.5 billion in 2013. Furthermore, the Masdar Initiatives had signed a US$125 million 50MW wind farm in Oman, Masdar is also developing a US$290 million 117 MW wind farm project

[11] Desalination: The process of removing salt, especially from sea water so that it can be used for drinking or irrigation. (Dictionary.com.)

[12] Trade flow (inport+export+re-export). Where 2US$28 million were imports and US$43 million.

[13] Foreign direct investment

in Jordan, and in cooperation with Saudi Arabia's Acwa Power and the New and Renewable Energy Authority of Egypt to build 2 GW of wind and solar power (Luomi, 2015),

The success of Masdar initiatives in sustainable development remains unclear, as we cannot judge its performance before the completion of the city, but at the current level the sustainable development performance of the city, we can say is far away from a Western standard of sustainable development, where an urban area integrates well beings of social, economic and environment. But from another perspective, the interpretation of sustainable development under the guidance of Vision 2030, as a strategy to diversify its economic portfolio, engage in R&D in green technology, and gain foreign investors and companies' attention, it had to an extent been successful.

Masdar city: Conclusion

In summary, we have explored the geo-political situation of Abu Dhabi, combined with the global trend moving toward sustainable development and both internal and external pressures, dictated by 4 major challenges, natural resource depletion, population growth, climate changes, and Arab Spring. In response to these challenges the government has proposed a long-term national strategic plan; Vision 2030, dedicated to diversifying its economy and investing in green technology and building Masdar City as a global leader in sustainable technologies. Then we have introduced that Abu Dhabi as a neo-patrimonial regime has an authoritarian nature, capable of exerting political pressure on urban development to achieve economic success. Under this pressure exerted by eco-political frameworks, the principles of the imported model of sustainable development have been altered to adapt to Vision 2030, therefore within this context the definition of sustainable development has been translated to a mode of economic development, the city is treated as a commodity, and the principle behind the urban development are not guided by sustainable design, but business and markets rules. In the end, we have demonstrated the result of this sustainable development, lack of incentives in environmental and social aspects of the city, and in terms of economic success, to an extent it had achieved something, but considering the whole project has a US$19.8 billion budget, we really must ask the question, it is worth it?

To conclude, when sustainable development is confronted with authorities in an authoritarian country the definition of sustainable development will be altered to adapt and fit to the intentions of the local authorities, therefore derailing away from its original purpose. However, the project of Masdar City has not been completed yet, maybe under

this ecological-modernization urban development plan, 20-30 years later, the city could make some technical or scientific advancements in sustainable development, and the city may become a socially approachable, environmentally friendly, and economic just city, and truly became a model city of the future.

Masdar city: References

Abu Dhabi Government (2008) Economic Vision 2030. Available at: http://gsec.abudhabi.ae/Sites/GSEC/Content/EN/PDF/Publications/ economic-vision-2030-full-version,property=pdf. pdf (accessed 03 January 2014).

ADFEC (Abu-Dhabi Future Energy Company) (2010) Why is Masdar City sustainable? ADFEC, Abu Dhabi.

Albrecht, H. and Schlumberger, O. (2004) 'Waiting for Godot': regime change without democratization in the Middle East, International Political Science Review, 25(4), pp. 371–392

Bsat, S. (2010) Masdar 2009 headlines, in: T. Reisz (Ed.) Al Manakh Continued, p. 243. Amsterdam: Stichting Archis.

Cervero, R. (2003). Growing Smart by Linking Transportation and Land Use: Perspectives from California. *Built Environment*, 29(1), pp.66–78. doi:https://doi.org/10.2148/benv.29.1.66.53948.

Crot, L. (2013). Planning for Sustainability in Non-democratic Polities: The Case of Masdar City. *Urban Studies*, 50(13), pp.2809–2825. doi:https://doi.org/10.1177/0042098012474697.

Clapham, C.S. (1985). *Third World Politics*. Univ of Wisconsin Press.

Combes, P.-P. ., Duranton, G. and Gobillon, L. (2010). The identification of agglomeration economies. *Journal of Economic Geography*, 11(2), pp.253–266. doi:https://doi.org/10.1093/jeg/lbq038.

European Commission (2022). *EDGAR - The Emissions Database for Global Atmospheric Research*. [online] edgar.jrc.ec.europa.eu. Available at: https://edgar.jrc.ec.europa.eu/report_2022.

Fasano, U. and Iqbal, Z. (2003) GCC countries: from oil dependence to diversification. International Monetary Fund, New York.

Joss S, Tomoseiu D and Cowley R (2011) Eco-cities – A global survey 2011. Available at: http://www.westminster.ac.uk/?a=119909 (accessed 03 January 2014).

Linz JJ and Stepan AC (1996) Problems of Democratic Transition and Consolidation: Southern Europe, South America, and Post-communist Europe. Baltimore, MD: Johns Hopkins University Press

Luomi, M. (2009). Abu Dhabi's Alternative-Energy Initiatives: Seizing Climate-Change Opportunities. *Middle East Policy*, 16(4), pp.102–117. doi:https://doi.org/10.1111/j.1475-4967.2009.00418.x.

Luomi, M. (2015). The international relations of the green economy in the Gulf : lessons from the UAE's state-led energy transition.

Masoud Dauda (2019). Ecological Modernization Theory and Sustainable Development Dilemmas: Who benefits from technological innovation? 46(1), pp.68–83.

Nystrom, J. (1992). The Cyclical Urbanization Model. A Critical Analysis. *Geografiska Annaler. Series B, Human Geography*, 74(2), p.133. doi:https://doi.org/10.2307/490569.

Newurbanism.org. (2020). *Urbanism Principles*. [online] Available at: http://www.newurbanism.org/newurbanism/principles.html.

Nader, S. (2009). Paths to a low-carbon economy—The Masdar example. *Energy Procedia*, 1(1), pp.3951–3958. doi:https://doi.org/10.1016/j.egypro.2009.02.199.

OPEC (2017). *OPEC : United Arab Emirates*. [online] Opec.org. Available at: https://www.opec.org/opec_web/en/about_us/170.htm.

Reiche, D. (2010). Renewable Energy Policies in the Gulf countries: A case study of the carbon-neutral 'Masdar City' in Abu Dhabi. *Energy Policy*, 38(1), pp.378–382. doi:https://doi.org/10.1016/j.enpol.2009.09.028.

Rosenthal, S.S. and Strange, W.C. (2020). How Close Is Close? The Spatial Reach of Agglomeration Economies. *Journal of Economic Perspectives*, 34(3), pp.27–49. doi:https://doi.org/10.1257/jep.34.3.27.

Rapoport E (2014a) Globalising sustainable urbanism: The role of international master-planners. Area 47(2): 110–115.

www.tcd.ie. (n.d.). *Federico Cugurullo'Trinity Research - Trinity College Dublin*. [online] Available at: https://www.tcd.ie/research/profiles/?profile=cugurulf.

Wigglesworth, R. (2009) Paradise built— Masdar, Financial Times, 20 March.

WWF (World Wildlife Fund) (2008a) Living Planet Report. Gland: WWF.

WorldAtlas. (n.d.). *The United Arab Emirates Maps & Facts*. [online] Available at: https://www.worldatlas.com/maps/united-arab-emirates.

Worldconstructionnetwork.com. (2024). Available at: https://www.worldconstructionnetwork.com/projects/masdar-city-uae-zero-carbon/f [Accessed 25 Apr. 2024].

Zhu, D. , Kung, M. and Zhou, L. (2015) Analysis of Sustainable Energy Systems in Ecovillages: A Review of Progress in BedZED and Masdar City. *Low Carbon Economy*, **6**, 1-6. doi: 10.4236/lce.2015.61001.