

Measuring Abu Dhabi's liveability using the global liveable city index (GLCI)

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Abu Dhabi's
liveability

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Khee Giap Tan and Sujata Kaur

*Asia Competitiveness Institute, Lee Kuan Yew School of Public Policy,
National University of Singapore, Singapore, Singapore*

Abstract

Purpose – The purpose of this paper is to use a newly developed Global Liveable Cities Index (GLCI), to assess how Abu Dhabi ranks among global cities. The paper sheds some light on the strengths and weaknesses associated with the city's emergence as a global city, as identified by the index.

Design/methodology/approach – This paper makes use of a new measure of liveability – the GLCI – to rank the world's major cities. The GLCI advances the measurement of the "Liveability" construct by taking into account the multi-dimensional sensibility of diverse groups of ordinary persons across 64 cities. The paper also conducts policy simulations to help aid city planners invest in areas with low scores in the GLCI.

Findings – The results from the analysis show Abu Dhabi as a city that has a lot more potential than what most conventional city benchmarking exercises have revealed. It is a city with immense potential in the region by not just being the driver of growth but also being a nodal center for attraction of global talent. It is fast growing into a city of opportunity and already satisfies the characteristics of an emerging global city with a lot of regional attention. The empirical results also find that its potential has been clearly under-rated by many existing studies and indices primarily because of their narrow scope in measuring liveability. The GLCI results brought together multiple indicators to devise an index that is strongly based on a combination of analytical and philosophical values. Taking stock of the rankings of Abu Dhabi using the GLCI so far as well as the policy simulations, one can conclude that Abu Dhabi has multiple strengths as an aspiring global city. The results also indicate that one area that has been consistently identified as lacking in Abu Dhabi is that of environmental sustainability.

Originality/value – While cities have always played a historic role in powering economic growth in some form or the other, the scale of expansions and the speed at which it is happening today appears unprecedented. While a considerable number of indices benchmarking cities exist, they are rather narrow in scope. None of them model liveability from the perspective of an ordinary person with multi-dimensional sensibilities toward issues like economic well-being, social mobility, personal security, political governance, environmental sustainability and aesthetics for a more representative coverage of major cities around the world. These factors are critical measures of "liveability" of a city that in turn elevates it to the status of a global city. This paper thus makes an original contribution to the literature on understanding global cities by applying a newly developed GLCI to assess how Abu Dhabi ranks among global cities. The paper sheds some light on the strengths and weaknesses associated with the city's emergence as a global city, as identified by the index.

Keywords Abu Dhabi, Liveability, City benchmarking, Economic competitiveness

Paper type Research paper



1. Motivation and literature

A central feature of rising urbanization in the last few decades has been the growing significance of cities as a locus of economic activity. With globalization leading to the intensification of cross-border mobility not just of goods and financial capital but also of labor and human talent, there has also been a marked rise in interconnectivity among cities, primarily due to advancements in transportation and telecommunication technology.

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A combination of attractive infrastructure and supporting regulatory environments has helped cities compete for global talent, resources and capital, positioning themselves as a platform for innovations to occur and ideas to grow.

There has been a burgeoning academic literature following the influential contributions of Florida (2002) that has recognized cities as the primary drivers of innovation and economic growth[1]. Globally, several urban centers have emerged as the hubs of creativity and innovation as they attract the best and brightest minds, fostering creative thinking and expression (Landry, 2000). Thus global cities, by being home to “the creative class” (Florida, 2002), consistently compete to attract the best human talent to become hubs of creativity and innovation that in turn generate economic growth. As Florida (2002) further notes, cities are propelled by the amalgamation of diverse and talented individuals, driven largely by the employment opportunities and educational facilities that they offer. Notwithstanding the benefits of exogenous factors such as strategic location endowments and path dependence from historical industrial developments, urban centers offering higher quality services become more prosperous.

While cities have always played a historic role in powering economic growth in some form or the other, the scale of expansions and the speed at which it is happening today appears unprecedented. The process of globalization has paved the way for the emergence of what has been referred to as the “global cities.” Subsequently, there has been a surge in the literature on global cities particularly since the mid-1980s. The emphasis of this growing literature has been on the rise of these cities to their “global status” primarily on account of the high concentration of the world’s financial and other related industries in those cities – a by-product of rapidly increasing economic and financial globalization of the world economy (Ancien, 2011).

Despite the proliferation of papers on this subject, it is still difficult to exactly define what a global city is. However, a broadly accepted definition based on a common theme that runs through the various papers suggests that a global city is one that is “[...] in a position to realize the economic coordination of complex activities at a global scale” (Bourdeau-Lepage and Huriot 2006, p. 1), with the emphasis being on the coordination function, which is deemed a major feature of global cities. It is by fulfilling that role of coordination that these cities differentiate themselves from the rest and gain their strategic position in the global economy (Bourdeau-Lepage and Huriot, 2006). In one of the well-cited works in the field, Sassen (2005) succinctly summarizes what a global city is:

Global cities around the world are the terrain where a multiplicity of globalisation processes assume concrete, localised forms. These localised forms are, in good part, what globalisation is about. Recovering place means recovering the multiplicity of presences in this landscape. The large city of today has emerged as a strategic site for a whole range of new types of operations – political, economic, “cultural,” subjective. It is one of the nexi where the formation of new claims, by both the powerful and the disadvantaged, materialises and assumes concrete form (p. 40).

In short, global cities act as key nodal points in the organization of the world economy as well as serve as prime and strategic locations and marketplaces as well as a production sites for leading finance and specialised industries, including the “production of innovations” (Sassen, 1994, p. 4).

In addition, one can also relate to how the “quality of place” argument a la Florida (2002) matters in the context of a city establishing itself as a global city. Florida (2002)’s original theory of creative class emphasized on three “Ts” of economic development encompassing technology, talent and tolerance, which are essential ingredients of the

“creative class” that form the cities. In addition to these three Ts, it is also argued that “territorial assets” play a role in defining the attractiveness of a city (Florida, 2012).

Examples of global cities today span a variety of continents. Most of the literature has focussed on the traditional mega cities in developed countries such as New York, London, Tokyo, etc. However, there is increasing recognition among both the theorists in the field of urban studies, as well as other large reputable organizations that engage in ranking global cities, for the need to include a host of other major cities from emerging economies in Asia-Pacific region and elsewhere.

Among the growing list of cities from the Asian region such as Hong Kong and Singapore, one city that appears to have attracted a lot of attention over the last decade in the context of rapidly emerging global cities and impressive economic performance is Abu Dhabi (Abu Dhabi Council for Economic Development, 2012). A variety of indices have included and ranked Abu Dhabi as one of the emerging global cities of importance on the basis of multiple indicators. For instance, the KPMG's (2013) global cities investment monitor included Abu Dhabi in the list of top 25 cities in the world for greenfield foreign direct investment. Abu Dhabi also enjoys a strong image as an attractive destination, being ranked as number 6 out of 132 global tourism hotspots by mastercard's global destinations index 2013 (Hedrick-Wong and Choog, 2013).

One of the most recent attempts to measure the degree and quality of innovation in Abu Dhabi was reflected in the “Abu Dhabi Innovation Index” (Department of Economic Development, 2014). The results of this index revealed that relative to other similar economies that are natural resources dependent, Abu Dhabi featured as a highly efficient city in terms of “the adoption and positioning of knowledge, new technologies, products and services across its entire economy” (Wam, 2014).

However, interestingly, existing broader measures on liveability and quality of life are not as positive about Abu Dhabi. While the Economist Intelligence Unit's (2011) global liveability index ranks the Emirate above average at 39 in the list of 120 potential “hotspots” of 2025, Mercer's (2012) quality of living index places Abu Dhabi at 78 out of 221 cities. Abu Dhabi does not even figure in the top 66 cities ranked by AT Kearney (2012) global cities index which ranks 66 leading global cities from around the world. Along similar lines, the Foreign Policy (2012) global city index in its projections for the most dynamic regions in 2025 ranks Abu Dhabi around only 65 out of 75 cities[2].

While there exist a considerable number of indices on various city benchmarks (competitiveness, cost of living, investment attractiveness, etc.), they are rather narrow in scope (see Tan *et al.*, 2012 for elaboration). None of them model liveability from the perspective of an ordinary person with multi-dimensional sensibilities toward issues like economic well-being, social mobility, personal security, political governance, environmental sustainability and aesthetics for a more representative coverage of major cities around the world (Tan *et al.*, 2012). These factors are critical measures of “liveability” of a city that in turn elevates it to the status of a global city. Thus, taking into account these factors listed above, the Global Liveable Cities Index (GLCI) offers a unique index that could be highly useful for policy making[3]. In this context, the focus of this paper is on how Abu Dhabi ranks among global cities as measured by the GLCI. As elaborated above, in light of the rising importance of Abu Dhabi by various metrics coupled with the fact that the “popular” indices in the literature fall short of adequately capturing the dynamics of the city in a holistic way, the case for an interesting case study from a policy point of view to test the usefulness of the GLCI arises, which is what this paper is interested in doing. In the process, this paper sheds some light on the strengths and weaknesses associated with the city's emergence as a global city, as identified by the index.

The remainder of paper is as follows. Section 2 introduces the GLCI and discusses the analytical and philosophical basis of the index. Section 3 details the methodology and assumptions of the paper. Section 4 discusses the empirical findings by explaining the ranking results and where Abu Dhabi is placed and why, i.e. strengths and weaknesses. Particular focus is also given to comparing Abu Dhabi relative to other Asian counterparts like Shanghai, Beijing, Taipei and Kuala Lumpur. The section also details the policy simulation exercise that was undertaken, with an elaboration of the methodology and assumptions of the simulation. The simulation specifically focus on the “what if” question, namely, what if Abu Dhabi was able to improve its bottom 20 percent indicators. The final section concludes with a summary and policy options going forward. The data sources used in the construction of the GLCI is summarized in the Appendix.

2. Liveability and the GLCI

“Liveability” is one of the key characteristics of cities that enables them to attract a disproportionate amount of globally mobile resources (such as talents, high net worth individuals, investors, innovators, entrepreneurs and capital) recognized to make positive contributions to economic growth, economic resilience, global political influence, world agenda-setting power, socio-cultural innovation and international lifestyle impact. As competition among cities is considered as strategic as competition between nations, the city that fares well in this competition becomes an epicenter for advanced economic and cultural activities while those that lack the required standards of competitiveness shrink economically and become irrelevant (Tan *et al.*, 2012, 2016).

Thus the growing popular interest in the liveability of cities (examples of bestsellers on cities in the last two decades are Sassen, 1991 and Glaeser, 2011) has also led to an increasing desire to rank the liveability of cities that will help policy makers frame appropriate policies. The accelerated globalization has also reinforced our understanding that the agglomeration of activities by cities constitutes powerful growth engines. In the words of Glaeser (2011) “cities magnify humanity's strength” as they improve enable socio-economic mobility by creating opportunities, and inducing innovation by easing face-to-face engagements. An increasing recognition of the importance of global competition among cities in attracting all forms of capital has also been acknowledged by the Organization for Economic Cooperation and Development (2007) in its Competitive Cities Report and is also reflected in the growing popularity of city benchmarking as well, of which notions of liveability form an important – yet under-researched – component.

2.1 Liveability and the GLCI

The concept of “liveability” has to be multi-dimensional in the same way that human nature is. We propose here to capture the multi-dimensional character of liveability by using five themes to operationalize the measurement of liveability. These five themes have their theoretical basis in social sciences, humanities and natural philosophy; and they have their empirical validation in the policies of outstanding political leaders. The five themes are as follows:

- Theme 1.* The degree of satisfaction with “the freedom from want[4].” “Freedom from want” captures the right to a decent livelihood. More broadly, this theme emphasizes people's craving for creature comforts (material abundance). The degree that this craving is satisfied is, in large part, determined by the income level and the growth rate of income: two issues that are central to the field of economics.

Theme 2. The degree of satisfaction with the state of the natural environment and its management. This theme captures not only the desire of people for responsible stewardship of the environment for the welfare of future generations but also the aesthetic appreciation of nature by people. Furthermore, biological survival of the human species requires that the selfish gene in the human species restrains itself adequately because of the inter-connectedness of life across species.

Theme 3. The degree of satisfaction with “the freedom from fear.” This theme captures the natural right of people to live in safety through the maintenance of law and order, the alleviation of natural disasters, and the prevention of wars by the state. The absence of such psychological pressures in a city increases its liveability in the same way that an improvement in the economic prospects of a city increases its liveability.

Theme 4. The degree of satisfaction with the socio-cultural conditions. For a city, this theme stresses: the social comfort of living there (e.g. degree of income inequality, social harmony and social mobility); the physical ease of living there (e.g. adequacy of mass transit, healthcare and education); and the cultural richness of living there (e.g. amount of social diversity, acceptance of different religious beliefs, and access to museums and cultural performances)[5].

Theme 5. The degree of satisfaction with public governance. This theme covers the effectiveness of the government in providing public services (e.g. extent of corruption and quality of judiciary system); the responsiveness of the government (e.g. degree of transparency and accountability); and the openness to political participation (e.g. existence of organized opposition, regular elections, cleanness of elections, fairness of elections)[6].

Thus to be compatible with the literature on the liveability of cities, Tan *et al.* (2012) have used:

- “Economic Vibrancy and Competitiveness” and “Freedom from Want” interchangeably;
- “Environmental Friendliness and Sustainability” and “The State of the Natural Environment and Its Management” interchangeably;
- “Domestic Security and Stability” and “Freedom from Fear” interchangeably;
- “Socio-Cultural Conditions” in the sense we have defined above; and
- “Public Governance” in the sense we have defined above.

To provide comprehensive coverage of the major cities for all continents, the cities selected for the computation of their GLCI values are: the mega cities (cities with population exceeding ten million inhabitants), the major cities in most of the developed countries; and the major cities in most of the important emerging countries. In total, 64 global cities are included in the GLCI, of which 36 are Asian cities. Data unavailability for most of the practical indicators was the reason for the exclusion of some major cities in the study. The entire sample of global cities chosen for the study as well as the list of Asian cities is provided in Tables AI and AII.

Each of the five categories above is based on a number of sub-components and indicators. While the number of sub-components varies for each main category, the aggregate score for each main category is given an equivalent weighting, namely, 20 percent of the GLCI. Identical weights are assigned to each category as they represent equivalent significance to the computation of the GLCI. This method is repeated and applied consistently across all the cities to ensure precision of the rankings. The sub-components and data sources are listed in the Appendix[7].

2.2 How is GLCI different?

While a considerable number of indices on city benchmarks already exist in the literature, none of them model liveability from the perspective of an ordinary person with multi-dimensional sensibilities toward issues like economic well-being, social mobility, personal security, political governance, environmental sustainability and aesthetics for a more representative coverage of major cities around the world. The GLCI offers one such index which could be highly useful for policy making.

The existing major city indices can be divided into two groups: first, those that value highly the cities with economic-financial prowess, and strong global agenda-setting power in political and cultural matters; and second, those that value highly the cities with pleasant living in mild climate, scenic locations. The GLCI has been able to combine these two aspects by focussing more on the multi-dimensional needs of the working professionals. The ordinary-resident's-perspective approach of GLCI makes it substantially different from exiting liveability indices noted above. GLCI explicitly takes into account a comprehensive list of the everyday concerns of the ordinary household: the maintenance of law and order, the availability of affordable healthcare, the average quality of the public school system, the accessibility to tertiary-level training and the adequacy of the mass transit infrastructure.

The implicit ethical values of a balance between work and play, and of a balance between thinking globally and acting locally are values which we are comfortable in advocating to any city, and which we think most people could accept. By spelling clearly the construction of GLCI and by selecting a wide range of indicators that are moderately easy to access, we have enabled a city that wishes to promote this kind of lifestyle to achieve it by investing in the areas identified as the low-score components of its GLCI ranking.

3. Research methodology

A step-by-step description of the ranking process of the GLCI is described below for N cities, M practical indicators and C categories, with each category comprising S sub-categories.

Algorithm 1: Ranking Methodology:

- (1) Compute the mean value of practical indicator j ($j = 1, \dots, M$):

$$\bar{X}_j = \frac{1}{N} \sum_{i=1}^N X_{ij}$$

where X_{ij} represents the value that city i ($i = 1, \dots, N$) takes for practical indicator j .

- (2) For each practical indicator j ($j = 1, \dots, M$), calculate its standard deviation:

$$SD_j = \sqrt{\frac{1}{N} \sum_{i=1}^N (X_{ij} - \bar{X}_j)^2}$$

- (3) Compute the standardised value of indicator (SVI) that each city i ($i = 1, \dots, N$) takes under each of the practical indicators j ($j = 1, \dots, M$):

$$SVI_{ij} = \frac{X_{ij} - \bar{X}_j}{SD_j}$$

- (4) Compute the “ranked” standardised value of indicator (RSVI) that each city i ($i = 1, \dots, N$) takes under each of the practical indicators j ($j = 1, \dots, M$):

$$RSVI_{ij} = \begin{cases} SVI_{ij}, & \text{if a lower value is better} \\ -SVI_{ij}, & \text{if a higher value is better} \end{cases}$$

- (5) For each of the practical indicators j ($j = 1, \dots, M$), a ranking can be obtained for cities: cities with a lower value of RSVI for indicator j are ranked ahead of those with a higher value.
- (6) For each city i ($i = 1, \dots, N$), calculate the RSVI for each sub-environment k ($k = 1, \dots, S$) belonging to environment l ($l = 1, \dots, C$):

$$RSVI_{i,lk} = \frac{1}{y_{lk}} \sum_{p=1}^{y_{lk}} RSVI_{i,j_{lk,p}}$$

where y_{lk} is the total number of practical indicators under sub-category k of category l and $RSVI_{i,j_{lk,1}}, \dots, RSVI_{i,j_{lk,y_{lk}}}$ are the RSVIs for city i that make up sub-category k of category l .

- (7) For each city i ($i = 1, \dots, N$), calculate the RSVI for each category l ($l = 1, \dots, C$):

$$RSVI_{i,l} = \sum_{k=1}^S RSVI_{i,lk}$$

where $RSVI_{i,1}, \dots, RSVI_{i,S}$ are the RSVIs for the S sub-categories under each category l .

- (8) Overall rank score of city i ($i = 1, \dots, N$):

$$R_i = \frac{1}{C} \sum_{l=1}^C RSVI_{i,l}$$

where cities with a lower R_i are ranked ahead of those with higher value of R_i , and the city with the lowest R_i is the most liveable city.

Step (5) of Algorithm 1 provides the ranking of each city for each individual practical indicator. To achieve this ranking, Step (4) of Algorithm 1 adjusts the value of

the SVIs so that a lower value will lead to a better ranking in terms of “liveability.” Depending on the nature of the indicator in question, a higher or lower value may reflect a more “liveable” city. Take for instance the practical sub-indicators “1.1.1 GDP” and “1.1.5 Unemployment Rate.” A higher GDP but a lower “unemployment rate” suggest better economic performance, which makes a city more “liveable.” In most cases where a higher value is better (e.g. GDP), the negative of the SVIs of cities are considered, and those with a lower “negative SVI” will have a better ranking. However, for indicators where the inverse is true (e.g. unemployment rate), the SVI itself is compared between cities and a lower SVI value will lead to a better ranking. Step (4) of Algorithm 1 thus seeks to make all standardises values of all practical indicators consistent for ranking purposes.

Step (6) of Algorithm 1 determines the sub-category rankings of each city. The average RSVI of all the indicators in the sub-category are calculated and compared to other cities. Cities with a lower average RSVI rank better in the sub-category. Similar to WCY, unavailable data for a particular city is replaced by the average of existing data within the sub-category. This fixes the weight of the sub-category independently of the number of criteria contained, so that each sub-category has an equal impact on the overall ranking. To arrive at the city ranking for each category, the RSVIs of the sub-categories are aggregated as detailed by Step (7) of Algorithm 1. Finally, Step (8) of Algorithm 1 requires the RSVI values of each category to be totaled to determine the overall ranking of the city. Cities with a lower RSVI are ranked ahead of those with a lower RSVI.

As noted earlier, each category has been given equal weight. Mathematically, this can be illustrated as follows:

$$\begin{aligned} \text{Global Liveable Cities Index} = & 20\% \times (\text{Economic Vibrancy and Competitiveness}) \\ & + 20\% \times (\text{Environmental Friendliness and Sustainability}) \\ & + 20\% \times (\text{Domestic Security and Stability}) \\ & + 20\% \times (\text{Socio – Cultural Conditions}) \\ & + 20\% \times (\text{Political Governance}) \end{aligned}$$

4. How liveable is Abu Dhabi?

The GLCI presents a comprehensive framework, which has a strong philosophical as well as analytical basis to measure the liveability quotient of a global city. We use the GLCI described in Section 3 to generate the rankings for Abu Dhabi and understand how it performs relative to other global cities in the world.

4.1 Abu Dhabi’s rankings in the GLCI

The GLCI finds that the top ten cities in their overall index ranking of 64 countries always hail from the European region, which is broadly consistent with the overwhelming focus of the larger literature on global cities. However, there are five Asian cities that find a place among the top 20 cities. They are Singapore, Hong Kong, Osaka-Kobe, Tokyo and Yokohama. While Abu Dhabi does not enter the top 20 in terms of any of the indicators, the GLCI ranks Abu Dhabi right at the middle of the pack at no. 32, with a score of 32 in the overall ranking of all 64 cities (Table I). However, a disaggregated picture clearly reveals much more than what is seen at the overall level.

In terms of economic vibrancy and competitiveness the city ranks 28 with a score of 29.61. It stands at 24 for two indicators – domestic security and stability as well as socio-cultural conditions. It is important to underline this point because many indices that were already mentioned above have touched upon the issue of Abu Dhabi having a greater socio-cultural environment with abundant opportunities for employment, in addition to being a very safe city. But none of them have been integrated in the way the GLCI has and upon doing so, the results are much stronger than before.

On the flip side is Abu Dhabi's rather disappointing performance when it comes to environmental friendliness and sustainability. This category has been a problem across the board in Asia for other cities as well as evident from the rankings of the GLCI – only three Asian cities enter the top 20 ranking – Tokyo (13th position), Singapore (14th position) and Osaka-Kobe (16th position). In similar vein, for the category "Political Governance," Abu Dhabi takes the 38th position. The overall rankings and scores of all the 64 global cities included in the sample study are provided in Table II just to facilitate overall comparison of the aggregate rankings.

4.2 Asian liveable cities ranking

A more detailed comparison of these indicators with its other counterparts in Asia would help us put things in perspective (Table III). When only the 36 Asian cities are included, the top five cities are Singapore, Hong Kong, Auckland, Sydney and Melbourne. Abu Dhabi is ranked well above average at 13. The high levels of vibrancy and competitiveness that the city possesses is also reflected in its performance in two categories, namely, socio-cultural conditions (ranked 6 below Singapore, Tokyo, Osaka-Kobe, Yokohama and Hong Kong) and domestic security and stability (ranked 12). All this is broadly consistent with what was observed earlier in the entire sample.

It is useful to keep in mind that Abu Dhabi's relatively high rank (6) in terms of socio-cultural conditions comes largely from the fact the city is a melting pot of different cultures. Data from the population census indicate that Abu Dhabi hosts roughly 200 different nationalities and ethnicities (Abu Dhabi Population Census, 2011). By the same token, Abu Dhabi's significant investments in domestic security and stability, as reflected in the fact that more than 80 percent of UAE's total military manpower and defense budget comes from Abu Dhabi (Foley, 1999) places them very highly among its Asian counterparts on the security and stability indicator (ranked 12). Thus, socio-cultural conditions as well as domestic security and stability complement each other and Abu Dhabi has excelled on both counts.

However, as mentioned before, the most problematic indicator, even within the region, for Abu Dhabi is in terms of "environment friendliness & sustainability." This is a cause for concern. This said, these problems seem to exist for several Asian global

Indicator	Overall liveability	
	Ranking	Score
Overall	32	32.00
Economic vibrancy and competitiveness	28	29.61
Environmental friendliness and sustainability	46	35.73
Domestic security and stability	24	27.10
Socio-cultural conditions	24	23.54
Political governance	38	33.62

Table I.
Ranking of Abu
Dhabi in GLCI

Table II.
Overall ranking for
64 global cities

		Overall liveability				Overall liveability	
City	Region	Score	Rank	City	Region	Score	Rank
Geneva	Europe	3.40	1	Kuala Lumpur	Asean	32.00	32
Zurich	Europe	4.60	2	Rome	Europe	34.00	34
Singapore	Asean	5.60	3	Amman	Mid East	36.60	35
Copenhagen	Europe	7.00	4	Jerusalem	Asia	37.00	36
Helsinki	Europe	7.00	4	Sao Paulo	South America	43.40	37
Luxembourg	Europe	7.80	6	Riyadh	Mid East	44.00	38
Stockholm	Europe	8.20	7	Shanghai	Asia	45.00	39
Berlin	Europe	11.20	8	Nanjing	Asia	45.20	40
Hong Kong	Asia	11.20	8	Bangkok	Asean	45.80	41
Auckland	Oceania	11.60	10	Shenzhen	Asia	45.80	41
Melbourne	Oceania	11.60	10	Ahmedabad	Asia	46.00	43
Sydney	Oceania	12.00	12	Cairo	Mid East	46.00	43
Paris	Europe	12.40	13	Tianjin	Asia	47.40	45
Vancouver	North America	16.20	14	Beijing	Asia	47.80	46
Amsterdam	Europe	16.80	15	Chennai	Asia	48.20	47
Osaka-Kobe	Asia	17.80	16	Guangzhou	Asia	48.20	47
New York	North America	18.20	17	Pune	Asia	48.20	47
Tokyo	Asia	18.60	18	Mexico City	North America	48.40	50
Los Angeles	North America	18.80	19	Damascus	Mid East	48.60	51
Philadelphia	North America	21.40	20	Chongqing	Asia	48.80	52
Yokohama	Asia	21.40	20	Hanoi	Asean	48.80	52
Boston	North America	21.60	22	Ho Chi Minh City	Asean	48.80	52
London	Europe	21.60	22	Bangalore	Asia	49.00	55
Chicago	North America	22.40	24	Mumbai	Asia	49.00	55
Washington DC	North America	22.80	25	Delhi	Asia	50.20	57
Barcelona	Europe	23.20	26	Buenos Aires	South America	50.60	58
Taipei	Asia	24.00	27	Istanbul	Mid East	52.20	59
Prague	Europe	25.80	28	Karachi	Mid East	53.00	60
Seoul	Asia	26.20	29	Phnom Penh	Asean	53.80	61
Madrid	Europe	27.00	30	Moscow	Europe	55.20	62
Incheon	Asia	27.40	31	Manila	Asean	56.60	63
Abu Dhabi	Mid East	32.00	32	Jakarta	Asean	57.40	64

Table III.
Ranking of Abu
Dhabi in GLCI
in Asia

Indicator	Overall liveability	
	Ranking	Score
Overall	13	15.60
Economic vibrancy and competitiveness	16	15.96
Environmental friendliness and sustainability	25	17.93
Domestic security and stability	12	13.10
Socio-cultural conditions	6	11
Political governance	19	15.15

cities as well, including Hong Kong, which have otherwise excelled in every other indicator[8]. However, within the Asian cities, Singapore ranks second in terms of environmental friendliness and sustainability (at the global level it is ranked at a credible 14 overall). It appears that both Hong Kong and Abu Dhabi could learn some

lessons from Singapore in this area (Abu Dhabi does have a number of initiatives in this regard).

Abu Dhabi's performance in terms of political governance is also rather modest. Its rank hovers just around the average (19). In comparison, Hong Kong and Singapore top the charts among the Asian countries. Their performance in the area of "political governance" stands out because of its outstanding scores in the sub-categories – "policy making & implementation" and "corruption." Abu Dhabi might do well to try and learn appropriate lessons from Singapore and Hong Kong with regard to aggressive and strategic policy making as well as its implementation. The overall sample of countries and the Asian sample are summarized in Tables AI and AII.

4.3 Policy simulations

While rankings are useful reference points for policy makers, a notable innovation of our GLCI framework lies in undertaking policy simulations, which allows the policy makers to gauge and project the extent to which the city will be able to improve its liveability. Policy simulations are "experimental" similar to scientific laboratory conditions in order to predict results before the actual implementation occurs. This in turn ensures that the policy makers can have some space to try implementing policies in a controlled setting before directly launching them for public scrutiny which will also enable them to pre-empt potential problems pertaining to loss of credibility. This exercise not only assists policy makers to understand the magnitude of the impact of their policy choices but also helps them to prioritize their goals, ultimately streamlining and enhancing the policy making process.

We now conduct a policy simulation to explore the extent to which Abu Dhabi is able to improve on its "liveability" ranking. The rank of a city's liveability is neither absolute nor static. An important value-added of the GLCI lies in policy simulations to explore the extent to which policies can improve on cities in their liveability ranking based on two assumptions. First, each city will work on areas where their rankings are worst. Specifically, each city will work in the areas identified by their 20 percent lowest (worst-performing) practical indicators. The weakest 20 percent indicators for each city were selected from the entire list of practical indicators regardless of which category they belong to [9]. The bottom 20 percent were chosen because resources are limited and it is not possible for a city to work on all areas concurrently. Second, after identifying the indicators where the city performance is most lagging, the cities would implement policies to raise its scores on those indicators to the "average" score of that particular indicator for all cities (computed using the original data). As no city is expected to score high on all aspects in the near future, such a simulation would not result in a decline in a city's rankings as measured by any particular indicator. A more detailed exposition of how the simulations are conducted is provided below:

- (1) The first step is to sort the indicators (j) for city i_1 from the lowest to the highest (from $RSVI_{i_1 j_{\min}}$ to $RSVI_{i_1 j_{\max}}$). This allows us to identify the bottom 20 percent of indicators j for city i_1 . Let us call these indicators $j_{i_1 \max}$.
- (2) Second, we identify which of city i_1 's 20 percent weakest indicators ($j_{i_1 \max}$) have a positive RSVI (RSVI is above zero). This means that for these specific indicators, the city i_1 is performing "below average." Let us call these indicators $j_{i_1 \max \text{pos}}$ and their respective RSVIs as $RSVI_{i_1 j_{i_1 \max \text{pos}}}$. If city i_1 has no indicators in $j_{i_1 \max \text{pos}}$, then skip the third step below and go directly to the fourth step. The logic is that some cities may already be very competitive such that all of their indicators are performing above average.

- (3) Third, we reduce $RSVI_{i_1 j_{\maxpos}}$ to 0 (zero). This assumes a policy simulation where a city i_1 has improved the performance of its $j_{i_1 \maxpos}$ indicators from “below average” ($RSVI$ above zero) to “average” ($RSVI_{i_1 j_{\maxpos}}$ is now zero).
- (4) Now, we repeat Steps (5)-(8) of Algorithm 1 described Section 3. Thus with the re-calculation, we get the updated competitiveness ranking and score for city i_1 .
- (5) The simulation for city i_1 is done. Repeat steps (1) to (4) noted above for the remaining cities. Each time Algorithm 2 is repeated for a new city, $RSVI_{ij_{\maxpos}}$ for previously simulated cities are returned to their original (i.e. positive) scores.

Based on the steps elaborated above, Table IV illustrates this simulation for the city of Abu Dhabi where the score of the weakest 20 percent indicators are raised to the average level. The potential for improvement is revealed by the change in overall rankings after the simulation. We see that Abu Dhabi’s overall ranking in terms of liveability rises sharply and it almost breaks into the top 20 cities (ranking of 22). In terms of economic vibrancy and competitiveness and socio-cultural conditions, the ranking sees a marked improvement while the environmental friendliness indicator shows tremendous improvement as well, with Abu Dhabi’s ranking jumping from 46 to 28 in the event of such policies being undertaken specifically to enhance environmental sustainability.

However, one area that has been consistently identified as lacking is that of environmental sustainability. On a positive note, such concerns have been recognized by the policy makers and they have undertaken measures to chalk out an environmentally sustainable growth model for the city to be a truly global city. For instance, Abu Dhabi launched “Etidama” (meaning “sustainability” in Arabic) in 2008 in order to achieve a more sustainable way of living and provide a higher quality of life for everyone. The idea is to make successful urban planning decisions and policies that favor sustainable economic growth through developing sustainable cities and communities. Further, this is the first of its kind in the entire Middle Eastern region and forms the core of the government’s “Plan Abu Dhabi 2030” (Abu Dhabi Urban Planning Council, 2010).

The Urban Planning Vision 2030, launched in 2007 outlined a specific set of four key priority areas for policy which includes: economic development; infrastructure development and environmental sustainability; social and human resources development; and optimization of government operations. Putting environmental sustainability on the radar of policy making has helped the city move along the direction of sustainable development. Also, a major part of the vision 2030 is to strive for a city that will satisfy the environmental preservation, social equality and cultural development (Abu Dhabi Urban Planning Council, 2010). The government has also been pursuing projects like the “MASDAR Initiative” – an “arcology” project based in Masdar City located in Abu Dhabi. This aims to “develop and integrate the full

Table IV.
Policy Simulations
for Abu Dhabi

Indicator	Overall liveability ranking	
	Before simulation (current standing)	After simulation
Overall	32	22
Economic vibrancy and competitiveness	28	14
Environmental friendliness and sustainability	46	28
Domestic security and stability	24	24
Socio-cultural conditions	24	12
Political governance	38	31

renewable and clean technology lifecycle, from research to commercial deployment” as well as “create scalable clean energy solutions with global partners with proven technologies venturing into new research” (Low, 2012, p. 31).

In fact, the Abu Dhabi innovation index report notes that the innovation capabilities of the city reflected a rise in the city’s standards of knowledge accumulation and diffusion – the two requisite factors for innovation – to global level. As the report identifies, this rise can largely be attributed to “its ability to access skilled international talent and know-how, the results of investment in world-class telecommunications and transportation infrastructure, and strong leadership from its government in the form of savvy procurement processes and other strategic investments in high-tech anchoring platforms such as Masdar, Strata, Advanced Technology Investment Company and the Cleveland Clinic Abu Dhabi” (Department of Economic Development, 2014, p. 5).

However, there are two major concerns with such initiatives. The first relates to whether projects like Masdar city create enclaves for the rich and the wealthy promoting “ghettos, where issues like sustainability have little immediate relevance” (Kirk, 2013)[10]. The second relates to the question of implementation (which has defined the ascendance of city-states like Singapore and Hong Kong). While such policies are definitely welcome and puts the city on the right path toward sustainable development, whether the city has enough supply capabilities to effectively implement such projects that exist on paper remains a question.

5. Conclusion

International experiences have shown that the globalized world of very mobile capital and talents has forged a special kind of relationship between the dynamism of the economic and social spheres of a city and the liveability of that city. This relationship is special because it is a circular, cumulative, causational process, i.e. a virtuous cycle. It is therefore not speculative to expect that investments that bring a large improvement in the liveability of a city could kick-start this virtuous cycle of the liveability of the city and its economic-social dynamism (Tan *et al.*, 2012).

The GLCI can be used to enable the fulfilment of, what we have termed earlier, the primal human desire for self-improvement. By outlining clearly the construction of GLCI and by selecting a wide range of indicators that are moderately easy to access, the GLCI has enabled a city that wishes to promote this kind of lifestyle to achieve it by investing in the areas identified as the low-score components of its GLCI ranking. Apart from their usefulness to policy makers, the results of the simulation will also be helpful to the business community and to potential investors.

In this context, this paper has used Abu Dhabi as an illustrative case study to support the fundamental contention that existing popular studies trying to characterize and rank global cities lack a holistic approach, a gap which this paper has attempted to fill by using the GLI. The paper has argued that the approach advocated here to measuring liveability captures and brings out the true potential of cities like Abu Dhabi which tend to get masked otherwise. This could well be true of other cities with similar characteristics, but a discussion on all such potential cities is beyond the scope of the paper. Hence, choosing Abu Dhabi as a case study was driven by an attempt to reconcile the seeming contradiction of an ambitious city that has a lot of potential but one that does not get ranked very highly in mainstream rankings. Further, the strides that Abu Dhabi has been making in emerging as a leading innovation hub is of immense relevance to the greater Asian region in terms of the potentially valuable lessons that other vibrant cities in the region can learn from it.

Most informed observers would note that Abu Dhabi shows a lot more potential in the region by not just being the driver of growth but also being a nodal center for attraction of global talent. It is fast growing into a city of opportunity and already satisfies the characteristics of an emerging global city with a lot of regional attention. Yet its potential has been clearly underrated by many existing studies and indices primarily because of their narrow scope in measuring liveability. In this context, the GLCI has brought together multiple indicators to devise an index that is strongly based on a combination of analytical and philosophical values. Taking stock of the rankings of Abu Dhabi using the GLCI so far as well as the policy simulations, one can conclude that Abu Dhabi has multiple strengths as an aspiring global city.

The empirical results outlined in this paper clearly reveal that Abu Dhabi exhibits high levels of vibrancy and competitiveness with respect to socio-cultural conditions as well as domestic security and stability. Massive infrastructure investments and large scale real estate development and urban planning initiatives fostered by the government are steering the city in the right direction. The most notable policy initiative of “Plan Abu Dhabi 2030” discussed earlier is a case in point as it envisions a sustainable plan for the city’s long-term growth. However, as the empirical results of this paper indicate, the most problematic indicator for the city even within the region remains to be in terms of environment friendliness and sustainability, where Abu Dhabi’s performance is of concern. Its performance in terms of political governance also leaves a lot to be desired.

While these are definitely areas of policy concern, the governments appear to have recognized the importance of the need to pay closer attention to issues of environment sustainability to meet their aspirations of putting Abu Dhabi on the global radar in a more consistent manner. It is also pertinent to note that Abu Dhabi could well strive to learn the right lessons from its other Asian counterparts that have faced similar challenges and have improved their rankings. Conversely, other Asian cities could also learn from Abu Dhabi in areas that it has done well, including socio-cultural environment (i.e. the social comfort, the physical ease and the cultural richness of living there). As Low (2012, p. 148) notes, “(i)f Asia has perspiration without inspiration, then Abu Dhabi has plenty of vision, but needs to work hard towards its goal.” In the final analysis, the GLCI should be viewed not as a beauty contest but rather as an opportunity for cities to learn from each other and attempt to improve the livelihoods of its people.

As a concluding note, some limitations of the methodology applied in this paper are in order. As elaborated in Tan *et al.* (2012), it must be noted that any ranking of cities is bound to create controversies. The first type of controversy is the big picture controversy where the question remains how one could capture in a meaningful way the many qualitatively different aspects of city life in a single number. While there is no convincing answer to this criticism, one can reasonably argue that just like how some miss the big picture by seeing only the trees and not the woods, whether one takes the woods or the trees as the unit of analysis entirely depends on the question one is interesting in asking. Similarly, if one is asking about liveability, then it is hard to avoid looking at a bundle of attributes.

The other problem pertains to the smaller technical details such as weights being attributed to different qualities. The EIU-competitiveness index for instance assigns different weights to its categories without offering sufficient explanation. The GLCI in contrast adopts the maximum “maximum agnosticism principle” by placing equal weights on every category. However, the next step for future research is to obtain the weights from a survey on people’s preferences so as to lend more rigor to the assignment of weights to different attributes while computing the rankings.

Notes

1. For some recent comprehensive discussion of related issues, see among others, Storper (2013), Thisse (2014), Moretti (2014), Henderson (2010), Glaeser (2013) and Mellander *et al.* (2011).
2. Some other rankings do not even include Abu Dhabi.
3. Even those indices like EIU's global city competitiveness index (which is jointly done with *The Economist* magazine and CitiGroup) and Mercer's quality of life index are very narrow in the sense that they all have a focus on a set of indicators that proxy for competitiveness. These indices make use of some combination of economic, cultural, infrastructural and environment-related indicators. For instance while EIU's index benchmarks the competitiveness of 120 cities based on the cities' ability to attract capital, businesses, talent and visitors, the Mercer index uses city infrastructure rankings as a proxy for quality of living for 221 cities. Examples of other rankings are available here: http://en.wikipedia.org/wiki/Global_city (accessed June 2, 2016).
4. The term "freedom from want" is from the 1941 speech by US President Franklin Roosevelt who identified four kinds of freedom as the inherent rights of people. The four freedoms are: freedom from want, freedom from fear, freedom to worship, and freedom to speak.
5. This theme subsumes Franklin Roosevelt's third natural right, "the freedom to worship."
6. This theme subsumes Franklin Roosevelt's fourth natural right, "the freedom to speak."
7. The methodology follows that employed by the World Competitiveness Yearbook, accessible here: www.imd.org/wcc/ (accessed June 2, 2016).
8. Hong Kong is way down at the 15th place in the Asia sample and ranks at 36 in the full global sample.
9. Because each of the five main categories comprises of a different number of indicators, the subjecting of the weakest 20 percent indicators to category limitations or the setting of an equal number of indicators for each category would introduce some bias into the weightings of the simulation.
10. See <http://m.theatlanticcities.com/design/2013/06/tentative-optimism-abu-dhabis-next-phase-sustainable-architecture/5858/> (accessed June 2, 2016).

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Appendix. Indictors used to construct each aspect of liveability

Indicators for economic vibrancy and competitiveness (23)

Economic performance (9) – GDP, real GDP growth rate, labor productivity per hour, household consumption expenditure per capita, unemployment rate, resilience of economy, gross fixed capital formation, growth rate of consumer price index (CPI), debt to gross national income ratio.

Economic openness (11) – foreign direct investment, trade to GDP ratio, state ownership of enterprises, prevalence of trade barriers, number of free trade agreements, ease of doing business, prevalence of foreign ownership, tourism receipts, economic freedom, hotel occupancy rates, international tourist arrivals.

Infrastructure (3) – telephone lines (fixed and mobile), computers ownership, level of internet access.

Indicators for Environmental Friendliness and Sustainability (15)

Pollution (7) – greenhouse gas emissions, sulphur dioxide emission, CO₂ emissions in 2006, quality of the natural environment, water pollution, nitrogen oxide emission, particulate matter concentration.

Depletion of natural resources (3) – electricity generated from renewable sources, consumption of oil, threatened species.

Environmental Initiatives (5) – participation in selected international environmental agreements, stringency of environmental regulations, terrestrial protected area, protected marine area, enforcement of environmental regulation.

Practical indicators for domestic security and stability (10)

Crime rate (4) – number of homicides cases, number of drug offences (new), business cost of crime and violence, reliability of police services.

Threats to national stability (3) – business costs of terrorism, fatalities of terrorist attacks, natural disaster death toll.

Civil unrest (3) – severity of political violence, conflicts of ethnic, religious, regional nature, violent social conflicts.

Practical indicators for socio-cultural conditions (24)

Medical and Healthcare (5) – infant mortality rate, life expectancy, government health expenditure per capita, number of hospital beds, density of physicians.

Education (4), quality of education system, tertiary enrollment rate, government expenditure on education, higher education achievement, housing.

Sanitation and transportation (7) – percent of urban population living in slums, percent of population using improved sanitation, population using an improved water source, quality of ground transport network, quality of roads, quality of railroad infrastructure, quality of electricity supply.

Income equality and demographic burden (5) – GINI index, number of hours worked per year, human poverty index, child dependency ratio, old age dependency ratio.

Diversity and community cohesion (3) – percent of foreigners/percent of immigrants, number of religions, attitudes toward foreign visitors.

Indicators for political governance (13)

Policy making and implementation (4) – government effectiveness, government consumption expenditure, collected total tax revenues, regulatory quality.

Government system (5) – functioning of government system, effectiveness of judicial system, quality of e-government, political stability no violence, rule of law.

Transparency and accountability (2) – transparency of economic policy, voice and accountability.

Corruption (2) – control of corruption, corruption perceptions index.

*The numbers in parenthesis denote the number of indicator in that category.

	City	Country		City	Country
1	Abu Dhabi	United Arab Emirates	33	London	UK
2	Ahmedabad	India	34	Luxembourg	Luxembourg
3	Amman	Jordan	35	Madrid	Spain
4	Amsterdam	The Netherlands	36	Manila	Philippines
5	Auckland	New Zealand	37	Melbourne	Australia
6	Bangalore	India	38	Mexico City	Mexico
7	Bangkok	Thailand	39	Moscow	Russia
8	Barcelona	Spain	40	Mumbai	India
9	Beijing	China	41	Nanjing	China
10	Berlin	Germany	42	New York	USA
11	Boston	USA	43	Osaka-Kobe	Japan
12	Buenos Aires	Argentina	44	Paris	France
13	Cairo	Egypt	45	Philadelphia	USA
14	Chennai	India	46	Phnom Penh	Cambodia
15	Chicago	USA	47	Prague	Czech Republic
16	Chongqing	China	48	Pane	India
17	Copenhagen	Denmark	49	Riyadh	Saudi Arabia
18	Damascus	Syria	50	Rome	Italy
19	Delhi	India	51	Sao Paulo	Brazil
20	Geneva	Switzerland	52	Seoul	Korea
21	Guangzhou	China	53	Shanghai	China
22	Hanoi	Vietnam	54	Shenzhen	China
23	Helsinki	Finland	55	Singapore	Singapore
24	Ho Chi Minh City	Vietnam	56	Stockholm	Sweden
25	Hong Kong	China	57	Sydney	Australia
26	Incheon	Korea	58	Taipei	Taiwan
27	Istanbul	Turkey	59	Tianjin	China
28	Jakarta	Indonesia	60	Tokyo	Japan
29	Jerusalem	Israel	61	Vancouver	Canada
30	Karachi	Pakistan	62	Washington DC	USA
31	Kuala Lumpur	Malaysia	63	Yokohama	Japan
32	Los Angeles	USA	64	Zurich	Switzerland

Table AI.
List of 64 global
cities for
computation of
GLCI ranking

Table AII.
List of 36 Asian
cities for
computation of
GLCI ranking

City	Country	City	Country
1 Abu Dhabi	United Arab Emirates	19 Kuala Lumpur	Malaysia
2 Ahmedabad	India	20 Manila	Philippines
3 Amman	Jordan	21 Melbourne	Australia
4 Auckland	New Zealand	22 Mumbai	India
5 Bangalore	India	23 Nanjing	China
6 Bangkok	Thailand	24 Osaka-Kobe	Japan
7 Beijing	China	25 Phnom Penh	Cambodia
8 Chennai	India	26 Pane	India
9 Chongqing	China	27 Riyadh	Saudi Arabia
10 Damascus	Syria	28 Seoul	Korea
11 Delhi	India	29 Shanghai	China
12 Guangzhou	China	30 Shenzhen	China
13 Ho Chi Minh City	Vietnam	31 Singapore	Singapore
14 Hong Kong	China	32 Sydney	Australia
15 Incheon	Korea	33 Taipei	Taiwan
16 Istanbul	Turkey	34 Tianjin	China
17 Jakarta	Indonesia	35 Tokyo	Japan
18 Karachi	Pakistan	36 Yokohama	Japan

Corresponding author

Khee Giap Tan can be contacted at: sptkg@nus.edu.sg

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