# Urban planning and sustainable cities

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# Urban planning and sustainable cities

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**Abstract:** This article is a review of scholarly works on planning for urban futures with special reference to sustainable cities. The article aims to produce an update of the challenges and current perspectives on urban planning, sustainability and development across the globe. As informed by research from the academic and scientific communities, the review provides the prospective directions and trends for securing a sustainable urban future. Within the sustainable cities discourse, recent intellectual inquiry has centred on the conceptualisation and knowledge production in creating sustainable cities. Though the scope of the review may not be exhaustive, the purpose is to articulate the current progress in the research front concerning concepts and definitions on sustainable cities, planning and methods for urban sustainability development and assessment. The ultimate goal is to provide local authorities, practitioners and/or city governments with some perspective and guidance in working towards urban sustainability in the future.

**Keywords:** urban sustainability; sustainable cities; sustainable urban development; sustainability assessment; sustainable development; indicators; sustainable urbanism.

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## 1 Introduction

Over the last few decades, sustainability research has grown significantly with the surge of academic publications about sustainability science as a new field of research and practice that has emerged on a global scale (Shahadu, 2016; Bettencourt and Kaur, 2011; Kates, 2011; Kates et al., 2001). Since the 1980s, the new science has been viewed to

require more vigorous academic attention as a distinct discipline on sustainability (Shahadu, 2016). Different from the paradigm of sustainable development (SD), sustainability has been taken as a planning concept that had its beginnings in ecological thinking and economics and now widely applied to studies in urban development (Adinyira et al., 2007). There are various conceptualisations and diverse interpretations of sustainability as a concept, paradigm or buzzword, as others put it. Some use the term sustainability interchangeably to mean sustainable development but in theory, they are different.

Historically, sustainable development has been the subject of many debates since it emerged and came into use in policy circles more than three decades ago and labelled either as an oxymoron, a contradiction of terms, or just another jargon deemed to be overworked, if not overexposed (Robertson, 2014; Du Pisani, 2006; Redclift, 2005; Beckerman, 1994; Daly, 1990a; WCED, 1987). Regardless of what the critics say about sustainable development, it is contested yet widely recognised worldwide as a driving force in development discourses, if not in the broader policy arena. Comparatively, the concept of sustainability as a normative notion suggests how humans should act towards nature and be responsible towards one another at the present as well as the future generations (Baumgartner and Quaas, 2010). Others stressed that the meaning of sustainability *per se* varies according to context and perspective (Brown et al., 1987; Shearman, 1990). In the past, environmental problems such as deforestation, salinisation and loss of soil fertility that occurred as early as the ancient Egyptian, Mesopotamian, Greek and Roman civilisations are also among the pressing environmental issues that beset us in the past and the current century (Du Pisani, 2006). Historian Du Pisani (2006) pointed out that the term sustainability was first used in German Forestry circles by Hans Carl von Carlowitz in 1713 to call for a balance of harvesting old trees and have enough young trees to replace them. Here, the purpose is not to establish a precise, or universal definition of the term as there are multiple versions and differentiated meanings, as informed by varied research agenda. Two widely articulated views of sustainability pertain to:

a the triple bottom line or three pillars based on environmental, economic and social dimensions

b the need to maintain equity between current and future generations (Mori and Christodoulou, 2012; Shahadu, 2016; Turvey, 2017).

In understanding sustainability as it reflects itself in an urban context, scholars believe that humanity has the ability to build a sustainable world through the practice of urban sustainability (Smith, 2015; Glaeser, 2011; Owen, 2010). While there exists a broad literature on sustainability, the academic focus on the theory and practice of urban sustainability that concerns sustainable cities, have yet to gain robust attention from the community of intellectual and scientific scholars to address the challenges of the concepts and processes in sustainable urban development.

Sustainable urban development is currently the top priority of cities in both the developed and developing countries (Mori and Christodulou, 2012; Ben-Zadok, 2009; Keivani, 2009; Williams, 2010). This is triggered by the unprecedented 21st century issues of environmental sustainability, as well as the political, economic and cultural challenges of rapid urbanisation that significantly affected progress in urban theory and practice (Pizarro, 2015; Banai and Rapino, 2009; Whitehead, 2003). Since the 20th

century, the world's staggering urban population has posed various concerns in planning for sustainable urban development. With more than half of the seven billion people living in towns and cities on Earth, the 21st century is described the 'century of urbanisation' (UN, 2008; Keivani, 2009). Based on global statistics, 54% of the world's population in 2014 is urban, and the future of humanity is absolutely, urban (McLaren and Agyeman, 2015; WUP, 2014). The current global urban population is expected to rise by more than two thirds in just three decades. Approximately six billion of the world's nine billion people will live in urban settings by 2050 (Smith, 2015; WUP, 2014; UN, 2011; Bos et al., 1994). Close to one third of urban dwellers in North America live in settlements with fewer than 500,000 people. In Canada, urban population was 82% in 2014, and projected to rise to 88% by 2050 (WUP, 2014). With the huge volume of urban dwellers, planning for cities is beset with many environmental, economic and social problems in terms of sustainable urbanism (Williams, 2010; Keivani, 2009; Yigitcanlar and Dizdaroglu, 2015).

The pattern of urbanisation since the 20th century showed that demographic changes and/or increases were found mostly in cities of the developing world. Though one way to look at urban change where there is population growth is to assume that many countries will urbanise far into the future, there are some countries that may not grow economically hence the need to take the world's urban growth statistics with some caution (Satterhwaite, 2016). There are low-income countries with serious economic growth problems and political instability or even civil war that may certainly face smaller and slower growth in their urban populations given their hardly encouraging situations. Also, at the heart of the sustainability discourse is the emphasis upon the prudent use of environmental resources and social equity considerations, and the call for a more effective and resilient planning and development perspective (Yigitcanlar and Dizdaroglu, 2015; Yigitcanlar and Kamruzzaman, 2015). Since urban settlements are now the world's dominant human habitat, city sustainability as a compelling imperative is an obvious development goal. In confronting the enormous transformation of cities, societies and the environment, sustainable urban development is invariably the contemporary approach towards building a desirable future.

This article offers a review of literature on the challenges that relate to planning urban futures as it relates to sustainable cities across the globe. It attempts to highlight important scholarly works to bring about the prospective research directions and trends in securing a sustainable urban future for tomorrow, today. Within the sustainable cities discourse, there are increasing efforts in intellectual inquiry that seek the conceptualisation, analysis and knowledge production in hopes to create sustainable cities. In this review, conceptual and procedural challenges are identified to understand the progress and developments that relate to the narrative of sustainable cities. The ultimate goal is to be able to provide local authorities, practitioners and governments with some perspective and guidance in working towards urban sustainability in the future.

## 2 Background

Historically, cities are referred to as urban areas which are defined by settlements of larger population size and marked by high densities within areas distinct from those surrounding it (Kaplan et al., 2009). As a recent phenomenon, the evolution of cities

dates back more than 6,000 years ago at the earliest and globally by around 300 years (Kaplan et al., 2009). A city is typically an urban place that is non-rural, non-agricultural and functions as a centre of political, economic power, technological innovation, artistic achievement and much more (Fouberg et al., 2015). For cities to form, Kaplan et al. (2009) cited three preconditions to be in place, namely: ecological settings, technology and social organisation. Given these pre-conditions, most early cities developed in sub-tropical regions, river banks, and in proximity to fertile soil, fresh water and physical resources. Though some cities of the world recurrently experience boom and doom, cities commonly play a diversity of functions serving urban populations and operate as complex systems often described as growth machines; anchors of modern culture; centres of interaction and specialisation and agents of societal change (Fouberg et al., 2015; Khakee, 2014; Kaplan et al., 2009). There are assertions of cities as 'growth machines' analysed in relation to carrying capacity and ecological footprint as populations physically occupy substantial spaces in an urban area (Khakee, 2014). The enormous demographic size of urban areas had in fact placed tremendous challenges to the consumption of energy, water, nature and materials and provision of public services and amenities. In essence, cities provide local services such as water, sewage and waste services, development charges and utilities, public transit, land-use planning, infrastructure and economic development (Madsen, 2004). At the centre of debates are also questions on urban governance with respect to their operation, given its constant concern to maintain the well-being of its residents or overall management of life in urban areas while sorting out the day-to-day urban management issues of city life. Another concern about cities that has been identified in the Brundtland (WCED) 1987 report is centred on the environmental problems that have a local source or origin. This reality comes to fore as the urban dimensions of sustainability are increasingly getting more attention on a local, regional as well as global scale. But first is a review of cities in theoretical terms.

### *2.1 Cities in theory*

In the face of the complexity and dynamics of the city, the literature points to a multiplicity of urban theories or 'theoretical pluralism' that exists with no dominant perspective being privileged to be a monopoly in urban matters or to explain the urban form and function. This means with the complexity of urban form and function, there is no single philosophy or meta-urban theory that dominates the literature. A theoretical review of the city shows several types of urban theory. The normative theory of the city is focused on the human purposeful activities and city form as its principal feature. An example is the 'good city form' well known as the best example of the normative theory of the city, is well-fitted, stable and resilient… accessible and well controlled [Lynch, (1981), p.235]. A functional theory of the city is honeycombed with values, with examples of values as sustainability, social justice and efficiency (Farr, 2008). The economic theory of the city has increasingly become accountable to the space-economic impact of innovations and global trade (Krugman, 1995).

In their progress review of urban theory, Banai and Rapino (2009) examined the historical theory, the ecological theory, the economic theory, the communication theory, and the historical and material theory of the city. They argued that the urban theory is fragmented since the city's complexity defies a unitary imagery, though not necessarily a weakness in theoretical sense. Using Lynch's (1981) encyclopaedic review of the city, its

conceptualisation is reflective of the changing spatial, demographic and socio-economic and technological environments of the times. In the ecological theory of the city, the planning and design of sustainable cities increasingly treated nature and the built environment as integrated elements of an evolving ecology. It was noted in the review that the sustainable city is making room for a multicultural, diverse demography across the globe. At the same time, the quest for justice and fairness continues in the sustainable city (Banai and Rapino, 2009). Research indicates that planning for the sprawling urban population is of utmost importance that the idea of sustainable urban development does not come without challenges (Keivani, 2010; Williams, 2010). Practitioners and academics are mutually interested in finding out the most appropriate urban planning design particularly the one which relate to the creation of a sustainable city with its definition as diverse as the idea of sustainability. In designing the beautiful city, the garden city, or the eco-city, planners and planning-related professions have been in search of ways to create sustainable ways to develop urban areas.

## *2.2 Urban planning and design of cities*

Tracing back as far as the past substantive contributions to the field, planning visionaries such as Patrick Geddes, Lewis Mumford and Jane Jacobs have shown interest to develop designs and planning techniques to build sustainable urban environments (Smith, 2015; Wheeler, 2000; Jacobs, 1961). In tracking the early forms of sustainable communities, Hempel's (1999) work in Mazmanian and Kraft's edited collection is highlighted. The term sustainable communities refer to those communities that are planned, built or modified for sustainable living and characterised by attributes of social sustainability, economic sustainability and environmental sustainability. From both development and environmental lens, there are early forms of sustainable communities labelled in the literature as 'sustainable cities', 'green cities', 'eco-cities', 'livable cities' and 'livable communities'. The edited collection by Mazmanian and Kraft (1999) entitled: *Toward Sustainable Communities: Transitions and Transformations in Environmental Policy*, has contributed to better understanding about cases and applications in the field of *community sustainability* as the world transition toward a sustainability-based environmental policy in the 20th century. The book argued that it was not essential to have a single definition of environmental sustainability, SD or sustainable communities to study the transitions in urban public policy. It has acknowledged the groundwork that was laid out by Patrick Geddes (author, *Cities in Evolution*, 1915) and Lewis Mumford, author of *Sticks and Stones* (1924) and *The Golden Day* (1926).

On the one hand, Geddes stressed the integration of environmental protection and social organisation in urban design. Geddes believed 'the corrosive effects of industrialisation on geographic community with swift exhaustion of material resources' was a bit too much. On the other hand, Mumford was a leader of the Regional Planning Association during the 1920s in the USA. He was concerned with the early attempts to address the social and environmental consequences of the loss of community in his so-called 'machine civilisation' during the industrial age. He portrayed colonial New England as a promising model for contemporary human settlements, encouraged community and admired town planning as a culture of community with a commonality based on civic mindedness and social cohesion. Mumford believed in two things – the first is the attainment of a genuine 'sense of place' grounded in nature parallels that

encourage community and a productive, equitable and social cohesion of the built and natural environments. The other is the 'sense of commons' defined by Mumford as an acceptance of common destiny and social relations based on dignity and mutual respect (Hempel, (1999). Mumford's work was known to reconstruct the 'communitarian social tradition' that was deemed appropriate for the 20th century [Hempel, (1999), p.49]. In the same edited book, Lamont C. Hempel's (1999) chapter on the *Conceptual and Analytical Challenges in Building Sustainable Communities* is relevant in tracing early types of sustainable communities. The work pointed out the intellectual origins of the concept of sustainability and the competing orientations still found today in communities and cities in North America and others. Hempel's chapter provided a snapshot of the field applications of the so-called 'sustainable communities' movement over the last three decades as countries like the USA must come to terms to address the challenge of environmental sustainability. In listing some contributions on the evolution of the 'sustainable communities' framework since the 18th century, Hempel included the Garden City movement (Howard, 1898); bioregional planning and design (Geddes, 1915); the American New Towns movement; and grassroots communitarian movements (1940s). The Garden City movement is conceptualised by Howard (1850–1928). As a planned settlement, the garden city was a reaction to the ills of the industrial revolution by providing greenery for urban dwellers (Smith, 2015). Howard's idea was to create cities that promoted greenbelt around them with a low housing density, parks and open spaces and plentiful Victorian allotment of areas. The bioregional planning and design idea by Geddes was argued to be effective if the design was interdisciplinary in approach and focused on building sustainable communities as adopted by the University of Idaho.

In the USA, the American New Towns Movement involved newly created green field sites around a pre-existing settlement. It was planned to relieve overcrowding and congestion in the major conurbations with the aim to create a town that would be economically viable with light industry, shops and services. In the UK, a New Towns Act passed in 1946 aspired for low housing density (five houses per hectare) and neighbourhoods of 5,000 people with their own shops, schools and health centres. In the 1960s, the models and ideas included the great society urban programs; the decline of faith in technological progress; and the Spaceship Earth idea by Fuller (1969). The concept of Spaceship Earth was a view of the world and an expression of concern over the use of limited resources available on Earth and considered human behaviour. It asserted the need for harmony toward working for the greater good. To this day, this idea has become an iconic and symbolic structure that soon became a part of the corporate feature of the Walt Disney World Resort.

In the 1970s, more relevant ideas came into surface and were subject to debate and discourses such as *Limits to Growth* by Meadows et al. (1972); resilience of ecological communities (Holling, 1973), local self-reliance and appropriate technology movements in the 1970s (e.g., Morris, 1982); *Urban Ecology and Eco-city Movement* (1987) and strategic coupling of the environment and development within the sustainable development dialogue in 1987 and 1990s (Hempel, 1999). Holling's *Resilience Ecological Communities* meant communities able to bounce back or recover through an adaptation; or those with the capacity for returning quickly to their previous state to a constancy of persistence. These communities are capable of being back where they were, actively influencing and preparing for economic, social and environmental change. Urban Ecology and Eco-City Movement surfaced in 1987 with the strategic coupling of the environment and development within the sustainable development dialogue in 1987 and

1990s (Hempel, 1999). The *Urban Ecology and Eco-City Movement* (Engwicht, 1993) placed emphasis on urban ecology which is a sub-field of ecology that deals with the study of organisms in an urban or urbanised community and their interactions. Here, urban ecologists studied trees, rivers and open spaces and examined how these resources are affected by pollution, overdevelopment and pressures. The Eco-city movement was first launched in the 1990s with the vision for an ecologically efficient industry integrated with the people's needs and aspirations. With the eco-city seen as an ecologically healthy city, this movement was characterised by a harmonious culture and landscapes where nature, agriculture and the built-environment were functionally integrated in a healthy way. Clearly, what is needed is a research on the translation of sustainability concepts into planning and how these could lead towards building sustainable cities. Such research is expected to provide insights into the relationship between the urban issues, priorities and strategies in the pursuit of urban development and sustainability of cities, broadly defined.

There are design concepts termed 'sustainable urban forms' in the planning literature wherein an urban form is a result of bringing together the elements/concepts of urban pattern (Jabareen, 2011). The urban form is a composite of characteristics related to land use, transportation and urban design and they include compactness, sustainable transport, density, mixed land uses, diversity and greening in designing and structuring urban places to achieve sustainability. Urban forms have been examined and noted to contribute differently to sustainability but local governments, planners, landscape architects and others are still grappling with the right aspects of a sustainable urban form (Jabareen, 2011). Based on the design concepts, the ideal sustainable urban form is one which has a high density and adequate diversity and compact with mixed land uses (Jabareen, 2011).

Another dimension in urban planning is the sustainability assessment of cities on the environment and human life in terms of their economic contribution. Methods for sustainability assessment often use indicators and indices to measure city sustainability. Indicators are applied as tools for change, learning, propaganda and quantitative analysis whether the purpose is for ranking variables such as countries or, defining statistical outcomes in measuring what is valued or quantified. By definition, an indicator can be quantitative or a qualitative measure from a series of observed facts to define relative positions in a given area; it can give the direction of change across different units and time (Mamat et al., 2016). In respect of sustainability in cities, index and indicators are used to capture the underlying elements of urban sustainability (Alberti, 1996). The term 'indicator' is defined as a parameter or a value derived from parameters with a significance extending beyond that directly associated with it (UN ESCAP, 1995). The term 'index' as described by UN ESCAP (1995, p.88) as a "set of aggregated or weighted parameters or indicators." Sustainability indicators have been employed in sustainability assessment methods including comparative studies in sustainable urban development. Examples of this include the environmental sustainability index (ESI), and the environmental performance index (EPI). Indicators are also used in sustainability indices such as dashboard of sustainability (DS), development index, genuine progress indicator (GPI) and city development index (Mori and Christodoulou, 2012). In a review of sustainability assessment methods, it was noted that a new city sustainability index (CSI) need to be created to assess and compare cities' sustainability performance to understand the global impact of cities on the environment and human life (Mori and Christodoulou, 2012).

### *2.3 Defining 'sustainable cities'*

A review of existing definitions of a sustainable city is made briefly to trace how it has evolved over time with differentiated connotations and meanings. An obvious finding from the review is that the meaning of the term is varied with no universal definition in place. The notion of the sustainable city is said to have emerged as a political initiative to respond to urban environmental degradation in the twentieth century (Hassan and Lee, 2015). In the late 1970s, the efforts for planning and management of human settlements were associated with addressing issues that concerned urban and rural communities which were allied with sustainability questions at the local level (White and Lee, 2009). To others, a sustainable city is framed as a city that meets the social, cultural, environmental, political, economic and physical objectives where there is equitable access to all services (Rogers, 1997).

There is no shortage of cutting-edge types of cities that have been examined widely in the literature from the compact city to ubiquitous city, also called the U-city (Yigitcanlar and Lee, 2013; Hassan and Lee, 2015). The U-city in countries like Korea features ICTs in the city infrastructure and eco-technologies to provide residents with quality environmental resources, conserve energy and water supply (Yigitcanlar and Lee, 2013). Dantzig and Saaty's compact city has a minimum density of 40–80 residential units per net hectare with a height of two to four storeys for more efficiency and interaction. In theory, the compact city does not consider the shortages of liveable environments and why suburbs grow outside of the city. More importantly residents wanted to leave the high-density zones for lower-density zones with cleaner environment in a compact city (Hassan and Lee, 2015; Howley et al., 2009). With several definitions for the sustainable city label, there are advocates for a city of transition into sustainability rather than the sustainable city. Further, the application of cutting-edge technologies and brandable terminologies of new cities are however deemed to be insufficient to develop sustainable cities (Hassan and Lee, 2015).

While the sustainable city is arguably seen to require resilient and efficient economic, environmental and social systems, others articulate the design of future cities offering the opportunity for the happiness of its residents. In such condition, are sustainable cities 'happy' cities? (Cloutier et al., 2014). In examining the relationships of four indices of sustainable urban development and the happiness of residents in US cities, Cloutier et al. findings indicated that happiness and sustainable development were positively associated. This refers to the city-level self-reported happiness in US urban areas and noted to be an interesting area for future inquiry in the study of how cities and its components influence happiness and drive the progress toward urban sustainability. In tracing the earlier versions of sustainable cities, relevant examples have already been cited before this section, with the discussion of the Garden City movement in the 18th century developed by Ebenezer Howard (1898), the American New Towns movement and the Eco-city. The Garden City marked the emergence of sustainability as a new paradigm that might reshape the planning profession (Ben-Zadok, 2009). In research and practice, a sustainable city is defined environmentally when resources are used efficiently; when social equity is considered in policy decisions; or when a *compact form* of urban design is adopted in terms of sustainable urban form. For a city to be sustainable, they must recognise the finite nature of the natural resources from which urban activities depend and meet the needs of all people not only of the present but also the future generations (Alberti, 1996). The needs for sustainability in cities, coupled with the lack of knowledge

on how to deliver it, are important subjects of inquiry in building sustainable cities. Sustainable urbanisation requires that cities should generate better income and job opportunities, provide the needed infrastructure for water and sanitation, energy and transportation and preserve its natural assets.

Over the past three decades, sustainable cities have been the leading global paradigm of urban development (Whitehead, 2003; Williams, 2010). Indeed, the subject of sustainable cities is endlessly captivating yet quite paradoxical to others. There is reference in published works that the sustainable city discourse is now relatively mature, with precise but contested, conceptualisations (Williams, 2010) while others note the paradox in terms of its meanings and contradictions (Hassan and Lee, 2015). Examples of the latter types of cities labelled as the sustainable city were subject of studies within the sustainability discourse. Hassan and Lee's (2015) study in particular examined three emerging models namely the zero-carbon city, the ubiquitous eco-city (or U-eco-city) and the compact city regarded as an outmoded model. By design, the ubiquitous city is a built environment with information and communication technologies embedded in its infrastructure for purposes ranging from disaster management to pollution monitoring and energy conservation to improve the economic and environmental aspects of the city. In their review, a sustainable city was described to be a self-sufficient city; a political initiative to address urban environmental degradation; a city able to retain the supply of natural resources while achieving economic, physical and social progress.

Dantzig and Saaty (1978) coined the term compact city as a backlash against postwar urban planning was a city with minimum density in urban form; multifunctional in land use; built as nodes in its residential development; and in harmony between spatial structure and the public transit system. Its key feature is to shorten the trip and adopt mixed use in urban patterns. Critics criticised the compact city because it does not consider the shortages of liveable environments and the need for green spaces within the city that others in high-density zones left in favour of lower-density zones. Challenges to the compact city claimed that:

a telecommunication cannot be substituted for social interaction

b the cost of infrastructure is prohibitive and cannot be affordable to all social classes

c profits are gained by the private sector but not by the public sector and its citizens.

The zero-carbon eco-city coined by Richard Register in 1987 in his book *Eco-city Berkely: Building Cities for a Healthy Future* was aimed to reduce the emissions of carbon dioxide or green house gases (GHG) to zero (Kolte et al., 2013). Viewed to contribute to improving the quality of life, the Masdar City in the United Arab Emirates (UAE), the Petite Riviere in Canada, and Barangaroo in Australia are among the few models of eco-cities in the world (Elchalakani et al., 2013; Reiche, 2010). To Yigitcanlar and Lee (2013), the obstacles to the free carbon city pinpoint uncertainties to waste-free cities and the question of an affordable and sustainable city without getting rid of the car in existing cities. The authors argued that there is an ambiguity of the sustainability notion on 'the impetus to create sustainable cities. They conclude that the use of the label called sustainable city limits the potential for sustainability in future projects and preferred the term 'transition toward the sustainable city' as being more accurate and effective. With differing visions of urban futures and a multiplicity of socially constructed views in sustainable urbanism, Guy and Marvin (1999) explains this is due to

a diverse and expanded group of interests and competing visions of what a sustainable city is.

## 3 Challenges in researching 'sustainable cities'

This section outlines the challenges in researching sustainable cities. It summarises the threads of discourse concerning urban sustainability, planning and sustainable urbanism research on sustainable cities. The purpose is to highlight important scholarly works to show several attempts to urban planning and design and create an understanding of the latest progress in sustainable urban development. In this intellectual inquiry, the objective is to get some perspective on the research directions and emerging trends that relate to building of sustainable cities.

### *3.1 Challenge of sustainability, sustainable planning and urban design solutions*

To achieve a harmonious balance as a global goal in terms of sustainable development, the Brundtland Report in 1987 identified three components of urban development namely: social welfare, economic development and environmental protection (Drakakis-Smith, 1995; Yigitcanlar and Dizdaroglu, 2015). The common assessment points to the complex and destructive impacts of human activities and population pressure on questions of the sustainability of resources and degradation of the environment (Yigitcanlar and Dizdaroglu, 2015). The wide assertion in recent years point to how cities struggle in dealing with local and global environmental issues such as urban sprawl, rapid urbanisation, urban population pressure, degraded water quality, air pollution and soil erosion (Parmesan et al., 2013; Mahbub et al., 2011; Teriman et al., 2009; Pittock, 2003). In seeking sustainable urban design solutions, scholars have invariably stated the demographic picture of city life that called for re-examining the processes and methods to deal with the sheer volume of people in urban areas particularly in megacities in the world (Smith, 2015; Rana, 2011; Keivani, 2009). Others have stressed the need to focus on urban sustainability from a variety of disciplines (Smith, 2015; Lake and Hanson, 2000). In the past, design approaches have been advanced from Green Building to New Urbanism. According to Smith (2015), green building has some issues of affordability due to the cost of building them and does not allow economies of scale for some larger projects. For New Urbanism, some criticisms include its rigidity (Rowe, 1997), unaffordability and lack of economies of scale like green building.

In recent times, an approach to push for sustainable urban places introduced the Leadership in Energy and Environmental Design (LEED). In drawing from the foundations laid out by Green Building and others, Smith (2015) sees LEED as an effort to bring the best parts of related urban models toward a more sustainable pattern of development. In promoting sustainable urbanism, it is seen as a tool to reduce urban sprawl and deal with urban regeneration efforts in the US. Local entities in the US and Canada have adopted LEED as well as universities and non-profit organisations in the belief for an alternative form of development. LEED could be a form of urban sustainable development for areas with smaller demographics, help reduce energy consumption, and reduce pollution.

### *3.2 Challenges in sustainable urbanism*

Based on the work of Williams (2010), two challenges are specified based on her experience in sustainable urbanism projects, policies and monitoring strategies. The first is concerned with the *challenge of 'the vision'* to ask the question: do we know what 'the sustainable city' is and the second is about *the challenge of 'change'* in terms of 'how to bring about sustainable urban development. These challenges are not just relevant but truly important in current sustainability research as the focus on such inquiry on sustainable cities have gone local as well as global in scale. Sustainable urbanism as a subject of intellectual inquiry has become an area of research interest by academics and practitioners with various disciplinary backgrounds from planning, architecture, sociology, engineering, social science and environmental/sustainability science. A more serious concern by Williams surrounds the nature of progress towards sustainable cities which has been deemed 'problematic' over the last three decades. Some of the points raised by Williams reflected the lack of optimism particularly the urban problems in the South; rise of infrastructure and building projects that defy sustainability; and the problem of conceptualisation of sustainable cities despite huge advances in some knowledge areas. Williams rightly argued that the issue is on the differing visions of the future in current debates where diverse or multiple definitions and socially constructed visions of sustainable cities exist is that they do not capture the complex whole called the 'city'. While acknowledging the need for 'coherence in purpose, there is apparently no conceptual 'anchor' in sustainable urbanism thinking and practice (Williams, 2010). With multiple visions of 'the sustainable city', Williams suggests that the challenge to bring about sustainable urban development may involve:

a advancing technical and social change

b deepening of specialised knowledge given variation in research approaches and new ways of working

c building partnerships and coalitions to various interest groups through multi or transdisciplinary research and practice

d implementing changes in behaviour, policy and urban governance.

### *3.3 Challenge of transformative learning*

In the 21st century, there are complex problems facing societies that fundamentally require the need to re-frame and re-learn how humans relate to each other and with the environment (Konig, 2015). As such, society in general needs to re-organise their relationships and interactions between society, the economy and the environment. With diverse knowledge from the academia, professionals and a broad base of practitioners, we are fraught with challenges that require education and capacity building in the sustainability front (Konig, 2015). This suggests putting sustainability at the heart of university education in science through learning, research and teaching. The lack of prescriptive knowledge to building sustainable urban projects [Pizarro, (2015), p.48]; need academic institutions to deliver the know-how and translate knowledge into reality through the production of urban design that promote sustainability.

### *3.4 Challenge of 'urban sustainability' concept*

Another concern is the analysis of the 'urban sustainability concept' in the context of developing countries (DCs) where there are questions that arise in transforming urban reality. Of tremendous concern is the problem of an estimated 1 billion of poverty-stricken urban dwellers in slums that deserve serious attention (Bolay, 2012). 94% of slum dwellers live in the DCs with the highest urban growth rate and least access to resources. The idea of urban sustainable development demands a multidimensional approach to urbanisation in the South as a complex phenomenon. According to Bolay (2012, p.85), a new approach to urban development that must be put in place involves:

a a multidimensional perspective on new urban forms

b participation of all stakeholders in designing and implementing the city's transformations

c multiplicity of scale ranging from neighbourhoods to the edge of the city, outwards to urban expansion to regional scales

d use of different instruments allowing for combined social and urban processes with architectonic or urbanistic objects.

The point is that positive change is not solely dependent on architects or urbanists and other professionals in the field of urban development. Rather, what is required is a combination of disciplines and professions in planning for a built-up environment as a project for urban governance such as changes in business relationships among partners in local urban initiatives (Bolay, 2012). In sum, cities deserve attention in any analysis for sustainable urbanism to find solutions as they deal with a multi-dimensional mix of environmental, financial, social, demographic and urban governance issues.

### *3.5 Challenge in the delivery of green urbanism*

There is growing knowledge on green urbanism produced in universities but the question becomes: What are green cities? Are they built with compactness, public mass transit, mixed land uses and pedestrian environments (Pizarro, 2015)? What we need is to apply the most advanced sustainability principles in developing sustainable urban projects in new urban spaces whether in energy generation, wastewater recycling organic waste reuse or enhancing urban biodiversity (Pizarro, 2015). What is the academic way of conceiving sustainable cities? Academics differ (antithetically) while the development firms think of land and housing development whose main concern is the proverbial bottom line. In the delivery of realistic sustainable urban projects, academic urban projects will face the economic challenge in urban design thinking and in meeting the demands of real estate development as one of sub-sectors that could potentially be affected in the planning process. Suffice it to say, that "with the many unknowns about how to build sustainable cities, and in particular, the lack of prescriptive knowledge to build sustainable urban projects, schools have a vital role in the delivery of know-how and in translating such knowledge into reality" [Pizarro, (2015), p.48].

### *3.6 Challenge in assessing the sustainability of major cities*

The literature indicates a mounting interest in measuring sustainable cities while recognising that sustainable development (SD) springs at the local scale, i.e., at the level of municipalities, cities or metropolitan regions (Tanguay et al., 2010; Fan and Qi, 2010). Studies of this kind that seek to assess the sustainability of cities are found in cities located in both the developed and developing countries. Some studies used sustainable development indicators and indices that examined three dimensions, namely environmental, social and institutional and economic. For example, Tanguay et al. (2010) reviewed 17 of 23 studies they compiled that applied SD indicators and noted the lack of consensus on the conceptual framework and selection of indicators. In their own study, Tanguay et al. proposed a selection strategy for SD indicators to adopt a parsimonious list on SD components with an optimal but minimal number of indicators. From the 188 indicators compiled by this team, they used 29 indicators for the 20 categories for environmental, social, and economic components in their study. In reflection, the selection of indicators could be an arbitrary decision as sustainability research considers the desire to mirror local concerns within the integrated components of sustainable development while investigating scientifically-based assessment methods.

Major cities in emerging countries like China are experiencing rapid urbanisation over the last five decades only to have placed serious burdens on the urban environments affecting overall urban environmental quality in many ways, e.g., an uneven distribution of the environmental burden (Fan and Qi, 2010). In view of the wide range of environmental issues in emerging countries, sustainable urban development has emerged as one of the top priorities in the developing world. In the case of China, sustainable urban development is a top priority for addressing the issue of urban sustainability in this emerging country. In constructing the urban sustainability index (USI), Fan and Qi (2010) combined normalised measures of economic development and social equity from which their index had three basic components namely: economic index, environmental index and equity index.

Another approach to sustainability assessment focuses on the urban ecosystem as part of the decision-making and urban planning processes. One of the early works on ecological planning that is relevant to the discourse is Howard's Garden City theory which introduced an ecological approach to urban planning and asserted to bring nature back to cities with greenbelts (Wong and Yuen, 2011). To Yigitcanlar and Dizdaroglu (2015), the purposes of an 'urban ecosystem sustainability assessment' are to:

a define sustainable development targets and assess progress in meeting targets

b revise the effectiveness of current planning policies and assist in making needed corrections relative to changing realities

c compare over time and across space a performance evaluation and provide the basis for planning future actions.

This kind of assessment has been perceived as a powerful tool to connect past and present activities to future development as noted by Hardi et al. (1997) and Lamorgese and Geneletti (2013). The idea of contemporary ecological planning is not without criticism as it draws from ecological modernisation theory linked to a post-industrial society. Here, the theory describes environmental improvements to be economically feasible and second, it depicts political actors to build new and different coalitions to make

environmental protection politically feasible (Fisher and Freudenburg, 2001). Furthermore, many scholars view ecological modernisation, (also known as 'sustainable capitalism'), as an approach that is not possible (Pellow et al., 2000). Urban ecosystem sustainability assessment commonly uses sustainability indicators and composite indices for assessing sustainable land use and urban management (Yigitcanlar and Dizdaroglu, 2015; Yigitcanlar and Kamruzzaman, 2015).

### *3.7 Challenge of urban sustainability in the South*

In considering the important role of cities for wealth creation and greater life opportunities, Keivani (2010) has outlined the challenges that cities posed for sustainable development. On the social front is the presence of intra-urban social inequalities in both the North and the South as evidenced by relative income poverty and crime, and concerns over severe exclusion, among others. Economically, many cities in both the North and the South face the challenges for sustainable economic growth. Cities in the North struggle with economic restructuring in a globalising era with loss of major industries and past economic roles (Keivani, 2010). Cities in the South suffer from institutional weaknesses and lack of material and financial resource coupled with the lack of strategic economic vision, compartmentalised sector-based policy making and need for coordination among various levels of government.

Urbanisation in the developing world such as Bangladesh is a 'growing phenomenon' that raises serious concerns over urban sustainability due to lack of good governance (Rana, 2011). As a case in point, the situation in the country is considered to be more dangerous with the urban poor and the informal life in precarious environments to be among the issues toward sustainable urban development. Rana cites Dhaka city as a growing megacity (cities with population in excess of 10 million) currently faced with major challenges associated with rapid urbanisation. In creating sustainable cities in Bangladesh, an important problem is the rapid urban growth that could pose challenges toward formulating strategies for urban sustainability. With its total urban population at 28.6 million and the annual exponential growth rate at 3.15 % as of 2001, the country's urban figures has doubled every 12 years (Rana, 2011). Dhaka's population is 30% of total urban population, of which 37% are poor. Most notably, Rana raised the issue that population growth has outpaced service provisions like water, sanitation, waste disposal and housing. Rapid urbanisation in the South is claimed here to be part of the dilemma of economic development and environmental suffering and that there are consequential challenges for urban sustainability as is the case of Dhaka city's water supply problems along with inadequate infrastructural services, natural and human-made hazards and poor urban governance.

### *3.8 Challenge of alternative models: the unbalanced model for sustainable urban development*

Are there alternative models to urban sustainability? One important challenge to Khakee (2014) concerns the issue of geographical scale in sustainable urban development because it has not received much attention in sustainability research. The literature findings indicate that many past initiatives for sustainable urban development have placed emphasis on 'endangering greater environmental responsibility on behalf of the people' (Khakee, 2014). Environmental responsibility placed upon an individual,

according to Khakee (2014), deflects attention away from broad economic and social factors that encourage lifestyles harmful to the environment. Further, he cited possible urban sustainability initiatives that could range from policy measures such as public transportation, increasing the density of urban development and new eco-towns or eco-suburbs. His work proposed a model of unsustainable urban development based on an old theory in development economics called unbalanced growth. The idea of spatial imbalance is argued to provide a feasible approach for cities to carry out city-wide sustainable development, noting the messy, everyday reality in urban areas. Here, the view is that sustainability in one part of the city could produce spin-off effects in the entire city. The unbalanced approach is seen to help break the inertia of attitudes and institutions; bring about necessary reactions to pursue sustainable changes in the entire urban society and break the current economic, social and political malaise in cities (Khakee, 2014).

## 4 Planning and urban sustainability

This review highlighted the important role of urban planning and design with the need for robust research on the sustainability of urban areas. One main argument made here is that urban planning and sustainability are closely intertwined as advanced in various initiatives to build sustainable cities, whether through education, research and professional practice. With the sizeable impacts of rapid urbanisation, an enormous challenge that cities and societies have been going through call for resilient planning and development perspectives (Yigitcanlar and Lee, 2013). In this context, 'sustainable urban development' as a contemporary paradigm is seen to address the impacts arising from the challenges of rapid urbanisation. As such, an opportunity for the search for new mechanisms to develop approaches for building an urban future is perceived.

The planning profession has widely contributed toward more contemporary attempts to develop sustainable urban communities. As urban populations grow, cities have confronted urban sprawl a phenomenon tied to the automobile era with significant waste of farmland. The term 'sprawl' is attributed to urban growth with low population density, leapfrogging, separate land uses and dependency on the car or transportation (Fischler and Wolfe, 2006). Urban sprawls which are urban areas found in many growing cities around the world characterised by an unrestricted growth of housing, commercial developments and road networks over large expanses of land (Fouberg et al., 2015). Urban planners and developers argue that urban sprawl has little concern for urban planning. In the 1980s, New Urbanism was introduced as a "complex planning paradigm and social movement that has recently become influential in planning, residential development and government housing" [Falconer et al., (2001), p.189]. In 1993, the Congress for New Urbanism presented the world with an urban design philosophy for urban revitalisation, development and suburban reforms with walkable neighbourhoods and a diversity of housing. As pursued by planners, the rationale in the design was to reduce people's time in traffic, emphasise pedestrian scale and mixed-use spaces, offer a supply of affordable housing and address the challenges of urban sprawl (Fouberg et al., 2015; Kaplan et al., 2009). Ideally, it seeks more environmentally, ecologically, economically and socially sustainable communities, liveable neighbourhoods – really in urban and suburban utopia (Falconer et al., 2001). In this design, new urbanists wanted to

promote a sense of community and a sense of place in their vision of urban design that supported regional planning of open space, right architecture and appropriate planning. The only problem is that it exists in relatively few neighbourhoods despite its appeal in urban development. Also taking on a regional approach like New Urbanism is the movement for transit-oriented development (TOD) (Calthorpe, 1993). TOD links land-use planning and urban design along with transportation planning to create higher density, nucleated urban clusters in mass-transit stops (Fischler and Wolfe, 2006). The most cited example of a TOD is the Town of Mount-Royal, an inner suburb of Montreal, Canada.

A more comprehensive approach for containing urban sprawl is that of the Smart Growth movement (Bunting and Filion, 2006; Onyschuk, Kovacevic, and Nikolakakos, 2001). Seen as a better way to build and maintain towns and cities, this means building urban, suburban and rural communities near jobs, shops and schools; supports local economies and protects the environment (Smith, 2015). Advocates assert that before new public investments are made, existing investments must have been fully exploited by infill development (Fischler and Wolfe, 2006). Existing areas and new suburbs are targeted for smart growth projects for residential densification and for making the urbanised area more attractive, with its mix land uses, walkable neighbourhoods, compact building design, and a variety of transportation choices. Critics for Smart Growth argue it is vague enough to use as an intervention in urban change. It is aimed purportedly for planning, regulation and construction relative to land, natural resources and public funds to promote greater densities and prevent leapfrog development, in-fill development and reuse of brownfield sites among others. Identified issues with Smart Growth ranged from having more regulations, more congestion and less affordability in housing (Downs, 2005; Nelson and Wachter, 2003; Alexander and Tomalty, 2002). Opponents of Smart Growth argue that the lack of design guidelines limits its success and that the political and urban geography of most of the USA do not make it a suitable strategy for implementation. Overall, Smart Growth is an ideology that is bigger than a single city but smaller than a state in its application.

Urban planners in particular are actively engaged in the process of defining the vision for urban futures from community or stakeholder perspectives to bring the planning practice closer to reality, i.e., in real world context. Over the last few decade potential urban planning solutions ranged from Green Building to Smart Growth and New Urbanism (Smith, 2015). Efforts along these lines must be appreciated to address concerns on urban sprawl and others but they are not short of design and operational issues. There are lessons to be learned from efforts to find design solutions in pressing issues affecting urban development. Green building seeks to construct efficient homes, businesses and facilities to deal with the impacts of new buildings. Smart growth as proposed by planners in the USA is seen to be a better way to build and maintain towns and cities be it in urban, suburban and rural communities given the choices in housing and transportation. To critics, smart Growth has led to more regulations, reduced affordability and found its principles largely unenforceable (Smith, 2015; Downs, 2005; Nelson and Wachter, 2003). New Urbanism was expected to mitigate urban sprawl, seek sustainable growth and encourage infill development (Smith, 2015; Garde, 2004). Some of its development principles include connectivity, mixed housing, quality architecture and urban design, sustainability and quality of life.

In recent years, the practice of planning by many local governments can be found in Europe, North America and Australia where they have figured out ways to integrate

sustainability principles, technologies and frameworks in their planning practice (Yigitcanlar and Kamruzzaman, 2015). Urban planning for sustainability also exists in several developing countries such as China, Malaysia, Turkey and Vietnam, though with limited success but with the belief in the specific roles of planning, development and management in building sustainable cities (Yigitcanlar and Kamruzzaman, 2015). To Yigitcanlar and Lee (2013), sustainable urban development of cities is aimed at improving the quality of life, including ecological, cultural, political, institutional, social and economic components to form a sustainable city. It is argued that positive change may not solely come from architects or urbanists and other professionals in the field of urban development but from a combination of disciplines and professions in planning for a built-up environment and urban governance.

From the perspective of planning education, Pizarro (2015, p.17) stressed the need for knowledge on how "to plan and deliver as there is a lack of prescriptive knowledge to build sustainable urban projects". In achieving sustainability of cities, urban projects have to specify the design elements and infrastructure systems, i.e., in commercial real estate development. There are university partnerships with Schools of Urban Planning and Design where the most advanced sustainability principles are applied in urban projects. In achieving sustainability in built environments, planners, scholars and practitioners frame sustainable planning and design solutions (Yigitcanlar and Dizdaroglu, 2015). In the design of cities, buildings, landscapes and infrastructure, planners are known to contribute toward building healthy ecological conditions for better life-support services, and reversal of impacts on the quality of life for all (Birkeland, 2008).

## 5 Final remarks

Research in sustainable cities is an emerging and important substantive field of study in Sustainability Science that certainly relates to planning, urban sustainability, urban design and assessment methodologies. The challenges presented in this article reflect a shared interest in researching sustainable cities to address the prevailing issues affecting cities around the world. There are notable challenges advanced by current research as reflected in the review. *First*, the review has noted a diversity of definitions and interpretations of sustainable cities in the same way that the terms 'sustainability' and sustainable development are debated and argued in development discourses. *Second* is the persistent quest for urban design in efforts to find the solution to issues concerning sustainable planning. The pressing need is to find planning and design solutions to deal with urban sprawl, rapid urbanisation, urban population pressure, degraded water quality, air pollution and soil erosion and so on. In seeking urban design solutions, the planning and research communities have stated the need to re-examine the demographic picture of city life to address the sheer volume of people in urban areas particularly in megacities around the world (Smith, 2015; Rana, 2011; Keivani, 2009). *Third* is the need to continue with the analysis of the 'urban sustainability concept' not only in the context of developing countries (DCs) where there are questions that arise in transforming urban reality. About 94% of slum dwellers live in DCs and these are the people with the least access to resources. Research suggest that the idea of sustainable urban development should take a multidimensional approach to urbanisation being a complex phenomenon in the South (Bolay, 2012). Further, urban development should involve the participation of all

stakeholders in designing and implementing the city's transformations, engage a multiplicity of spatial scales from neighbourhoods to the edge of the city and outwards to urban expansion to regional scales; and use different instruments to allow for combined social and urban processes. The sustainable urban development of cities is viewed to improve the quality of life, including ecological, cultural, political, institutional, social and economic components to form a 'sustainable city'. *Fourth* is the question of how the academia is conceiving sustainable cities. There is no agreement between how the term is framed by academics and the development firms with land and housing development being at the crux of their proverbial bottom line. In the delivery of realistic sustainable urban projects, academic urban projects face the economic challenge in urban design and the demands of real estate development as affected in the planning process. Definitely, with the many unknowns about how to build sustainable cities, and the lack of prescriptive knowledge to build sustainable urban projects, educational institutions play a vital role in the delivery of know-how and in translating such knowledge into reality. *Fifth* is the attempt to develop an assessment methodology to measure 'sustainable cities'. There is a considerable interest in measuring sustainable cities while recognising that sustainable development (SD) springs at the local scale, i.e., at the level of municipalities, cities or metropolitan regions. Studies to assess the sustainability of cities are found in cities located in both the developed and developing countries and commonly used sustainable development indicators and indices that examined three dimensions, namely environmental, social and institutional and economic indicators. With diverse knowledge from the academia, professionals and a broad base of practitioners, it has been recognised that education and capacity building are critically important in advancing sustainability. This suggests putting sustainability at the heart of university education through learning, research and teaching. There is potential for building rich academic and pedagogic foundations from researchers and practitioners in urban planning, geography and sustainability science wherein solutions are found and opportunities created in sustainability education, contemporary urban planning and design. In assessing the sustainability of major cities, studies tend to apply several categories of sustainable indicators and construct urban sustainability indices in combined measures of economic development, social equity, and environmental components. Another challenge pertains to the lack of monitoring and evaluation systems to establish the level of achievement of urban sustainability. Finally, as environmental concerns become part of development discourses, there is a need for optimism in the eventual refinement of the process to create 'sustainable cities' in the subsequent future.

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