Measuring cities: a study of the development of Iranian urban sustainability assessment mechanisms from a UK perspective

MEASURING CITIES: A STUDY OF THE DEVELOPMENT OF IRANIAN URBAN SUSTAINABILITY ASSESSMENT MECHANISMS FROM A UK PERSPECTIVE

Ahmadreza Hakiminejad

Dissertation submitted in partial fulfilment of the requirements for the Degree of
Doctor of Philosophy
University of West London
2018

For Mahsa

CONTENTS

ABSTRACT

Given the qualitative, exploratory and comparative nature of the investigation, this study has employed a mixed-methods approach. According to the conceptual framework of this research, the emphasis of the study is on mechanisms and interrelationships that affect the process and product of urban sustainability assessment. Accordingly, this study has concentrated on the identification of the urban sustainability indicators, data sources and assessment methods and their strategies and interests within the environmental, socio-cultural and economic contexts in which they operated. To this end, the study has enjoyed the insights from 64 participants including experts, scholars, practitioners as well as high-ranking officials across the ministries, municipalities and local authorities, through carrying out a questionnaire survey and conducting a series of semi-structured interviews in Iran.

Due to a lack of established and well-documented data, it was initially required to find out what kinds of sustainability assessment methods have officially been used in Iran. This led the researcher to conduct a survey of Iranian local authorities and government departments. The findings of this survey were reviewed, discussed and compared to the UK sustainability assessment methods. As a result, the study suggests a detailed proposal for developing an urban sustainability assessment model in Iran including a comprehensive urban sustainability indicator set. The research also concludes that there is an urgent need for establishing a bottom-up organisational structure in Iran to pursue the concepts of sustainable development and sustainability assessment within the public and private sector.

The unique contribution of this study is that it has done a systematic research on the principles and frameworks of developing an urban sustainability assessment mechanism in Iran based on the UK experience and achievement in this area. It has also explored various weaknesses and barriers in the current Iranian urban planning and development system. Examining these barriers and weaknesses may form the demand and objectives of reforms in the current Iranian planning and development systems. Furthermore, the findings of this study provide insights into the issues that policymakers and practitioners need to consider in developing programs and efforts dealing with the problems of urban sustainability assessment. It will enhance the theory and literature within the knowledge bases of evaluation of urban sustainability in Iran tackling the existing issues and making suggestions which will depict the most appropriate way for the development of Iranian urban sustainability assessment mechanisms considering the three substantial pillars of sustainability: environment; society; and economy.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my principal supervisor Dr. Changfeng Fu for the continuous and precious support of my Ph.D study within the past four years. I am also greatly indebted to him for providing me an opportunity to gain teaching experience.

I would also like to thank my advisor Dr. Hamideh Mohammadzadeh Titkanlou for the enormous help throughout the whole process, especially during my visits to Iran. I also need to thank her for the kind support for organising a research seminar in Tehran, Iran.

I would like to thank the rest of my thesis committee: Dr. Anthony Olden, and Professor Thomas Roth-Berghofer for their insightful comments and encouragement. My sincere thanks also goes to Professor Peter Komisarczuk for his support in early stages of this research.

Last but not least, I would like to thank my family: my wife, my parents and my brothers for supporting me throughout writing this dissertation.

PUBLICATIONS AND PRESENTATIONS

BOOK
Afzalian, K., and Hakiminejad, A. (eds.). (2013). *Shahrhaye Paydar Baraye Sayyare e Koochak* (Farsi edition of *Cities for a Small Planet* (Richard Rogers, 1997)), Ketabkadeh Kasra Publishing, Mashhad, Iran.

PEER-REVIEWD ARTICLE
Hakiminejad, A., Fu, C., and Mohammadzadeh-Titkanlou, H. (2015), A critical review of sustainable built environment development in Iran, *Proceedings of the ICE- Engineering Sustainability*, 168(3), pp. 105-119, June 2015. [Online]. Available at: www.icevirtuallibrary.com/doi/abs/10.1680/ensu.14.00017

ARTICLES
Hakiminejad, A. (2017) Tehran's *Stone Palace*: A House for a City (in Farsi), *Anthropology and Culture*, Tehran, Iran.

Hakiminejad, A. (2016) The Role of Historical Buildings in Cities: the Case of Moshirolmilk Carvanserai in City of Borazjan (in Farsi), *Anthropology and Culture*, Tehran, Iran.

Hakiminejad, A. (2016) From "*Sheikh*'s Dome to *Sayyid*'s Minaret (in Farsi), *Anthropology and Culture*, Tehran, Iran.

Hakiminejad, A. (2016) A Land for the Square, A Space for the City(zen): the potentiality of a vacant land in transformation of a significant urban node (in Farsi). Shargh Daily. 11 June 2016, p.10.

Hakiminejad, A. (2016) People; the Missing Link of Iranian Cities (in Farsi). Shargh Daily. 2 July 2016, p.12.

Hakiminejad, A. (2016) *Why "Charkhab" Is Important? A Note on the Significance of Charkhab Palace in South Iran* (In Farsi), Bamdad jonoub Daily, Iran.

Hakiminejad, A. (2012) *Borazjan: an isolated city* (in Farsi), Ettehda-e Jonoub Weekly, Bushehr, Iran.

CONFERENCES AND PRESENTATIONS
Hakiminejad, A. (2016) *Women vs Cities: The Masculinity of Urban Space in Traditional and Modern Iran.* ELEVENTH BIENNIAL IRANIAN STUDIES CONFERENCE, University of Vienna, Vienna, 2-5 August 2016.

Hakiminejad, A., Fu, C., and Mohammadzadeh-Titkanlou, H. (2016) *The Interrelationship of Social Sustainability and Urban Form; the Case of Modern and Traditional Iranian Cities,18th International Conference on Sustainable Urban Environment* Paris, 21-22 January 2016.

Hakiminejad, A., Fu, C., and Mohammadzadeh-Titkanlou, H. (2015) *A Mysterious Approach: The Elements of Environmental Sustainability in Traditional Iranian Architecture and Urban Design.* UWL DOCTORAL CONFERENCE, London, 19 May 2015.

PANEL DISCUSSION

Participated in the panel discussion "Urban Air and Pollution" in "*Iran's Natural Heritage: A Catalyst for Measurable Change"* conference, Asia House, London, 19 January 2014. Panel members: Dr John Curtis, Dr Dariush Borbor, Dr Vahid Hosseini, Ali Hendessi, Ahmadreza Hakiminejad.

SEMINAR

Organised a seminar entitled *"Urban Sustainability Assessment Indicators: A Review"*, Andisheh New Town Development Company, Tehran, Iran, September 2015. (Speakers: Hamideh Mohammadzadeh Titkanlou, Ahmadreza Hakiminejad).

LIST OF FIGURES

LIST OF TABLES

Chapter 1: Introduction

1.1 Background

The story began in 1957 when the first satellite was launched into orbit. We could look at ourselves from a particular ‘vantage point’. It gave us a new vision to the planet and changed our relationships with it. As Richard Rogers, one of the leading architects and planners of our time remarks in his text book *cities for a small planet*: “seen from space, the beauty of earth's biosphere is striking- but so also is its fragility” (Rogers, 1997). Satellites recorded the wounds of ‘deforestation’, ‘industrialisation’ and the ‘sprawl’ of our cities on the earth’s face and illustrated the environmentally disastrous situation of the planet.

The world’s urban population has been dramatically increasing since the early twentieth century. In the year 1900, only ten percent of the world’s population lived in cities, and it reached 50% in 100 years. Only in 40 years between 1950 and 1990 the urban population of the world increased ten-fold from 200 million to more than 2 billion (Rogers, 1997). The massive growth of urban population, a huge number of migrants pouring from rural areas into the cities and also the very fast process of urbanisation turned cities into consumerist giants. More population led to more demands, more consumption, more waste and therefore more pollution. The cars, one of the most influential environmental pollutants, are also critical. In 1950, there were almost 50 million cars in the world, and it reached 500 million at the end of the century and it is estimated to reach one billion by 2025 (Rogers, 1997). Boulding (1966) defines the planet as a “closed system with finite resources”. A serious need to redefine the relationships between human being and ecological environment was recognised. By shaping the “Green Politics” in western countries in the 1970s, the first international gathering entitled *‘United Nations Conference on Human Environment’* (UNCHE) took place in Stockholm (1972) to consider the global ecosystem and environment. This movement followed by significant global conferences in the late twentieth century to unite countries around the world to peruse the aims of sustainable development together. The Report of *‘the World Commission on Environment and Development’* (WCED, also known as Brundtland Commission) in 1987, published as “Our Common Future”, defined ‘sustainable development’ as a development “that meets the needs of the present without compromising the ability of future generations to meet their own needs”. ‘UN Habitat’, the first UN conference on Human Settlements (Vancouver, 1976); ‘UN Conference on Environment and Development’ (UNCED) held in Rio de Janeiro

(Earth Summit, 1992) which led to one of the most important sustainability manifestoes: “Agenda 21”; and the second ‘UN Conference on Human Settlements’ (Istanbul, 1996), have been the focal points of the global concerns to the sustainable development.

Since the early 1990s, arguments over “Sustainable Cities” were raised among theorists, scientific and academic circles, architects, urban planners and also governmental and non-governmental institutions (Lashkari and Khalaj, 2011). According to Rogers (1997), sustainability is about finding the best ways of producing and distributing existing resources which could be socially organised, economically efficient and ecologically reliable. A sustainable city is simply described as a compact, just, diverse, beautiful, creative, and ecological city and also as a “city of easy contact”. Although ‘urban sustainability’ has been recognised for more than two decades, it still is a very controversial issue in spatial planning and urban design. Urban sustainability is becoming more and more fashionable in the contemporary world. But the question is: how achievable is it? How can we recognise a city as a ‘sustainable city’? What are the criteria of a sustainable city? How can we analyse these criteria? How analysable and assessable they are? This research is to, specifically, focus on the assessment mechanisms of urban sustainability and its relevant indicators, data sources and assessment methods and techniques for sustainable urban and regional planning based on Iranian national and local characteristics.

Located in a semi-arid region of the Middle East, 25% of Iran’s land area is covered by two salt deserts that lie within the centre of a plateau (Foy, 2001) and more than 85% of its land area is considered to be arid or semi-arid (Madani, 2014). Adding to the geographical situation of Iran, the complexity of urban governance and decision making processes, social inequality coupled with a vast gap between rich and poor, an inefficient public transport system and massive environmental pollution are the major challenges faced by Iranian cities today. Research particularly focuses on the evaluation, measurement, and assessment of sustainable urban development in Iran. Since Iranian cities suffer from considerable challenges towards sustainable development, the recognition, analysis, and assessment of this problematic situation is imperative. This is exactly what this study concentrates on. In Iran, due to the lack of sufficient research on approaches of urban sustainability assessment mechanisms and the absence of comparing and assessing their results, this study aims to provide a deeper insight and develop a better understanding of these approaches to define a theoretical and integrated framework regarding urban sustainability assessment mechanisms and systems.

The findings of this study provide insights into the issues that policy makers and practitioners should consider in developing programs and efforts dealing with the problems of urban sustainability assessment mechanisms. This piece of work draws a comprehensive study on the urban sustainability assessment mechanisms in Iran which tries to delve deeply into the environmental, social and economic aspects of systems and mechanisms of urban sustainability assessment with regards to indicators, data sources, and assessment techniques based on a comparative study. It will enhance the theory and literature within the knowledge bases of evaluation of urban sustainability in Iran tackling the existing issues and making suggestions which will depict the most appropriate way for the development of Iranian urban sustainability assessment mechanisms considering the three substantial pillars of sustainability: environment; society; and economy. It also develops a detailed proposal for developing a sustainability assessment mechanism in Iran with detailed indicators, data requirements and assessment techniques.

The research requires to be developed through some particular case studies. Iran, obviously, is the central case study of this research, although it is needed to determine a holistic urban sustainability baseline. It would be based on the successful experiences which already involved with sustainability criteria in depth and details. Therefore, the UK as one of the pioneers of sustainable urban development in the world is selected. Identifying the key characteristics of their indicator systems, data sources and assessment methods/techniques, some of the British urban sustainability assessment mechanisms and tools will be investigated. This is to find out how and to what extent, findings of the British assessment systems can be adoptable to Iran’s situation, given the fact that every situation (in this case, country) could have its own unique socio-cultural and environmental circumstances.

1.2 Research questions

This study aims to answer the following questions:

- How can urban sustainability assessment improve urban planning in Iran?
- What is the role of urban sustainability assessment mechanisms in decision-making processes in Iran?
- What kinds of policy/principles are needed in the urban planning process for the development of sustainability assessment mechanisms?
- What kinds of sustainability assessment mechanism are most demanded/urgently needed in Iran?

- What kinds of indicators and datasets are needed in the development of urban sustainability assessment mechanisms in Iran?

1.3 Aim and objectives

Through research, it aims to explore how to improve a theoretical framework and to develop a better understanding of urban sustainability assessment mechanisms, based on Iranian national and local characteristics. Therefore, to achieve this aim, it is necessary to:

- Review in-depth the UK experience and achievements in urban sustainability assessment through indicator systems; data sources; and assessment methods and techniques.
- Investigate the existing situation of Iran in terms of urban sustainability development (regulations and legislation, technologies, assessment).
- Explore the urban sustainability assessment mechanisms in Iran through indicators; data sources; and assessment techniques
- Develop a sustainability assessment mechanism for Iran with a comprehensive plan of an integrated indicator system, data sources and assessment techniques.
- Re-assess the interim suggestions and draw final conclusion of this study (collecting feedback from academics; practitioners; policy and decision makers through a questionnaire-based survey and interviews in Iran)

1.4 Research methods

This research follows an interpretivist research paradigm with a neo-positivist (functionalist) perspective to knowledge. This interaction is known as “paradigm interplay” or “paradigm crossing”. According to Leedy and Ormord (2005) in a neo-positivist (functionalist) approach there is a different aspect of realism, “where humans are not capable of finding definite answers to what knowledge is” and also humans cannot be completely objective. This ‘paradigm interplay’ is derived from the nature of sustainability. All indicators of urban sustainability including social, economic and environmental categories have a severe relationship with human interactions and social structures. Even the study of natural resources and environmental circumstances in an urban sustainability research is based on impacts of social behaviour on them. Urban sustainable development strategies can be derived through observing reality of the social world. As neo-positivists (functionalists) do not believe in the “dynamic socially constructed nature of knowledge”, interpretivism is the leading paradigm of this research. The neo-positivist paradigm covers those quantifiable and computerised (technical) systems of this research and helps it to be more useful and applicable. “Paradigm interplay”, inevitably, goes to a mixed methods approach. In this case both qualitative and quantitative methods are considered. However the study will be dominantly carried out through a qualitative approach. The research methodology will be extensively discussed in Chapter 4.

1.5 Research contribution

The unique contribution of this study is that it has done a systematic research on the principles and frameworks of developing an urban sustainability assessment mechanism in Iran based on the UK experience and achievement in this area. It has also explored various weaknesses and barriers in the current Iranian urban planning and development system. Examining these barriers and weaknesses may form the demand and objectives of reforms in the current Iranian planning and development structures. Furthermore, the findings of this study provide insights into the issues that policymakers and practitioners need to consider in developing programs and efforts dealing with the problems of urban sustainability assessment. It will enhance the theory and literature within the knowledge bases of evaluation of urban sustainability in Iran tackling the existing issues and making suggestions which will depict the most appropriate way for the development of Iranian urban sustainability assessment mechanisms considering the three substantial pillars of sustainability: environment, society, and economy. The study also suggests a detailed proposal for developing an urban sustainability assessment model in Iran including a comprehensive urban sustainability indicator set.

1.6 The structure of the thesis

This thesis is organised in seven chapters. The opening chapter: introduction, aims to offer a glimpse of what the thesis is about. Giving a brief background, it highlights the key questions of the study, its aim and objectives, as well as the methodological theories the research employed.

The second chapter starts with a theoretically-expanded explanation of urban sustainability definitions before it jumps, specifically, into the matter of urban sustainability evaluation. Subsequently, the chapter provides an overview of theories and concepts of evaluation of urban sustainability and expands upon fundamental elements of evaluation: indicator, data, and assessment methods and techniques, from a UK perspective.

Chapter 3 undertakes an in-depth review of sustainable built environment development in Iran. It draws a generic picture of the country as it opens with introductory sections about Iran’s geographical features and its sociocultural contexts. Furthermore, through the review of literature the chapter investigates the current situation and experience of sustainable urban development in Iran in terms of: (1) governmental administrative framework, policies, legislation and regulations; (2) the application and development of sustainable technologies; and (3) sustainability assessment mechanisms and tools.

In Chapter 4, the methodological framework of the study is described and discussed. The chapter starts with theoretical discussions of research philosophies and methods, followed by descriptions of the specific methods used for the purpose of this research.

Chapter 5 is comprised of two major sections. Firstly, it explores the urban sustainability assessment methods in Iran coupled with the previously-discussed UK assessment methods, aimed at suggesting two comprehensive sets derived from the literature review and investigation processes. Secondly, it tries to draw a comparison between the two by discussing their relevant indicators, data sources and assessment techniques. Consequently, by understanding the two systems, a finalised urban sustainability assessment framework will be suggested to be set in the Iranian context in Chapter 7.

Chapter 6 sets out the results of the study through conducting a questionnaire survey as well as semi-structured interviews. Therefore, descriptive analytical approaches, including the use of Excel and SPSS are applied to assess the questionnaire results, while the oral communications are analysed by employing the qualitative content analysis methodology. Subsequently the survey results are discussed.

Lastly, the closing chapter of the thesis will conclude with a brief review of the study, highlighting research limitations, contributions, and recommendations for potential further research. In a nutshell, the chapter provides a conclusive manifesto of what the thesis adds to the knowledge bases of urban sustainability assessment in Iran.

The table below on the next page demonstrates a brief timeline of the research journey (see Table 1.1).

Table 1.1. The research timeline

Research activity		**Month/Year**
Research proposal approved		Jun. 2013
Literature review		2013 – 2015
Data collection processes	Survey of 33 local authorities	Jul.– Sept. 2013
	Conducting interviews	Summers of 2013-14-15
	Conducting the questionnaire survey	Aug. – Oct. 2016
Holding a research seminar in Iran		Sept. 2015
MPhil to PhD Transfer	Presentation	Jul. 2015
	Partial draft submission	Aug. 2015
	Transfer viva	Dec. 2015
	Transfer approved	Feb. 2016
Analysing interviews and questionnaire		May – Jul. 2016 / Nov. – Dec. 2016
Writing up the thesis		Jan. – Sept. 2017
Submission of the thesis		Oct. 2017

Chapter 2: Evaluation of Urban Sustainability

2.1 Introduction

This chapter starts with a theoretically-expanded explanation of the historical evolution of the term: sustainable development, before it jumps into the matter of urban sustainability assessment. Subsequently, the chapter provides an overview of theories and concepts of evaluation of urban sustainability and expands upon fundamental elements of evaluation: indicator, data, and assessment methods and techniques, from a UK perspective.

2.2 Sustainable development: a historical overview

Although, "after a period of fashionable overuse (and abuse)" some scholars have recently echoed alternative notions (e.g. 'regenerative city') to 'sustainable development' (Girardet, 2010; Girardet, 2015; James, 2015; Forrest, 2017), SD is yet the "most important policy goal" that has been widely acknowledged all over the globe (Rydin, 2010). The well-known definition of it, as first appeared in the 1987 Report of Brundtland Commission entitled *Our Common Future*, depicts sustainable development as a kind of "development that meets the needs of the present, without compromising the ability of future generations to meet their own needs" (WCED, 1987). Prior to its first major global reception in the United Nations Conference on the Human Environment in 1972, the notion of 'sustainable development' as known in the modern day, has first emerged in several publications during the 1960s and 1970s (e.g. Rachel Carson's *Silent Spring* in 1962; Barbara Ward's *Spaceship Earth* in 1966; Buckminster Fuller's *Operating Manual for Spaceship Earth* in 1968; Barbara Ward and René Dubos' *Only One Earth* in 1972) (Satterthwaite, 2006). However, Ulrich Grober, the author of *Sustainability: A Cultural History* argues that the term is rooted in the 18th century book: 'Sylvicultura oeconomica' (published in 1713), the work of German nobleman Hanns Carl von Carlowitz, in which he discussed the sustainable use of timber and woodland management (Grober, 2007). As he asserted, the rise of environmental concerns over forestry can even be traced back to the 17th century France and Britain. The notion later appeared in *An Essay on the Principle of Population* (published in 1798), written by the English demographer, political economist and country pastor, Thomas Robert Malthus in which he pointed out that the world's population would eventually face the shortage of food supply due to the drastic growth of population (Bâc, 2008).

The abovementioned 1972 Conference on the Human Environment in Stockholm, Sweden— attended by 113 states and representatives from 19 international organizations— which culminated in the decision to initiate the United Nations Environmental Program (UNEP), has aimed to: "provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations" (Vogler, 2007). In the same year of the Stockholm conference, The Club of Rome circle (a global think tank inaugurated in 1968) published its first manifesto book *The Limits to Growth*, as part of its "remarkably ambitious undertaking": 'the Project on the Predicament of Mankind' to:

"examine the complex of problems troubling men of all nations: poverty in the midst of plenty; degradation of the environment; loss of faith in institutions; uncontrolled urban spread; insecurity of employment; alienation of youth; rejection of traditional values; and inflation and other monetary and economic disruptions."

All of these issues mentioned above, as The Club of Rome calls it: "world problematique" have three characteristics in common: "they occur to some degree in all societies; they contain technical, social, economic, and political elements; and, most important of all, they interact" (Meadows et al., 1972).

Following the publication of the aforementioned report of Brundtland Commission (initially created by the UN General Assembly as the World Commission on Environment and Development in 1983), which coined the concept of 'sustainable development', the next major global event, the UN Conference on the Environment and Development (UNCED), took place in Rio de Janeiro, Brazil, during the summer of 1992 (Bâc, 2008). The key outputs of the conference were: the Rio Declaration, Agenda 21, and the Commission on Sustainable Development (Vogler, 2007). Subsequently, the World Summit on Sustainable Development (WSSD) (also known as Rio+10) was held in Johannesburg in 2002. Reviewing progress in the implementation of Agenda 21 since its adoption in 1992, the summit concluded with two specific outcomes: Johannesburg Declaration on Sustainable Development; and Plan of Implementation (Bâc, 2008). The Johannesburg summit also tried to further social and economic aspects of sustainable development. The summit returned to Rio de Janeiro in the summer of 2012 to hold the UN Conference on Sustainable Development (Rio+20) which led to publication of the pamphlet of *The Future We Want* (UN, 2017). Along with the UN major events mentioned above, on sustainable development, three peculiar *Habitat* events have been hitherto held with special consideration to the world's urban environment in 1976 (Vancouver), 1996 (Istanbul) and 2016 (Quito) respectively. These are to respond to and deal with the concept of ‘sustainable urban development’ more closely (see Table 2.1).

Table 2.1: The UN Habitat Conferences

Habitat conferences	Title	Place	year	Outcome
Habitat I	United Nations Conference on Human Settlements	Vancouver, Canada	1976	Vancouver Declaration on Human Settlements
Habitat II	United Nations Conference on Human Settlements	Istanbul, Turkey	1996	Istanbul Declaration and the Habitat Agenda
Habitat III	United Nations Conference on Housing and Sustainable Urban Development	Quito, Ecuador	2016	The New Urban Agenda

2.3 Evaluation of urban sustainability: a theoretical narrative

The term ‘Urban Sustainability Assessment’ tries to answer this apparently simple quest appeared on the cover of the book ‘*How Green Is the City?’* almost two decades ago. In this book, Devuyst et al. (2001) have explained how sustainable urban development might technically work. They have looked at the subject from these perspectives: first, environmental education should be implemented at every level, “formal and informal”. People need to learn and understand that environment is not only an untouchable technical or scientific knowledge. They need to realise that it is something related to their everyday life. Environment should be “re-installed as a common knowledge”. Second, individuals’ and households’ awareness of their impacts on the environment should be made through the measurement of their “ecological footprint”. And third, in order to reduce that “footprint”, we need “visible indicators” around us to monitor our continuous use of certain resources. As we need to monitor our daily energy usage through the visible indicators, we also need to analyse, and to evaluate them. The third point they pointed out, opens the gateways toward the evaluation of urban sustainability. Monitoring, analyzing and evaluating these specific indicators can be generalised to the urban scale. Urban sustainability assessment tools help us to forecast the impact of human behaviours and activities on the sustainability of societies and quantify the progress made toward sustainable development (Devuyst et al., 2001). Despite agreement on the main elements of sustainable development, the method of sustainability measurement still remains the key challenge to both research and practice. The purpose of assessment is more about discovering methods of “improvement” than the “judgement” of the subject (Badri and Eftekhari, 2003). The term sustainability assessment is applied in two different contexts. Firstly, it is used to assess the life cycle performance of existing buildings and communities. Secondly, it is used to identify the evaluation of sustainability measures considered for forthcoming projects at the pre-implementation stages (Adinyira et al., 2007). In recent years, the great amount of experience at an international level has revealed that there are tremendously "heterogeneous approaches" in urban sustainability assessments and those projects with the very formalised and clearly structured models have been rarely seen (Deakin et al., 2007). Linking evaluation with decision-making process, Devuyst (2001) defines sustainability assessment as:

"a formal process of identifying, predicting, and evaluating the potential impacts of a wide range of relevant initiatives (such as legislation, regulations, policies, plans, programs, and specific projects) and their alternatives on the sustainable development of society. The process includes a written report on the findings of the sustainability assessment in such a way that it improves the publicly accountable decision-making process."

As James (2015) concisely explains, the concept of sustainability assessment "is used to cover the manifold activities of monitoring, evaluating, reporting and providing an evidence base for policy development in relation to sustainability problems and outcomes".

Gibson (2006) argues that sustainability assessment should be designed in a way that is 'integrative', so it can perform as a framework for better decision-making on all undertakings: policies, plans and programmes as well as physical undertakings. Being 'integrative' means that three pillars of sustainability (environment, society and economy) need to be taken into consideration throughout assessment processes in conditions in which they can be co-operative and enhance a peaceful coexistence, rather than falling into "ugly trade-offs" (Gibson, 2006). Several authors and scholars (e.g. Gibson *et al.*, 2005; Gibson, 2006; Morrison-Saunders and Therivel, 2006; Pope and Grace, 2006) have raised concerns over the issue of trade-offs in sustainability decision-making as a key element that should be unequivocally acknowledged and explicitly addressed in sustainability assessment processes. They have challenged the notion expressed by, for example, Dovers (2002) who suggests that "environmental and social issues matter, until it matters economically". As Gibson (2006) and Morrison-Saunders and Therivel (2006) stated, social and environmental factors should not be sacrificed in the name of sustainability decision-making by favouring the economy priority, emphasising the need for a more advanced approach to sustainability assessment that could expand the search for feasible solutions with "wider benefits and less ugly trade-offs". James (2015) goes even further and argues that sustainability should be framed as a *social* condition and in this respect, economics becomes just another social category.

To this end, Gibson (2006) proposed a package of key assessment design components based on seven broad components that might help providing a viable solution (see Table 2.2). As shown in Figure 2.1, Morrison-Saunders and Therivel (2006) suggested that, for understanding the characteristics of any given sustainability assessment, it is essential to consider the interrelationship between both the decision question being asked and the type of approach being used.

Table 2.2: Seven key assessment design components toward a more integrative sustainability assessment approach (Gibson, 2006)

- Build sustainability assessment into a larger overall governance regime that is designed to respect interconnections among issues, objectives, actions and effects, though the full interrelated set of activities from broad agenda setting to results monitoring and response.
- Design assessment processes with an iterative conception-to-resurrection agenda, aiming to maximise multiple reinforcing net benefits through selection, design and adaptive implementation of the most desirable option for every significant strategic or project level undertaking.
- Redefine the driving objectives and consequent evaluation and decision criteria to avoid the three conventional categories, to ensure attention to usually neglected sustainability requirements, and to focus attention on the achievement of multiple, mutually reinforcing gains.
- Establish explicit basic rules that discourage trade-offs to the extent possible while guiding the decision-making on those that are unavoidable.
- Provide means of combining, specifying and complementing these generic criteria and trade-off rules with attention to case- and context-specific concerns, objectives, priorities and possibilities.
- Provide integrative, sustainability-centred guidance, methods and tools to help meet the key practical demands of assessment work, including identifying key cross-cutting issues and linkages among factors, judging the significance of predicted effects, and weighing overall options and implications.
- Ensure that the decision-making process facilitates public scrutiny and encourages effective public participation.

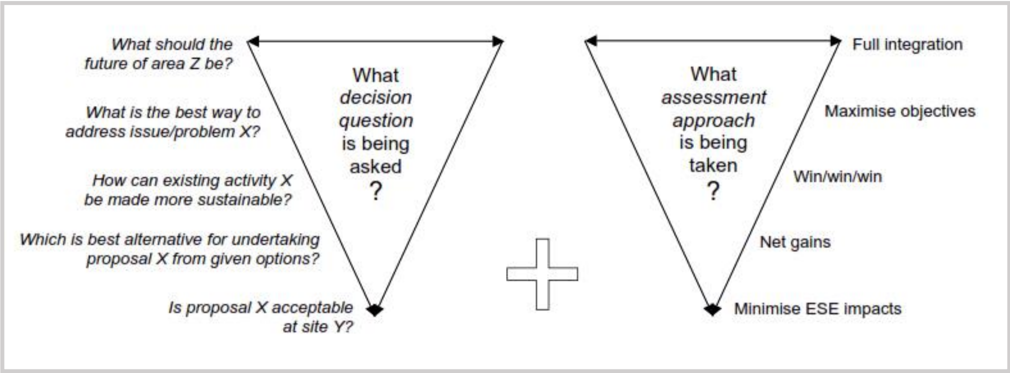


Figure 2.1: Model for understanding the characteristics of sustainability assessment (Morrison-Saunders and Therivel, 2006)

The core questions that any given sustainability assessment might need to answer, could be incorporated into five key questions raised in a sustainability assessment framework called 'Systemic User-driven Sustainability Assessment' (SUSA), which was developed in 1993 by the World Conservation Union (IUCN) and the International Development Research Center (IDRC) (Devuyst, 2001). These five questions are as follows (IUCNIAT, 1995):

- What is the condition of the ecosystem, how is it changing and why?
- What is the condition of people, how is it changing and why?
- What are the main interactions between people and the ecosystem?
- What conclusions can be drawn about progress toward the goal?
- What needs to be done to make progress toward the goal?

James (2015) explains the sustainability assessment within two approaches: 'top-down' and 'bottom-up'. As he describes, on the one hand, the formal "bird's-eye, expert-driven processes" of top-down assessment, conducted at national, transnational and global levels, were largely developed for and by corporate and government organisations. Although they may not necessarily lead to policy-making, they have become a vital part of the public image of many organizations. On the other hand, there are the bottom-up qualitative assessment approaches derived from measures based upon a community-minded point of view. Non-governmental organizations (NGOs), municipal authorities, community groups and localities have increasingly favored these approaches (James, 2015).While the top-down assessment methods typically suffer from the lack of engagement with municipal governments, urban communities and small NGOs, the bottom-up approaches, apart from the issue of 'non-comparability', lack the rigor and rigidity of those top-down assessment protocols (Turcu, 2013; James, 2015).

Moreover, the nature of public engagement, its processes and procedures are matters of concern (James, 2015).

As Devuyst (2001) stated, the role of human resources involved in the assessment processes, is crucial to the outcome of the sustainability assessment:

"It is therefore very important to think about the profile and position of the person doing a Sustainability Assessment. (...) Experience (...) has shown that more inspiring results are obtained if the person doing the Sustainability Assessment is a passionate and stubborn promoter of the concept of sustainable development."

He went on to argue that if the assessor / evaluator is not convinced of the implications of, and the need for a more sustainable future, the sustainability assessment will be reduced to a mere "bureaucratic fulfilment of official requirements". It is also essential that evaluators act independently and are not influenced by lobby groups within authorities and the society (Devuyst, 2001). Devuyst (1998) also proposed the establishment of a 'Sustainable Development Flash Team' within the ASSIPAC-method— a sustainability assessment framework ('Assessing the Sustainability of Societal Initiatives and Proposing Agendas for Change') he developed at the EIA Centre, Rije Universiteit Brussel. The 'Flash Team' comprised of enthusiastic individuals who are advocates of sustainable development, should (Devuyst, 2001):

- be completely independent from the initiatives they study;
- be specialized in short interventions in government departments where important decisions are about to be made;
- surprise decision-makers and stakeholders with the strength, inventiveness, and creativity of their visits;
- be like a flash light: surprising, brief, leaving a strong impression, enlightening, and full of energy;
- make proposals for what a more sustainable initiative would look like and develop scenarios for change towards a more sustainable society;
- take a role of training and motivating policy-makers, planners, and decision-makers on sustainable development.

From the introduction of Environmental Impact Assessment (EIA)— which is described in more detail in section 2.7 of this chapter— in early 1970s, to the emergence of experimental assessment concepts in 1990s (e.g. 'Systemic User-driven Sustainability Assessment' (SUSA) (IUCNIAT, 1995); 'Strategic Sustainability Assessment' (SSA) (Partidario and Moura, 1997); 'System for Planning and Research in Towns and Cities for Urban Sustainability' (SPARTACUS) — a two-year research project within the Environment and Climate research program of the European Union, carried out in Finland, the UK, Italy, Spain, and Germany between 1996 and 1998 (Devuyst, 2001)); to the birth of new generation of evaluation methods such as 'BREEAM Communities' and Arup-developed 'Sustainable Project Appraisal Routine' (SPeAR) in recent years, the term 'sustainability assessment' has now gone through as an imperative mechanism (James, 2015) to pinpoint not only the ecological footprint, but also socioeconomic impacts of decisions we make and policies we develop to run the human settlements on the Planet Earth.

2.4 The role of sustainability evaluation in spatial planning and urban design

"The first reason for undertaking an evaluation is to resolve the incompleteness and uncertainty surrounding any problem in the public domain" (MeLoughin, 1969; Lombardi, 1999). Thus, it can be said that 'urban sustainability evaluation' is to resolve the "incompleteness and uncertainty" surrounding any problem in the process of stainable development of urban areas. However, a mere 'evaluation' will never be able to do this, unless it could have a significant stake in the process of decision-making. This is where the link between urban planning and evaluation begins to take shape (Gibson et al., 2005; James, 2015). In other words, the evaluation outcomes could play an integral role in spatial planning and urban design, only if it gets involved with the policy- and decision-making processes (Brandon and Lombardi, 2011). In fact, the evaluation is to assists the process of decision-making, or as Clough (1984) puts it, the process of "making consequential choices (...) thinking in advance about what alternatives to consider and how to choose a good, better or best alternative". Dovers (2002) argues that sustainability assessment needs to make every effort to defy everything leaning towards unsustainability: it should "challenge the status quo and strive to change not just decisions but well-established institutions and familiar patterns where these are unsupportive of sustainability". Referring to Patassini (1995) and Stanghellini (2006), an evaluation can be defined by its three main characteristics: a) it is action-oriented; b) it helps to structure an understanding of processes and problems; c) it is associated with a decision.

In recent decades, the United Nations efforts which led to establishment of a series of agendas and action plans— from *Our Common Future* to the recently-launched *New Urban Agenda*, placed urban sustainability as a high priority for many governments all over the world, as well as for the private and academic sectors (Leach et al., 2015). The EU ministerial informal meeting in Bristol, UK, in December 2005, which resulted in the 'Bristol Accord' was centred upon a common European approach to 'sustainable communities agenda' (Evans, 2011). As Dempsey et al. (2011) pointed out, 'Bristol Accord' defines sustainable communities as "places where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all" (ODPM, 2006). Consequently, 'good urban design', which has now become an essential part of creating and retaining sustainable communities, can ensure that the governments' social, environmental and economic targets and plans were well-consolidated with how places were designed and shaped (ODPM, 2003; Leach et al., 2015).

Dempsey et al. (2011) have identified that for achieving a socially sustainable city or, say, a sustainable community, it is required to consider the dichotomy of physical and non-physical factors involved, explaining that within the term 'urban sustainability', the word 'urban' could refer to: (a) people who live within the urban areas; and (b) the urban built environment. The former (urban society) could be reflected in 'non-physical factors' such as health; education; social capital; etc., while the latter (urban built environment) could be traced in 'physical factors' such as urbanity; public space; neighbourhood, accessibility and the others (see Table 2.3). The 'physical factors' are directly related to, or better to say, dependent on the way cities are designed. Understanding the fact that how 'planning and design' and 'evaluation' are heavily interconnected, could help decision-makers to take serious steps towards sustainable planning and urban design. For example, in a locality / town / city which enjoys a more pedestrian-friendly layout of planning, people will be encouraged to use more sustainable methods of movement (e.g. walking and cycling). This inevitably leads to reducing private vehicle usage which is one of the most important factors that contributes to air pollution concentration. Therefore, the spatial organisation and arrangement of the built environment could have impacts on people's behavioural patterns and the way they engage with the city.

A plethora of studies have suggested that the isolated evaluation of buildings cannot be sufficient for assessment of urban sustainability, and that it is required to recognise a comprehensive vision of the city and its multifarious parts, such as: its neighbourhoods; population; land use; urban spaces; water and energy use; air quality; mobility and transportation; etc. (Mourshed et al., 2005; Haapio, 2012; Gil and Duart, 2013; Mohammed

Ameen et al., 2014). All these parts characterise the foundation of the evaluation of urban sustainability (Mohammed Ameen et al., 2014). As Sharifi and Akito Murayama (2013) and Mohammed Ameen et al. (2014) asserted, in recent years many of the renowned assessment tools which have been widely used globally, have tried to expand their scope of assessment of buildings towards the evaluation of urban design sustainability. These include: BREEAM Communities (2011-2012), LEED -ND for neighbourhood development (2007), CASBEE–UD for urban development (2007), SBTool PT – UP (2013), PEARL CO (the Estidama Pearls community rating system 2010), and QASA (the Qatar assessment system 2010).

Table 2.3: Contributory factors for urban social sustainability (Dempsey et al., 2011)

Non-physical factors	Physical factors
• Education and training • Social justice: inter- and intra-generational • Participation and local democracy • Health, quality of life and well-being • Social inclusion (and eradication of social exclusion) • Social capital • Community • Safety • Mixed tenure • Fair distribution of income • Social order • Social cohesion • Community cohesion (i.e. cohesion between and among different groups) • Social networks • Social interaction • Sense of community and belonging • Employment • Residential stability (vs turnover) • Active community organizations • Cultural traditions	• Urbanity • Attractive public realm • Decent housing • Local environmental quality and amenity • Accessibility (e.g. to local services and facilities/employment/green space) • Sustainable urban design • Neighbourhood • Walkable neighbourhood: pedestrian friendly

In the end, it is worth noting that, as Leach et al. (2015)— through an interview-based research, concluded, there might be tensions between sustainability assessment methods and creativity and innovation in urban design: “these methods contribute primarily to the technical aspects of sustainability, not to creativity”. However, they also recognised that these methods could “provide a way for urban designers to engage with sustainability” (…) “providing information that could form the basis for creativity and innovation”.

2.5 Measures and indicators

In the light of measuring performance of the cities, there should be measurable elements to give the possibility for evaluation and analysis. Literally, indicators are those "measurable elements". It is not more than two decades that local and national governments across the globe have developed 'indicators' to evaluate the urban sustainability performance. Indicators in themselves are tools and not the end products. They are a vehicle for guiding people's understanding of their community, articulating and weighting options and helping them make strategic decisions (Turcu, 2013). As Kline (2001) described, the first aim of urban sustainability indicators is to be obtained to guide new development decisions by "building on a community's assets and furthering community values and interests". The second purpose is to restore natural and human environments and a third purpose is to use them to foster planning and evaluation in order to prevent that past mistakes to be repeated. Indicators can also be used as a planning and policy tools to guide development as a whole.

With the aim of understanding on the state of, or changes to, urban areas in relation to better urban sustainability performance, sets of indicators, frameworks and assessment tools, have been developed (Davison, 1996; Briassoulis, 2001). Urban sustainability indicators are crucial for helping on target setting, performance reviews and facilitating communication among the policy makers, experts and public (Verbruggen and Kuik, 1991). Urban sustainability indicators are important instruments for assessing the performance of cities. They include environmental, economic and social indicators designed to identify progress in meeting the objectives of socio-economic and environmental sustainability. Many European cities work with specific sets of indicators which enable them to measure their success in attaining their targets and communicating with their citizens.

As noted above, indicators have the role of measuring performance, and in the process of urban sustainability assessment there is a need for measurable indicators. Many researches are attempting to document the extent to which cities are or are not becoming sustainable through the use of indicators, and to reveal the practical challenges that are being encountered in the process. However, the selection process of indicators should not be about gathering the information for all indicators, but rather selectively analysing the ones which are more fundamental in essence and more likely to produce the most accurate information about the status of practice. According to Mega and Pedersen (1998), indicators must be "clear, simple, scientifically sound, verifiable and reproducible". Tilbury et al. (2007) interestingly defined an indicator as "SMART": Specific, Measurable, Achievable, Relevant, and Time-related. The urban sustainability indicators should provide at least the following: (a) explanatory tools to translate the concepts of sustainable development into practical terms; (b) pilot tools to assist in making policy choices that promote sustainable development and (c) performance assessment tools to decide how effective efforts have been (Zhang et al., 2003).

Different projects concerning their particular needs apply different indicators. The process of indicators selection should be derived from the clear understanding of those needs. Indicators can give us a better understanding of the breadth and the scope of sustainable development issues and the relationships between them. Indicators are priceless tools not only because of their capabilities to measure, to communicate and to simplify the key issues, but as influential means to help society and policy-makers. Indicators can significantly raise the public awareness. They are likely to produce appropriate patterns of sustainable behaviors (Shen et al., 2011).

The list of urban sustainability indicators could vary in different practices, although some of the international institutes represented comprehensive lists that have been used as references in many practices. The most important lists set up by 6 international organizations during the last 15 years are: the European Foundation (1998), the European Commission on Science, Research and Development (2000), the UN Habitat (2004), Energy Environment and Sustainable Development (2004), United Nations (2007) and the World Bank (2008). The "International Urban Sustainability Indicators List" (IUSIL) is a single and comprehensive set which is derived from combination of these 6 lists. IUSIL is defined within 4 sustainable development dimensions (environmental, economic, social and governance) including 37 categories and 115 indicators. It should be noted that although this list can be applied in different circumstances for the purpose of comparative evaluations, many cities and communities have developed their own urban sustainability indicators (Shen et al., 2011). It is notable that whilst there are various lists of urban sustainability indicators there is no single set of indicators that suits equally all cities or communities.

2.6 Data sources for evaluating urban sustainability

In this section, data: the most challenging prerequisite for the process of assessment on which the practicality of the evaluation is based, is discussed. As mentioned earlier, indicators are the key role players in the development of urban sustainability evaluation mechanisms. Measurable indicators make the cities measurable. However, a measurable indicator needs a measurable data. As Wong (2006) emphasises in her textbook *'Indicators for Urban and Regional*

Planning: The Interplay of Policy and Methods', "of all the stumbling blocks in indicator research, it is clear that it is 'data, data and data' which makes it or breaks it". She describes 'data' as both a requirement and a problem to development of urban sustainability indicators. There is no doubt that the good-quality datasets significantly increase the possibility of producing reliable and vigorous indicators. In recent years, affordability of personal computers and development of Information Technology (IT), especially database technology, have been used to store, process and calculate large datasets of various national and regional statistics. Geographical Information Systems (GISs)— a comprehensive application of database and graphics technology— enable more effective and efficient application of national statistics in urban planning, and make quantitative analysis of urban sustainability possible (Wong, 2006; Fu and Aouad, 2009). By increasing availability of administrative data, the pieces of information are mostly accessible on the World Wide Web browser through websites of many government departments. For instance UK Office for National Statistics (ONS) and UK Data Service cover a variety of datasets on the web publishing their routinely collected statistics on their websites. Wong (2006) argues that while this progress in improving statistics is encouraging, there are still plenty of challenges ahead.

2.6.1 Types of data

Within the urban planning process, the nature of datasets could be divided into qualitative, quantitative and geospatial data. While qualitative data referred to descriptive data which is related to people's thoughts, feelings and opinions, quantitative data introduces numerical and statistical information. Geospatial or geographic data stands for those pieces of information that identifies the "geographic location and characteristics of natural or constructed features and boundaries on the earth" (Hobbs, 2013). Geospatial data is typically represented by points, lines and polygons. It plays a significant role in sustainable urban development research. All data which is collected based on geographic locations can be represented as geospatial data. For instance, geospatial analysis can be applied to the IMD (Index of Multiple Deprivation) assessment method that represents the level of deprivation in individual neighbourhoods (DCLG, 2010b). The outcome is illustrated through maps, images, aerial photographs and demographics.

2.6.2 Typical demographics and statistical data sources in the UK

A variety of statistical data sources can potentially be applied in urban sustainability assessment, but a carefully-detailed evaluation is a very complicated and time-consuming process (Fu and Aouad, 2009). As mentioned earlier, in recent years many IT applications have been used in the national census and national statistics collection, and these involve different geographic boundaries within which the data are collected or presented. These geographical boundaries include Census Output Areas (COAs), Super Output Areas (SOAs), Wards, Postcode, and Ordinance Survey MasterMaps (OSMM). In the followings, details of the UK's geographical boundaries being applied in the urban planning processes, are explained.

Wards

Before the implementation of more detailed statistical boundaries such as COAs (Census Output Areas) and SOAs (Super Output Areas), wards were traditionally used as national census and statistical boundaries. There are four types of ward divisions as follows:

Electoral wards

Electoral wards / divisions are the key building blocks of UK administrative geography, being the spatial units used to elect local government councillors in metropolitan and non-metropolitan districts, unitary authorities and the London boroughs in England; unitary authorities in Wales; council areas in Scotland; and district council areas in Northern Ireland (Fu and Aouad, 2009). Electoral wards/divisions vary significantly in size, from fewer than 100 residents to more than 30000, which is not ideal for nationwide comparisons. Furthermore, data for larger wards that can safely be released may not be published for smaller wards due to disclosure requirements (Fu and Aouad, 2009). Electoral wards are subject to regular boundary changes and this creates problems when trying to compare datasets from different time periods. There are 9,196 electoral wards in the UK (ONS, 2016a).

Statistical wards

Statistical wards are the ward boundaries changed and promulgated at the end of each calendar year, which are also used as the statistical purpose (boundaries) on 1 April of the following year (Fu and Aouad, 2009). This policy aimed to minimise the statistical impact of frequent electoral boundary ward changes (ONS, 2016b). The concept of statistical wards applied to England and Wales was not implemented in Scotland or Northern Ireland. The last set of statistical wards was produced in 2005 (ONS, 2016b).

Census Area Statistics (CAS) wards

CAS wards were created for 2001 Census outputs, including those available on the Neighbourhood Statistics (NeSS) website (ONS, 2016b). In England and Wales they are identical to the 2003 statistical wards, except that 25 of the smallest (sub-threshold) wards have been merged into seven receiving wards to avoid the confidentiality risks of releasing data for very small areas. This has occurred to those wards with fewer than 100 residents or 40 households (as at the 2001 Census). There are a total of 8,850 CAS wards in England and Wales (ONS, 2016b) and 1,222 in Scotland, with a minimum size of 50 residents and 20 households. It should be noted that Scottish Census outputs use different ward codes to the ONS standard. In Northern Ireland 2001 Census outputs use the 582 electoral wards in existence at Census Day. There was no requirement to introduce specific CAS wards, as all electoral wards exceeded the 100 residents / 40 households' threshold. However, as in Scotland, Northern Ireland Census outputs use different ward codes to the ONS standard (ONS, 2016b).

Standard Table (ST) wards

ST wards are those for which the 2001 Census Standard Tables are available. They are a further subset of the statistical wards such that those with fewer than 1000 residents or 400 households have been merged. In England and Wales a total of 113 of the 2003 statistical wards were involved in mergers to create the ST ward set (ONS, 2016b). There are a total of 8,800 ST wards in England and Wales, 68 fewer than the total number of 2003 statistical wards. Scotland's 1176 ST wards have the same minimum-size thresholds but do not always correspond exactly with Scottish CAS ward boundaries. There are no ST wards in Northern Ireland (ONS, 2016b).

Postcode

The Royal Mail developed and maintains a UK-wide system of postcodes to identify postal delivery areas. Postcodes have been used in many statistical and planning activities as the major geographic reference. For example, data from the 2001 national census can be searched by way of postcode. Many insurance premium calculations are based on postcodes as the major geo-reference. Postcodes are also important in Ordnance Survey MasterMap, one of the major digital map services in the UK. Although postcodes form a compact geographic reference with which the public and businesses are familiar, there are limitations in linking postcode boundaries to other boundaries because some postcode boundaries straddle a ward boundary. Most geographic boundaries use national census and statistics derived from ward boundaries, but postcode boundaries are not directly used in these statistics and the census. One reason for this is because of changes in postcode boundaries due to address changes and new building developments (Fu and Aouad, 2009).

Output Areas (OAs)

Output areas (OAs) are originally created for Census data, specifically for the output of census estimates. The OA is the lowest geographical level at which census estimates are provided. Output areas were introduced in Scotland at the 1981 Census and in the UK at the 2001 Census for the very first time.

Census Output Areas (COAs)

In the UK, national census data are collected every ten years. The last census was conducted in 2011 and the results were released in 2013 (ONS, 2015). The census output consists of 26 key statistics tables that include various social variables for 408 local authorities within the UK. The 2001 national census adopted the new geography of census output areas (COAs); data were collected by enumeration district (ED) but released by COA. COAs are clusters of areas aggregated by similar adjacent postcodes and the purpose of setting COAs is to provide a compact highly homogenous area in terms of housing type and tenure. A GIS approach was used to define COA boundaries and constrain them to census statistical ward boundaries (ONS, 2015).

Super Output Areas (SOAs)

Super Output Areas are geography for the collection and publication of small area statistics. They are used on the Neighbourhood Statistics site and across National Statistics. There are currently two layers of SOA: Lower Layer Super Output Area (LSOA) and Middle Layer Super Output Area (MSOA). The statistics for LSOA and MSOA were originally released in 2004 for England and Wales (ONS, 2016c) The two layers of SOA, with areas intermediate in size between Census Output Areas (COAs) and local authorities, each layer nesting inside the layer above. This offers a choice of scale for the collection and publication of data, and allows for the release of local data that could be disclosive if published for OAs (Fu and Aouad, 2009). SOAs give an improved basis for comparison across the country because the units are more similar in size of population than, for example, electoral wards. They are also intended to be stable, enabling the improved comparison and monitoring of policy over time. Two SOA layers are defined as following:

- Lower-layer SOAs (LSOA) for a minimum population of 1000, average about 1500 and 650 households
- Middle-layer SOAs (MSOA) are the boundaries for a minimum population of 5000, average about 7500 and 2000 households

Ordnance Survey MasterMap

Ordnance Survey MasterMap (OSMM) is one of the major GIS- based map systems in the UK. Providing a consistent and maintained framework for referencing geographic information, OSMM comprises detailed information on a national grid coordinate system and an imagery layer (OS, 2017). OSMM topographic features are representations of real-world objects, including buildings, roads, tracks, paths, railways, rivers, lakes, ponds, structure and land parcels. Every OSMM feature can be referenced through a unique identifier called a TOID (Topographic Object ID). OSMM also contains many non-topographic features, such as administrative and electoral boundaries, cartographic text, symbols and addresses. OSMM has been widely used in geographical analysis and referencing, data association, asset management, route planning and cartographic representation (Fu and Aouad, 2009).

2.7 Sustainability assessment methods in the UK

In the UK, there exist a handful of well-established and legislated urban sustainability assessment mechanisms. These assessment methods have been widely applied in urban development schemes and planning procedures. Therefore, nine significant urban sustainability assessment systems implemented in the UK have been selected and deeply reviewed. They include: Sustainable Development Indicators (SDIs); Environmental Impact Assessment (EIA); Strategic Environmental Assessment (SEA); Sustainability Appraisal (SA); Building Research Establishment Environmental Assessment Method (BREEAM); Index of Multiple Deprivations (IMD); Quality of Life (QoF); Standard Assessment Procedure (SAP); and 'Sustainable Project Appraisal Routine' (SPeAR). These nine methods are discussed in the following paragraphs.

2.7.1 Sustainable Development Indicators (SDIs)

The set of 'Sustainable Development Indicators' was firstly launched by Department for Environment, Food and Rural Affairs (Defra) in 2001. The SDIs set consisted of 68 indicators comprising 126 measures (Lofts and Macrory, 2015). To improve the set, in February 2011 the UK government published its plans for "mainstreaming sustainability and in it gave an undertaking to publish a revised set of SDIs" (Defra, 2013). Consequently, the new set of SDIs was published by Office for National Statistics (ONS) –which is now in charge of updating, maintaining and developing the SDIs– in collaboration with Department for Environment, Food and Rural Affairs (Defra) in July 2013 (Defra, 2013). The revised framework reduced the number of indicators by almost 50%. Therefore 12 'headlines' and 23 'supplementary' indicators were introduced, comprising 25 and 41 measures respectively, within three categories of economy, society, and environment (in total, 35 indicators and 66 measures) (Defra, 2013). These indicators have been developed by drawing on previous versions of the SDIs as well as on discussions with different government departments and feedback from the 2012 public consultation (Defra, 2013). It is worth mentioning that the SDIs align with existing measures used across other indicator sets such as ONS's National Well-being measures or the Department of Health's Public Health Outcomes Framework (ONS, 2014). The SDIs is an assessment tool that examines the levels of sustainability progress at the national level; "a means of assessing whether the nation as a whole is developing sustainably" (Defra, 2013). It also, is to help decision-makers to identify more sustainable policy options (Defra, 2013).

Each measure are assessed using a 'traffic light' system (Figure 2.2). They show whether changes in the trends are showing clear improvement (green), little or no overall change (amber) or deterioration (red). Where data are not available for the relevant time period, an assessment is not given (white as "Not assessed"). The change of a measure is assessed over a set time. The value of the start year is compared to the end of the end year. Where data are available, two assessment periods have been used:

- Long-term: an assessment of change since the earliest date for which data are available (usually back to 1990). If the earliest data available is after 2000, no long-term assessment is made.
- Short-term: an assessment of change for the latest five-year period.

	Improving
	Little or no overall change
	Deteriorating
	Not assessed due to insufficient or comparable data

Figure 2.2. Traffic light assessment criteria (Defra, 2013)

Where possible the indicators have been presented for England. Where data are not available, indicators may be presented for England and Wales combined, or for the UK as a whole (ONS, 2014). The traffic lights only reflect the overall change in the measure from the base to latest year and do not reflect fluctuations during the intervening years. The individual measures also have a third marker showing the direction of change between the two most recent data points. This period is too short for a meaningful assessment. However, when it exceeds a one percentage point threshold, the direction of change is given simply as an acknowledgement of very recent trends and as a possible early sign of emerging trends (Defra, 2013). The chart below (Figure 2.3) demonstrates a conclusive picture of the SDIs results in 2013. As shown in the chart, within a short-term period, 8 measures have been deteriorating while there has been a sign of clear improvement for 25 indicators. 15 remained unchanged and 12 indicators have not been assessed due to the lack of data. The outcomes are, also presented based on three themes of economy, society, and environment for 'headline' and 'supplementary' measures (Appendix 2.2) as well as for the individual indicators.

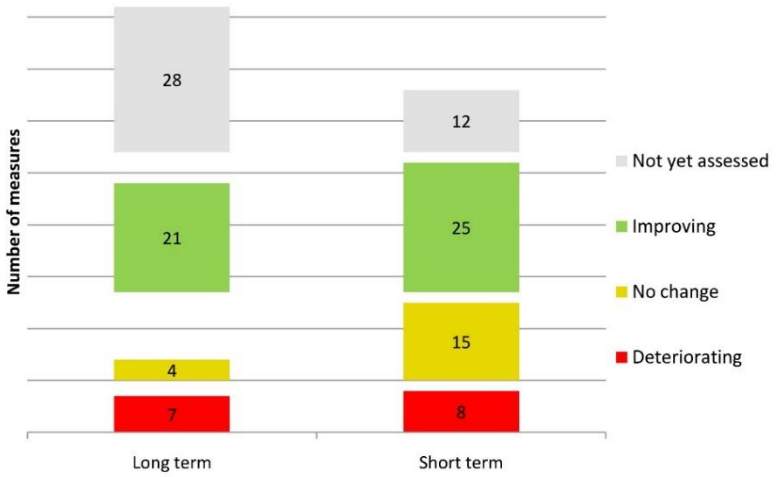


Figure 2.3. Long and short term assessments for all measures (Defra, 2013)

With more than 20 sources of data ranging from administrative to surveys measuring subjective opinions it is not possible to have one consistent method of assessing change. There are six methods of assessment used against the 66 indicators which can be assessed against. The methods of assessment used are: confidence intervals; standard errors; three percent rule; three percentage point rule; recognised targets; and in a very small number of instances, 'positive or negative change' supported by expert opinion (Lofts and Macrory, 2015). Wherever possible 'confidence intervals' or 'standard errors' are used to assess change, where these are either not available or no appropriate another method is used. An indicator is regarded as improving if the change between periods is greater than the threshold value (in a favourable direction). Likewise a change which is greater than the threshold value but in an unfavourable direction is regarded as deteriorating. Changes in either direction that are within the threshold values are presented as showing little or no overall change (Lofts and Macrory, 2015). A description of these methods is given in Table 2.4.

Table 2.4. *SDIs methods of assessment of change (Lofts and Macrory, 2015)*

Confidence intervals
Survey results are always estimates, not precise figures. This means that they are subject to a level of uncertainty which can affect how changes, especially over the short term, should be interpreted. Two different random samples from one population are unlikely to give exactly the same survey results, which are likely to differ again from the results that would be obtained if the whole population was surveyed. The level of uncertainty around a survey estimate can be calculated and is commonly referred to as sampling error. We can calculate the level of uncertainty around a survey estimate by exploring how that estimate would change if we were to draw many survey samples for the same time period instead of just one. This allows us to define a range around the estimate (known as a "confidence interval") and to state how likely it is that the real value that the survey is trying to measure lies within that range. Confidence intervals are typically set up so that we can be 95% sure that the true value lies within the range – in which case this range is referred to as a "95% confidence interval".
Standard errors
The term "standard error" is used to refer to the standard deviation of various sample statistics such as the mean or median. For example, the "standard error of the mean" refers to the standard deviation of the distribution of sample means taken from a population.
Three percent rule
When confidence intervals or standard errors are not available a percentage difference of three percent is used to assess whether an indicator is improving or declining. Any increase or decrease of less than three percent is assessed as little or no change.
Three percentage point rule
When an indicator is expressed in percentage terms a percentage change movement can exaggerate the size of the change. For these indicators a more accurate assessment can be calculated by using a change of three percentage points.
Recognised targets
A number of measures are assessed against agreed and recognised targets. These can include targets such as the Public Health England cessation of smoking amongst adults or the EU 2020 recycling target. Where an indicator is already exceeding a target it is assessed as Improving, for others progress towards meeting a target by a set date is assessed. Where progress indicates that the target will be met the indicator is assessed as improving. If progress is less than that required to meet the target the indicator is assessed as showing little or no overall change. If an indicator is showing negative growth it is assessed as deteriorating.
Positive or negative change
For the Median income measure a straightforward increase or decrease, supported by advice from colleagues in Economic Well-being branch forms the basis for the assessment of change.

As mentioned earlier, SDIs is formed of 12 'headline' indicators (4 Economy, 4 Society, 4 Environment) including 25 measures; and 23 'supplementary' indicators (6 Economy, 7 Society, 10 Environment) comprising 41 measures. Giving an example, the 'headline economy' indicators and measures are described in the table below (Table 2.5). The complete set of indicators and measures is presented in the Appendix 2.1.

Table 2.5. Headline Economy Indicators for SDIs (Defra, 2013)

Headline Economy
Indicator 1: Economic prosperity
1.1: Indices of Gross Domestic Product (GDP), GDP per head and median income 1.2: Income distribution of the whole population, before housing costs Economic prosperity generally means that the economy is doing well, and that most people have sufficient income. Comparing GDP and median Income gives an indication to economic prosperity.
Indicator 2: Long-term unemployment
2.1: Proportion of economically active adults unemployed for over 12 months Extended periods of unemployment can impact on individuals and families, through loss of income, social isolation, sense of worth and other factors. Employment enables people to meet their needs and improve their living standards, and is an effective and sustainable way to tackle poverty and social exclusion for those who can work.
Indicator 3: Poverty
3.1: Proportion of children in relative and absolute low income households before housing costs Poverty can perpetuate from one generation to the next, and the proportion of children in poverty is a key issue for intergenerational well-being. Poverty is measured by the proportion of children living in households with incomes below 60% of the median. This indicator measures the proportion of children in low-income households
Indicator 4: Knowledge and skills
4.1: Human capital stock (£ trillion) and human capital per head (£ thousand) 4.2: Employed human capital (£ trillion) by age group The indicator concentrates on the Value of Human Capital (£). The value of human capital is difficult to measure, as the international statistical community have not agreed a definition. The concept of human capital is broad and encompasses a range of personal attributes, such as people's health conditions. However, in practical terms the focus of measurement has been limited to people's skills, knowledge and abilities, and in particular on the role of formal education and training in developing them. Human capital is recognised as having important economic benefits; for example, there is a link between increased human capital (as measured by qualifications) and economic growth. For this indicator, the measurement of human capital has been restricted to people's skills and abilities.

2.7.2 Environmental Impact Assessment (EIA)

The EIA was defined in continuity of the Environmental Impact Statement (EIS) which had been established within the framework of 'National Environmental Policy Act' (NEPA) since 1969 in the United States (Wathern, 1988). The purpose of EIA is simply that to "assess the impacts of 'development actions' on the environment" (Glasson, 2007), while 'development action' could be termed as "determined intervention or transformation of a territorial initiative" (Deakin et al, 2007). EIA, at least in theory, is the most welcomed environmental agenda in the world so that, by the year 2012 "191 of the 193 member nations of the United Nations" either have exerted national legislation or have signed the manifestation of an international agreement that refers to the use of EIA (Morgan, 2012; Morrison-Saunders and Retief, 2012). As Morrison-Saunders and Retief (2012*)* maintain, the reputation of the EIA was built on the Principle 17 of the Rio Declaration on Environment and Development at the 1992 Earth Summit which provides that signatory nations must employ EIA "for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority". The EIA, in fact, is a pre-implementation analytical mechanism that provides the decision makers with a methodical scrutiny of the environmental consequences of a proposed action before a decision is taken which may lead to the refusal of development permission, if the identified 'consequences' considered unmitigatable (Glasson, 2007). As Glasson (2007) points out, EIA can make developers to deliver more "environmentally sensitive developments".

Following the European Commission EIA Directive of 1985, EIA came into force in the UK EIA Regulations in 15 July 1988 under the Office of the Deputy Prime Minister (presently DCLG: Department for Communities and Local Government) (CEC, 1985; IEMA, 2011). It subsequently faced revisions several times in 1999, 2007, and 2011 following the frequent amendments of EC Directives of 1997 (97/11/EC), 2003 (2003/35/EC), and 2009 (2009/31/EC) respectively (IEMA, 2011). By and large, EIA aims for a range of projects for which it is either 'mandatory' or 'discretionary' depending on their characteristics and conditions (see Table 2.7). As Glasson (2007) noted in his writing, the Commission for the European Communities in its 1993 report (CEC, 1993) expressed concern about several aspects of the EIA –such as

Table 2.6. Information required in an EIA under EC Directive 85/337 (1997 amendments are shown in italics) (Glasson, 2007)

1 Description of the project
2 Where appropriate (*an outline of main alternatives studied and an indication of the main reasons for the final choice*)
3 Aspects of the environment likely to be significantly affected by the proposed project, including population, fauna, flora, soil, water, air climatic factors, material assets, architectural and archaeological heritage, landscape, and the interrelationship between them
4 Likely significant effects of the proposed project on the environment
5 Measures to prevent, reduce and, where possible, offset any significant adverse environmental effects
6 Non-technical summary
7 Any difficulties encountered in compiling the required information

"insufficient consultation and public participation; lack of information about project alternatives; weak monitoring; and inconsistent implementation of the directive"– which consequently led to the first abovementioned amendment in 1997. Table 2.6 provides an outline of the information required in an EIA, while Figure 2.4 demonstrates the important steps in the EIA process.

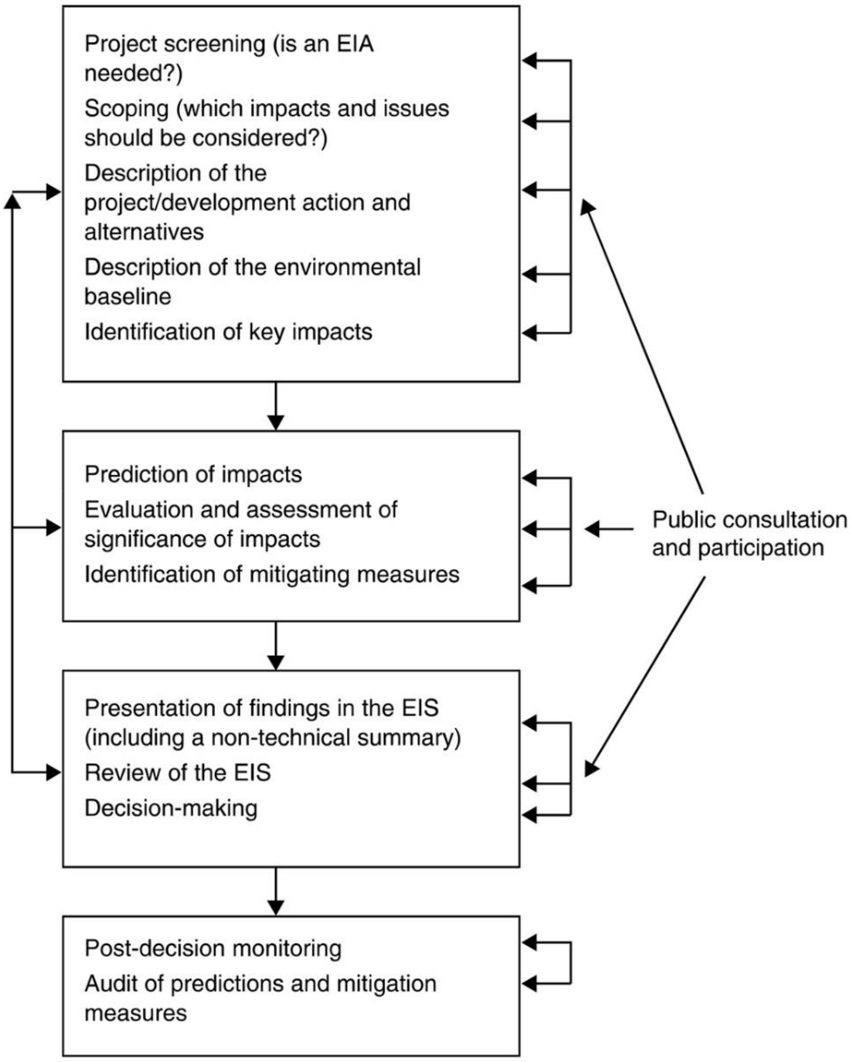


Figure 2.4. *Important steps in the EIA process (Glasson et al., 2012)*

Considering the UK's level of engagement in the EIA activities, it shares relatively a small portion of assessments across the EU in comparison to some other member states (IEMA, 2011). This reads for an average of almost 650 EIAs per annum – not to mention it has dropped by 15% in recent years– whereas the total number of EIAs conducted across the EU each year is around 16,000 (IEMA, 2011). Highlighting the state of EIA practice in the UK, the Institute of Environmental Management & Assessment (IEMA) –a major professional body which contributes to the development of environmental policies and legislations in the UK– launched a series of research workshops, held during 2009 and 2010, to investigate the effectiveness of EIA application, and the outcome report of it was subsequently published in 2011. The report states that EIA practice currently deals with the projects to 'mitigate' the negative rather than to 'enhance' the positive environmental effects they may cause. This depicts a situation in which 'compromise' is an inevitable part of the bid as the government asserts that EIA "should not be a barrier to growth and will only apply to a small proportion of projects considered within the town and country planning regime" (DCLG, 2014).

Table 2.7. *Projects requiring EIA under EC Directive 85/337 (1997 amendments are shown in italics) (Glasson, 2007)*

(mandatory)

1 Crude oil refineries, coal/shale gasification and liquefaction
2 Thermal power stations and other combustion installations; nuclear power stations and other nuclear reactors
3 Radioactive waste processing and/or storage installations
4 Cast-iron and steel smelting works
5 Asbestos extraction, processing, or transformation
6 Integrated chemical installations
7 Construction of motorways, express roads, other large roads, railways, airports
8 Trading ports and inland waterways
9 Installations for incinerating, treating, or disposing of toxic and dangerous wastes
10 *Large-scale installation for incinerating or treating non-hazardous waste*
11 *Large-scale groundwater abstraction or recharge schemes*
12 *Large-scale transfer of water resources*
13 *Large-scale waste water treatment plants*
14 *Large-scale extraction of petroleum and natural gas*
15 *Large* dams *and reservoirs*
16 *Long pipelines for gas, oil or chemicals*
17 *Large-scale poultry or pig rearing installations*
18 *Pulp, timber or board manufacture*
19 *Large-scale quarries or open-cast mines*
20 *Long overhead electrical power lines*
21 *Large-scale installations for petroleum, petrochemical or chemical products.*

(discretionary)

1 Agriculture, silviculture and aquaculture
2 Extractive industry
3 Energy industry
4 Production and processing of metals
5 *Minerals industry* (projects not included in Annex I)
6 Chemical industry
7 Food industry
8 Textile, leather, wood and paper industries
9 Rubber industry
10 *Infrastructure projects*
11 *Other projects*
12 *Tourism and leisure*
13 Modification, extension or temporary testing of Annex I projects

In the UK, EIA practice is dominated by the five key categories of waste, extraction, roads, urban/retail and energy projects (Glasson, 2007). As shown in the Table 2.7, those projects for which EIA is compulsory are mainly limited to schemes such as refineries, power stations, railways, motorways, water treatment plans, and so on. Further to this, Glasson (2007) spells out some "systemic weaknesses" observed in EIA practice, mentioning the lack of consideration for socio-economic impacts; as well as the limited reflection of 'cumulative' effects, and project alternatives. Elaborating on the latter, it should be noted that the environmental impacts of individual projects may seem insignificant, but 'cumulatively' the impacts of multiple schemes can pose a serious threat to the environment. Perhaps this is why Odum (1982) refers to EIA as "the tyranny of small decisions", a term coined by the American economist, Alfred E.Kahn in 1966.

2.7.3 Strategic Environmental Assessment (SEA)

The SEA Directive was introduced on 21 July 2001 as part of the 'European Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment', to be fully implemented on 21 July 2004 (CEC, 2001). SEA is defined as a tool for "improving the strategic actions" (Therivel, 2004) and is a precautionary measure which is to ensure that the plan-making processes are environmentally sensitive and to help protect the environment and promote sustainability (Noble and Hurriman-Gunn, 2009). The use of sustainability objectives in SEA can help decision/policy-makers "decide what actions they should take and should not take in an attempt to make society more sustainable" (Pope et al., 2004; White and Noble, 2013). In comparison to EIA, SEA seeks in fact, a more holistic approach and tend to act at a more strategic level (Glasson, 2007). In a nutshell, as defined by Sadler and Verheem (1996), SEA is:

"a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations."

SEA aims for PPPs –which stands for policies, plans and programmes – rather than for specific individual projects (Therivel and Walsh, 2006). To maintain what PPPs could mean for a SEA, Therivel (2004) refers to Wood and Djeddour's (1991) definition of these terms which, as he noted, is still the best one around:

- Policy: an inspiration and guidance to action (e.g. to provide housing for those currently not able to access the UK housing market);
- Plan: a set of coordinated and timed objectives for the implementation of the policy (e.g. the UK Sustainable Communities Plan);
- Programme: a set of projects in a particular area (e.g. housing projects in the Milton Keynes sub-region).

The aforementioned definitions and examples of PPPs represent SEA as a hierarchical multi-tiered system (see Figure 2.5), however, as Glasson et al. (2012) noted, these tiers are often obscurely demarcated and governments are not so profoundly keen "to engage in SEA at the policy level" as there is no general consensus among member states on the inclusion of the first 'P' which refers to 'policies' (Glasson, 2007). 'Plans' and 'programmes' largely relate to agriculture, forestry, fisheries, energy, industry, transport, waste management, telecommunications, tourism, town and country planning or land use. Although the list of plans and programmes may vary between the member states, Therivel and Brown (1999) argue that PPPs can generally be incorporated into the term 'strategic actions' which are as follows:

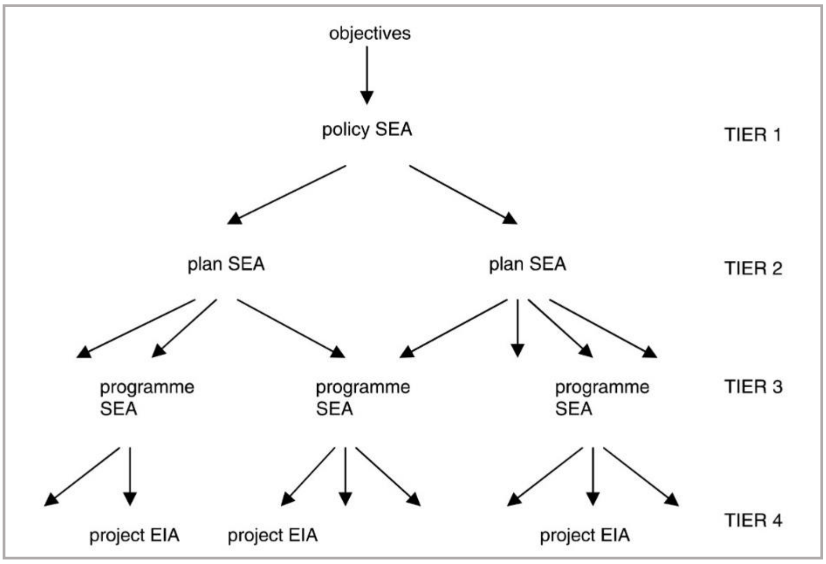


Figure 2.5. *Tiers of SEA (Glasson et al., 2012)*

- legislation: national, regional, local; international treaties;
- Green and White Papers;
- economic policies, budgets, fiscal planning, e.g. structural adjustments, privatization, subsidies, taxation, trade agreements;

- integrated/development plans: national, regional/territorial, local/town; multi-project programmes; conservation areas (World Heritage, national parks);
- sectoral policies, plans and programmes at a wide range of scales, e.g. for agriculture, transport, waste;
- policies, plans and programmes for management of a specific resource at a wide range of scales, e.g. coastal management, forest management, water management; and
- policies, plans and programmes to achieve social ends, e.g. employment development, equitable access to transport, international aid.

Table 2.8 (on the next page) illuminates the five key stages required to maintain a comprehensive SEA. They include: setting the context and objectives; developing alternatives and assessing effects; preparing an environmental report; consultation; and monitoring. Also, examples of SEA objectives and indicators can be obtained in the Appendices section (see Appendix 2.3).

In the UK, the SEA Directive is legally implemented by separate regulations in England, Wales, Scotland and Northern Ireland (see Table 2.9). However all of the regulations carefully follow the requirements of the SEA Directive (Hanusch and Glasson, 2008) (a summary of SEA requirements can be obtained from Appendix 2.4). In 2005, the four British administrations including Office of the Deputy Prime Minister (ODPM) in England, the Scottish Executive, the Welsh Assembly Government, and the Department of the Environment for Northern Ireland have collaborated on development of 'a practical guide to the Strategic Environmental Assessment Directive' which can be applied to any plan or programme to which the Directive applies (Therivel and Walsh, 2006). A survey conducted in 2006 (Therivel and Walsh, 2006) analysing the state of implementation of SEA in the UK, reveals that the assessment techniques used at the different stages of SEA processes rely heavily on people's opinions which include: expert judgement, public participation, and statutory consultees (about 80%). There are other techniques involved comprising impact matrices and GIS and mapping analysis. The more complex techniques such as modelling, scenario analysis, causal chain analysis, and sensitivity analysis offer a very small share (2%), according to the survey.

Table 2.8. *Stages in the SEA process (ODPM, 2005a)*

Setting the context and objectives, establishing the baseline and deciding on the scope
• Identifying other relevant plans, programmes and environmental protection objectives • Collecting baseline information • Identifying environmental problems • Developing SEA objectives • Consulting on the scope of SEA
Developing and refining alternatives and assessing effects
• Testing the plan or programme objectives against the SEA objectives • Developing strategic alternatives • Predicting the effects of the plan or programme, including alternatives • Evaluating the effects of the plan or programme, including alternatives • Mitigating adverse effects • Proposing measures to monitor the environmental effects of the plan or programme implementation
Preparing the environmental report
• Preparing the environmental report
Consultation on the draft plan or programme and the environmental report
• Consulting the public and consultation bodies on the draft plan or programme and the environmental report • Assessing significant changes • Making decisions and providing information
Monitoring the significant effects of implementing the plan or programme on the environment
• Developing aims and methods for monitoring • Responding to adverse effects

As White and Noble (2013) argue, despite the fact that SEA practice has been an essential move towards implementing more sustainable decision-making processes, it still faces a number of persistent challenges that need to be tackled. These issues are: (1) ambiguity in the meaning and scope of ‘environment’ and ‘sustainability’ in SEA; (2) the myriad of approaches to sustainability which may be creating uncertainty; (3) lack of integrity in adopting and operationalizing explicit sustainability principles and criteria; (4) flexibility versus structure; and lastly (5) lack of institutional willingness to change and learning (White and Noble, 2013).

Table 2.9. *SEA regulations and guidance in the UK (Therivel and Walsh, 2006)*

Administration	SEA regulations	SEA guidance
All UK		ODPM, Scottish Executive, Welsh Assembly Government and DOE Northern Ireland (2005): *A Practical Guide to the SEA Directive* (a consultation draft was issued in July 2004). English Nature and others (2004): *Strategic environmental assessment and biodiversity: Guide for Practitioners*. Countryside Council for Wales and others (2004): *Strategic environmental assessment and climate change: Guide for Practitioners*.
England	The Environmental Assessment of Plans and Programmes Regulations 2004 (also applies to any plans and programmes covering more than one administration)	ODPM (2005): *Sustainability appraisal of Regional Spatial Strategies and Local Development Documents* (this supersedes a consultation draft, which was issued in September 2004, and an interim advice note on frequently asked questions of April 2005). Department for Transport (2005): *Strategic Environmental Assessment of Transport Plans and Programmes*. Environment Agency (England and Wales) (2005) online good practice guidelines. Environment Agency internal guide on carrying out SEA for Agency plans and programmes.
Northern Ireland	The Environmental Assessment of Plans and Programmes (Northern Ireland) Regulations 2004	
Scotland	The Environmental Assessment (Scotland) Act 2005, Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004	Scottish Executive (2005): *The Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004: SEA Templates (trial version)*. Scottish Executive (2003): *Environmental Assessment of Development Plans: Interim Guidance*.
Wales	The Environmental Assessment of Plans and Programmes (Wales) Regulations 2004	Welsh Assembly Government (2004): *Strategic Environmental Assessment of Unitary Development Plans: Interim Good Practice Guide*.

2.7.4 Sustainability Appraisal (SA)

The Sustainability Appraisal (SA) is a kind of domestic version of SEA Directive within the UK (Therivel, 2013). The SA has originally emerged during the 1990s (Hanusch and Glasson, 2008) alongside with different planning instructions such as *development plans and regional planning guidance* (aka PPG12) and *Environmental appraisal of development plans: a good practice guide* which required authorities to carry out such appraisal (DoE, 1992; DoE, 1993; Glasson, 2007). However it was not until 2004 that SA became mandatory under the *Planning and Compulsory Purchase Act 2004*. The SA concentrates on the significant sustainability effects of spatial plans, including Regional Spatial Strategies (RSSs), development plan documents (DPDs) and supplementary planning documents (SPDs) (ODPM, 2005b). Although the SA follows the requirements of the SEA Directive, it widens the SEA environmental focus to social and economic aspects of sustainable development (Hanusch and Glasson, 2008). Perhaps this is why some authors (Sheate et al., 2004; Morrison-Saunders and Fischer, 2006; Hanusch and Glasson, 2008) argue that environmental issues may be weighted down with taking socioeconomic considerations into account. However the SA guidance (ODPM, 2005b) stresses that "no one of these objectives is more important than the other" and despite all potential tensions, "in the long term success in one is dependent on the others" (Glasson, 2007). All of the local planning authorities (LPAs) in the UK must undertake an SA during the preparation of Local Plans so as to evaluate the socioeconomic and environmental considerations of the possible strategic, policy and site options that may be included within the Plan. This process helps the authorities to evaluate which of those options may be more sustainable and therefore help ensure that the Local Plans contributes to achieving sustainable development. Overall, it can be said that SA is to promote sustainable development through consideration of environmental as well as social and economic factors in the plan making process (Hanusch and Glasson, 2008). As noted in the guidance (ODPM, 2005b), SA should be seen as an "integral" part of plan-making process, not as a separate activity. Figure 2.6 provides an overview of the five key stages of the SA process. Also the table below (Table 2.10) shows how an SA can be incorporated into DPD process. To carry out the SA, it is essential to develop baseline indicators which can be used to measure performance of the Local Plan against the SA objectives. An example of SA indicator framework suggested by London Borough of Camden (2014) can be seen in the appendices section (see Appendix 2.5).

2.7.5 BRE Environmental Assessment Method (BREEAM)

The BRE stands for the UK's Building Research Establishment which was originally founded in 1921 as the Building Research Station (BRS) under the then Department of Scientific and Industrial Research (BRE, 2017a). In the 1990, alongside its privatisation, the BRE gave birth to an assessment tool called BREAAM (Building Research Establishment Environmental Assessment Method) (BRE, 2017a) which aimed at evaluating the sustainability performance of different types of developments (master-planning projects, infrastructure and buildings) within the stages of design, construction and operation based on different criteria (Banihashemi-Namini et al., 2013). As noted, BREEAM measures the sustainability of a variety of building types such as: industrial, offices, retail and housing, healthcare venues, courts, prisons, and educational establishments, under ten criteria (Rydin, 2010).

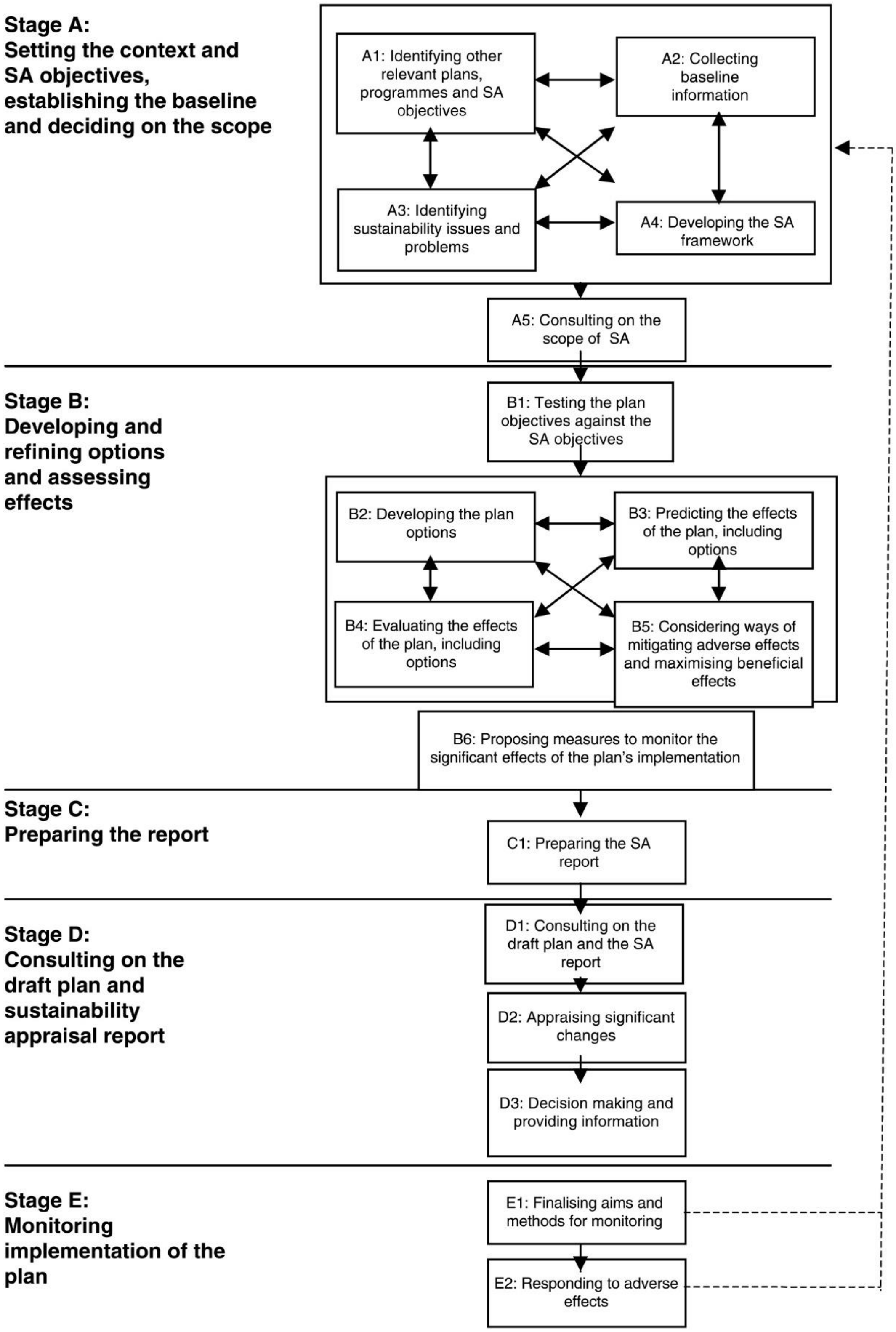


Figure 2.6. The Sustainability Appraisal process– stages and tasks (ODPM, 2005b)

Table 2.10. Incorporating SA within the DPD process (ODPM, 2005b)

DPD Stage 1: Pre-production – Evidence Gathering
SA stages and tasks
Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope • **A1:** Identifying other relevant policies, plans and programmes, and sustainability objectives. • **A2:** Collecting baseline information. • **A3:** Identifying sustainability issues and problems. • **A4:** Developing the SA framework. • **A5:** Consulting on the scope of the SA.
DPD Stage 2: Production
SA stages and tasks
Stage B: Developing and refining options and assessing effects • **B1:** Testing the DPD objectives against the SA framework. • **B2:** Developing the DPD options. • **B3:** Predicting the effects the DPD. • **B4:** Evaluating the effects of the DPD. • **B5:** Considering ways of mitigating adverse effects and maximising beneficial effects. • **B6:** Proposing measures to monitor the significant effects of implementing the DPDs.
Stage C: Preparing the Sustainability Appraisal Report • **C1:** Preparing the SA Report.
Stage D: Consulting on the preferred options of the DPD and SA Report • **D1:** Public participation on the preferred options of the DPD and the SA Report. • **D2(i)**: Appraising significant changes.
DPD Stage 3: Examination
SA stages and tasks
• **D2(ii):** Appraising significant changes resulting from representations.
DPD Stage 4: Adoption and monitoring
SA stages and tasks
• **D3:** Making decisions and providing information.
Stage E: Monitoring the significant effects of implementing the DPD • **E1:** Finalising aims and methods for monitoring. • **E2:** Responding to adverse effects.

These criteria include: energy, water, health and well-being, pollution, transport, materials, waste, land use and ecology, management, and innovation (BRE, 2014a). For each category, there are a number of 'credits' available. Where buildings have attained or exceeded various benchmarks of performance, an appropriate number of credits are awarded (Aspinall et al., 2012). The relative importance of the credits awarded under each category is taken into account in the final score, which is interpreted in the form of an overall rating of pass, good, very good, excellent and outstanding (BRE, 2014a) (see Table 2.11). BREEAM uses an explicit weighting system derived from a combination of consensus based weightings and ranking by a panel of experts (see Appendix 2.6). The outputs from this exercise are then used to determine the relative value of the environmental criterion used in BREEAM and their contribution to the overall BREEAM score (BRE, 2014a).

Table 2.11. BREEAM 'New Construction' rating benchmark (BRE, 2014a)

Assessment Rating	**Score (%)**
Outstanding	≥ 85
Excellent	≥ 70 to < 85
Very good	≥ 55 to < 70
Good	≥ 45 to < 55
Pass	≥ 30 to < 45
Unclassified	< 30

Since 1990, BREEAM has been considerably developed by introducing a number of guidance and instructions, namely: New Construction; Refurbishment; BREEAM In-Use; BREEAM Communities; and Code for Sustainable Homes (CHS). It now offers sustainability certifications to an international market, as, at the time of writing, there are 561,350 BREEAM certified developments, and 2,263,231 buildings registered for assessment in 78 countries around the globe (BRE, 2017b). Appendix 2.7 depicts how BREEAM assessment stages are incorporated within RIBA Plan of Work while Appendix 2.8 shows the examples of BREEAM certificates.

The 'BREEAM New Construction' scheme is a performance-based assessment method and certification scheme for new, non-domestic buildings. The primary aim of BREEAM UK New Construction is to mitigate the life cycle impacts of new buildings on the environment in a robust and cost effective manner. This is achieved through integration and use of the scheme by clients and their project teams at key stages in the design and construction process (BRE, 2014a). This performance is quantified by a number of individual measures and associated criteria stretching across a range of environmental issues (see Table 2.13). 'BREEAM In-Use' is being applied to evaluate the performance of existing (in-use), non-domestic buildings. For BREEAM In Use the assessment process is formed of three Parts (BRE, 2016):

- Part 1 – Asset Performance: the performance of the asset's built form, construction, fixtures, fittings and installed services;
- Part 2 – Building Management: the management of the asset;
- Part 3 – Occupier Management: the management of building users and services.

As shown in the table below, BREEAM rating benchmarks for existing buildings (In-Use) slightly differ from that of new-build assets (New Construction). Thus a new criteria: 'acceptable' has been added to the 'BREEAM In-Use' benchmark that resulted in the amendments of some of the assessment scores (see Table 2.12).

Table 2.12. *BREEAM In-Use ratings (BRE, 2016)*

Assessment score (%)	Assessment rating	Star rating
< 10	Unclassified	-
≥ 10 to <25	Acceptable	★
≥ 25 to <40	Pass	★★
≥ 40 to <55	Good	★★★
≥ 55 to <70	Very Good	★★★★
≥ 70 to <85	Excellent	★★★★★
≥85	Outstanding	★★★★★★

Table 2.13. *BREEAM 'New Construction' environmental sections and assessment issues*

Management	Health and wellbeing
— Project brief and design — Life cycle cost and service life planning — Responsible construction practices — Commissioning and handover — Aftercare	— Visual comfort — Indoor air quality — Safe containment in laboratories — Thermal comfort — Acoustic performance — Safety and security
Energy	**Transport**
— Reduction of energy use and carbon emissions — Energy monitoring — External lighting — Low carbon design — Energy efficient cold storage — Energy efficient transportation systems — Energy efficient laboratory systems — Energy efficient equipment — Drying space	— Public transport accessibility — Proximity to amenities — Cyclist facilities — Maximum car parking capacity — Travel plan
Water	**Materials**
— Water consumption — Water monitoring — Water leak detection — Water efficient equipment	— Life cycle impacts — Hard landscaping and boundary protection — Responsible sourcing of materials — Insulation — Designing for durability and resilience — Material efficiency
Waste	**Land use and ecology**
— Construction waste management — Recycled aggregates — Operational waste — Speculative floor and ceiling finishes — Adaptation to climate change — Functional adaptability	— Site selection — Ecological value of site and protection of ecological features — Minimising impact on existing site ecology — Enhancing site ecology — Long term impact on biodiversity
Pollution	**Innovation**
— Impact of refrigerants — NO_x emissions — Surface water run-off — Reduction of night time light pollution — Reduction of noise pollution	— Innovation

‘BREEAM Communities’ was launched in 2009 and is, since then, being adapted to assess the sustainability-related impacts of urban developments at the “earliest stage of design process” (BRE, 2012) and integrate with more strategic issues for planning at the neighbourhood level (Rydin, 2010). It encompasses 40 indicators within five categories including: governance; social and economic wellbeing; resources and energy; land use and ecology; and ‘transport and movement’. The BREEAM Communities Technical Manual (BRE, 2012) suggests that the aforementioned categories should be incorporated within three steps which are as follows (see Table 2.14):

- Step 1: Establishing the principle of development
- Step 2: Determining the layout of the development in BREEAM Communities
- Step 3: Designing the details

‘BREEAM Communities’ rating benchmarks follow exactly the same rating criteria used in ‘BREEAM New Construction’.

The Code for Sustainable Homes (CSH) aims at assessing the environmental performance of new homes within two stages of design and post-construction (DCLG, 2010a). The Code is a BRE-developed assessment tool launched by the ‘Department for Communities and Local Government’ in 2007 (DCLG, 2010a). However it was subsequently withdrawn by the government in March 2015 following the introduction of ‘Housing Standards Review’ within the Building Regulations (BRE, 2017c). It is argued that only around 30% of the CSH (including the optional requirements) is now available to local authorities through the updated Building Regulations (BRE, 2017c). Nevertheless the CSH remains a BRE voluntary scheme assessing the performance of new homes against the nine (six mandatory and three optional) categories of sustainable design: Energy and CO_2 emissions; water; materials; surface water and run-off; waste; health and wellbeing; pollution; management; and ecology. The BRE Global Ltd has also introduced a new standard for new homes called ‘Home Quality Mark’ (HQM) in 2015 (BRE, 2015) in which 35 assessment issues are categorised into three sections of: ‘our surrounding’; ‘my home’; and ‘knowledge sharing’ (see Appendix 2.9). The HQM tries to touch more on the issues in which BREEAM clan has been criticised for, due its lack of concern towards socioeconomic aspects of sustainability (Aspinall et al., 2012).

Table 2.14. *BREEAM Communities categories and assessment issues (BRE, 2014a)*

Step 1	Step 2	Step 3
Governance		
GO 01 – Consultation plan	GO 02 – Consultation and engagement GO 03 – Design review	GO 04 – Community man-agement of facilities
Social and economic wellbeing		
SE 01 – Economic impact SE 02 – Demographic needs and priorities SE 03 – Flood Risk Assessment SE 04 – Noise pollution	SE 05 – Housing provision SE 06 – Delivery of services, facilities and amenities SE 07 – Public realm SE 08 – Microclimate SE 09 – Utilities SE 10 – Adapting to climate change SE 11 – Green infrastructure SE 12 – Local parking SE 13 – Flood risk management	SE 14 – Local vernacular SE 15 – Inclusive Design SE 16 – Light pollution SE 17 – Labour and skills
Resources and energy		
RE 01 – Energy strategy RE 02 – Existing buildings and infrastructure RE 03 - Water strategy		RE 04 – Sustainable buildings RE 05 – Low impact materials RE 06 – Resource efficiency RE 07 – Transport carbon emissions
Land use and ecology		
LE 01 – Ecology strategy LE 02 – Land use	LE 03 – Water pollution LE 04 – Enhancement of ecological value LE 05 – Landscape	LE 06 – Rainwater harvesting
Transport and movement		
TM 01 – Transport assess-ment	TM 02 – Safe and appealing streets TM 03 – Cycling network TM 04 – Access to public transport	TM 05 – Cycling facilities TM 06 – Public transport facilities

2.7.6 Index of Multiple Deprivation (IMD)

Although the calculation of local measures of deprivation in England stretches back to 1970s, it was not until 2000 when the UK government introduced the new version of English indices of deprivations (also known as IMD) in collaboration with the Social Disadvantage Research Centre at the Department of Social Policy and Social Work at the University of Oxford (DETR, 2000; DCLG, 2010b). The IMD is a societal kind of assessment approach which measures the level of deprivation at the local level known as LSOAs (Lower Layer Super Output Areas). The IMD assesses the level of deprivation constructed by combining seven domains according to their respective weights, as described below (Table 2.15):

Table 2.15. 'Index of Multiple Deprivation' domains and weightings (DCLG, 2015)

IMD Domains	**Weight (%)**
Income Deprivation	22.5
Employment Deprivation	22.5
Health Deprivation and Disability	13.5
Education, Skills and Training Deprivation	13.5
Barriers to Housing and Services	9.3
Crime	9.3
Living Environment Deprivation	9.3

In addition to the seven domains mentioned above, there are two supplementary indices: the Income Deprivation Affecting Children Index; and the Income Deprivation Affecting Older People Index (DCLG, 2015). Table 2.16 shows the 38 indicators that are categorised into seven domains. The IMD ranks every small area from 1 (most deprived area) to 32,844 (least deprived) due to recognition of 32,844 LSOAs in England (DCLG, 2015).

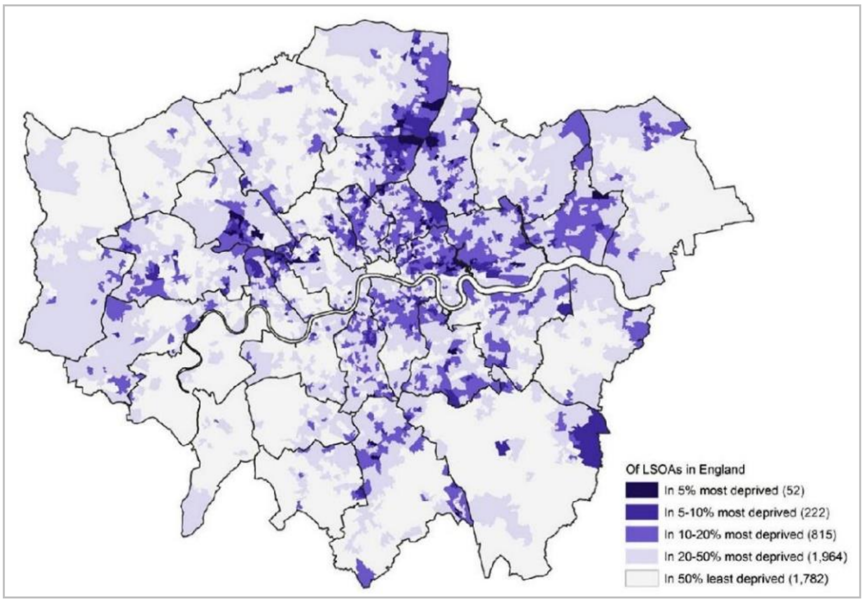


Figure 2.7: Index of Multiple Deprivation' 2015, London (DCLG, 2015; Leeser, 2016)

Table 2.16: *Index of Multiple Deprivation'* domains and indicators (DCLG, 2010b)

Income Deprivation
1. Adults and children in Income Support families 2. Adults and children in income-based Jobseeker's Allowance families 3. Adults and children in Pension Credit (Guarantee) families 4. Adults and children in Child Tax Credit families (who are not claiming Income Support, income-based Jobseeker's Allowance or Pension Credit) whose equivalised income (excluding housing benefits) is below 60% of the median before housing costs 5. Asylum seekers in England in receipt of subsistence support, accommodation support, or both
Employment Deprivation
1. Claimants of Jobseeker's Allowance (both contribution-based and income-based), Women aged 18-59 And men aged 18-64 2. Claimants of Incapacity Benefit aged 18-59/64 3. Claimants of Severe Disablement Allowance aged 18-59/64 4. Claimants of Employment and Support Allowance aged 18-59/64 (those with a contribution-based element) 5. Participants in New Deal for 18-24s who are not claiming Jobseeker's Allowance 6. Participants in New Deal for 25+ who are not claiming Jobseeker's Allowance 7. Participants in New Deal for Lone Parents aged 18 and over (after initial interview)
Health Deprivation and Disability
1. Years of Potential Life Lost: An age and sex standardised measure of premature death. 2. Comparative Illness and Disability Ratio: An age and sex standardised morbidity/disability ratio. 3. Acute morbidity: An age and sex standardised rate of emergency admission to hospital. 4. Mood and anxiety disorders: The rate of adults suffering from mood and anxiety Disorders
Education, Skills and Training Deprivation
Sub-domain: Children and Young People 1. Key Stage 2 attainment: The average points score of pupils taking English, maths and science Key Stage 2 exams. 2. Key Stage 3 attainment: The average points score of pupils taking English, maths and science Key Stage 3 exams. 3. Key Stage 4 attainment: The average capped points score of pupils taking Key Stage 4 (GCSE or equivalent) exams. 4. Secondary school absence: The proportion of authorised and unauthorized absences from secondary school. 5. Staying on in education post 16: The proportion of young people not staying on in school or non-advanced education above age 16. 6. Entry to higher education: The proportion of young people aged under 21 not entering higher education. ***Sub-domain: Skills*** 7. Adult skills: The proportion of working age adults aged 25-54 with no or low qualifications

Continued

Table 2.16: Index of Multiple Deprivation' domains and indicators (DCLG, 2010b)

Barriers to Housing and Services
Sub-domain: Wider Barriers 1. Household overcrowding: The proportion of all households in an LSOA which are judged to have insufficient space to meet the household's needs. 2. Homelessness: The rate of acceptances for housing assistance under the homelessness provisions of housing legislation. 3. Housing affordability: The difficulty of access to owner-occupation, expressed as a proportion of households aged under 35 whose income means that they are unable to afford to enter owner occupation. ***Sub-domain: Geographical Barriers*** 4. Road distance to a GP surgery: A measure of the mean distance to the closest GP surgery for people living in the LSOA. 5. Road distance to a food shop: A measure of the mean distance to the closest supermarket or general store for people living in the LSOA. 6. Road distance to a primary school: A measure of the mean distance to the closest primary school for people living in the LSOA. 7. Road distance to a Post Office: A measure of the mean distance to the closest post office or sub post office for people living in the LSOA
Crime
1. Violence: The rate of violence (19 recorded crime types) per 1000 at-risk population. 2. Burglary: The rate of burglary (4 recorded crime types) per 1000 at-risk properties. 3. Theft: The rate of theft (5 recorded crime types) per 1000 at-risk population. 4. Criminal damage: The rate of criminal damage (11 recorded crime types) per 1000 at-risk population.
Living Environment Deprivation
Sub-domain: The 'indoors' living environment 1. Housing in poor condition: The proportion of social and private homes that fail to meet the decent homes standard. 2. Houses without central heating: The proportion of houses that do not have central heating. ***Sub-domain: The 'outdoors' living environment*** 3. Air quality: A measure of air quality based on emissions rates for four pollutants. 4. Road traffic accidents: A measure of road traffic accidents involving injury to pedestrians and cyclists among the resident and workplace population.

The outcomes of IMD assessments are represented through charts, tables, diagrams as well as a series of color-coded maps (see Figure 2.7 and 2.8). The data required are derived from a variety of sources; most come directly from administrative sources such as ONS, some modelled or calculated using administrative and other data sets and some coming from the most recent census (Leeser, 2016).

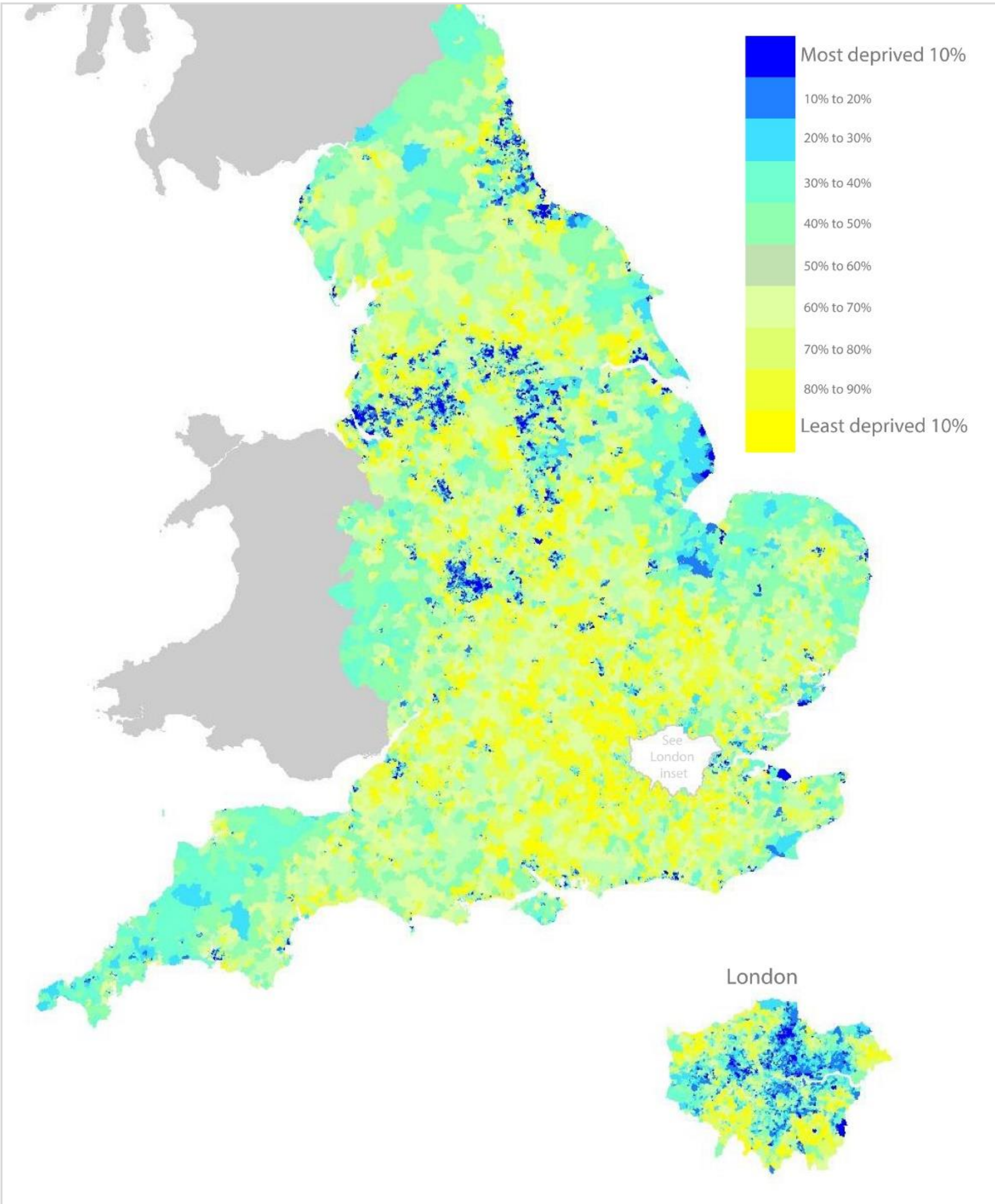


Figure 2.8: Index of Multiple Deprivation' 2015, England (DCLG, 2015)

2.7.7 Quality of Life (QoL)

As Smith (2000) stated, the concept of 'quality of life' is rooted in the works of renowned Greek philosopher, Aristotle, who wrote about *the good life* and *living well* and its relationship with the public policy around 2300 years ago. Although QoL as a modern concept emerged in the 1930s in several literary works and studies (Massam, 2002; Forward, 2003), the first EU QoL survey has not been launched until 2003 (EFILWC, 2004). Ferrans and Powers (1985) simply define quality of life as "a person's sense of well-being, his satisfaction or dissatisfaction with life, or his happiness or unhappiness". In the words of World Health Organisation (1997), QoL can be defined as: "individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns”. There has always been a lack of consensus on the definition of quality of life, however most researchers would discuss it as a “multidimensional construct” which tends to reflect “personal values” (Forward, 2003).

The London Sustainable Development Commission (LSDC) –an independent advisory body– was set up by the Mayor of London in 2002 and, since then, has produced four *Quality of Life Indicators Reports* of London (LSDC, 2012). The LSDC’s QoL assessment method measures London’s quality of life through 33 headline indicators across social, environmental and economic spheres (see Table 2.17). For instance, the 'environmental' category is divided to 11

Table 2.17: Quality of Life categories and headline indicators (LSDC, 2012)

Environmental	**Social**	**Economic**
Air quality	Childcare	Employment rates
CO_2 emissions	Education: primary	Business survival
Travel to school	Education: secondary	Income inequality
Traffic volumes	Crime	Child poverty
Access to nature	Decent housing	Fuel poverty
Bird populations	Life expectancy	Housing affordability
Ecological footprint	Physical activity	Gross value added
Flooding	Happiness	Carbon efficiency
Household recycling	Satisfaction with London	Low carbon and environmental jobs
Waste	Voting	Skills
Water consumption	Volunteering	Innovation

headline indicators comprising air quality, travel to school, waste, water consumption, household recycling, access to nature, traffic volume, CO_2 emissions, bird population, ecological footprint, and flooding. The QoL analyses all indicators through descriptive tables, charts and histograms (see Appendix 2.10). They illustrate the situation of each indicator within a specific period of time comparing the current condition with the latest data available. Demographic information defines a better understanding for further attempts regarding policy making and also for public domain purposes (LSDC, 2012). For each indicator, the report provides the reader with the significance of the indicator; explanation of measures; trend fluctuation; a summary of results; as well as representations of diagrams and charts if required (see Appendix 2.11). QoL also applies the national SDIs 'traffic light' method (previously explained in section 2.7.1– see Figure 2.2) to "provide the reader with an 'at-a-glance' understanding of the trends for each indicator" (LSDC, 2012). Table 2.18 shows the details of headline indicators and measures for environmental category. The complete indicator set can be seen in appendices section (see Appendix 2.12).

Table 2.18: 'Quality of Life' environmental headline indicators and measures (LSDC, 2012)

Environmental	
Headline indicator	**Measure**
Air quality	Tonnes of PM10 emitted in London
CO_2 emissions	Tot al CO2 emissions in London
Travel to school	Proportion of 5-16 year olds travelling to school by means other than car
Traffic volumes	Levels of road traffic in London: – Traffic volumes in Greater London (vehicle km, millions) – Estimated daily average number of passenger journey stages in Greater London
Access to nature	Areas of deficiency in access to nature by borough
Bird populations	Bird populations (number of species)
Ecological footprint	London's ecological footprint: – Ecological Footprint per capita - London and UK – Breakdown of Ecological Footprint
Flooding	– Number of properties at risk – Number of people signed up to flood warning system
Household recycling	Household recycling rates: – Percentage of household recycling and composting in London
Waste	Household waste in London – Local authority collected waste in London
Water consumption	Per capita consumption (household)– five year mean

2.7.8 Sustainable Project Appraisal Routine (SPeAR)

In the year 2000, the London-based transnational corporation; Arup, developed a sustainability assessment toolkit called SPeAR which stands for 'Sustainable Project Appraisal Routine' (AJ, 2000). The SPeAR can be used to monitor and assess project performance throughout the design and post-construction stages (Arup, 2012). It can also deal with all forms of built environment from individual buildings; to infrastructure projects and masteplans (Arup, 2012). The SPeAR process is defined within the four stages of: Initiative, Do, Review, and Report. Details of these stages are shown in the figure below (Figure 2.9).

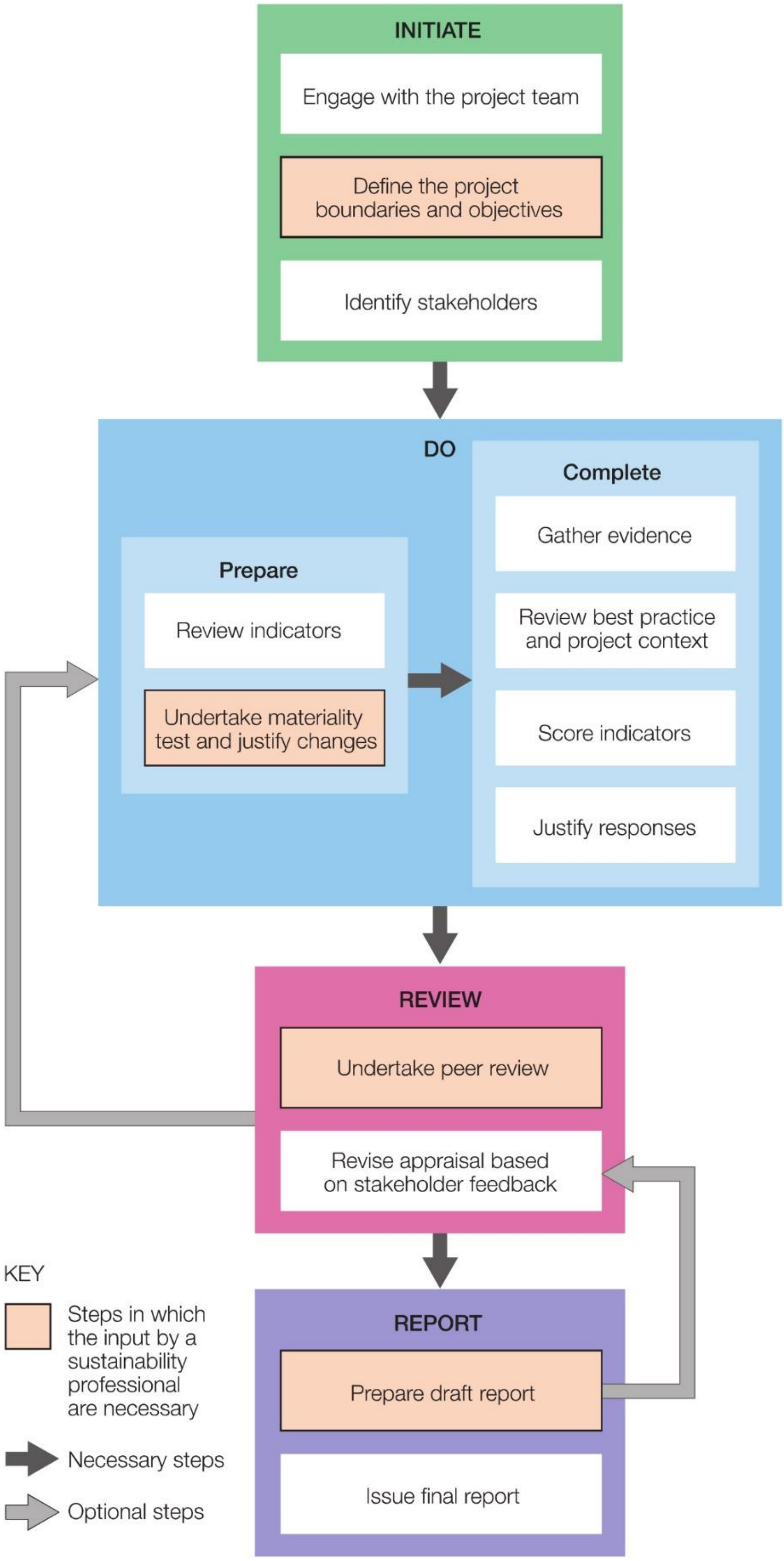


Figure 2.9: Detailed SPeAR process (Arup, 2012)

The SPeAR assessment final results appear on a dartboard-shaped diagram split into three major sustainability criteria: social, economic and environmental (see Figure 2.10). The assessment process is carried out through an Arup-developed software under the 'Oasys' clan (see Figure 2.11) which, in fact, provides a flexible platform that allows indicators to

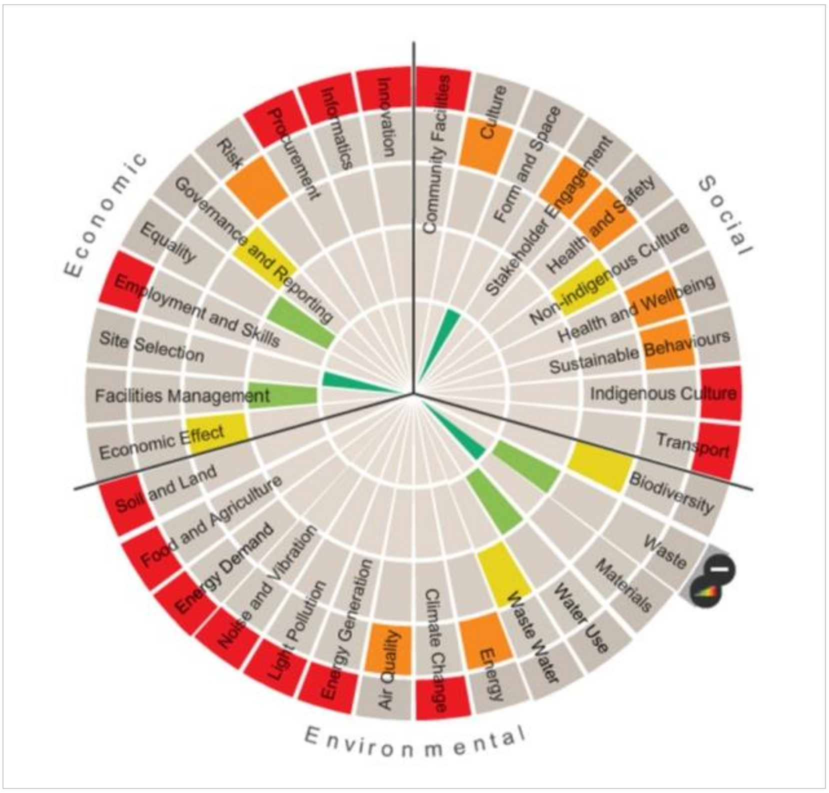


Figure 2.10: Arup's SPeAR diagram (Arup, 2012)

be added, modified or removed due to projects' circumstances. The default indicator set comprises 21 'core indicators' and 99 'sub-indicators' within three abovementioned categories. The set also offers 11 'additional indicators' including 52 'sub-indicators' which can be used in some types of projects if applicable (Arup, 2012). The full indicator set can be obtained from appendices section (see Appendix 2.13).

The circular diagram is incorporated within a color-coded rating system which ranges between +3 and -1 (see Figure 2.12). A rating of +3 with a dark green colour represents an 'exemplary' situation and is located within the inner most regions of the SPeAR diagram (Arup, 2012). It is followed by scores of +2, +1, 0, and -1 which represent best practice; good practice; minimum standard; and 'sub-standard' respectively. Minimum standard with a score of zero

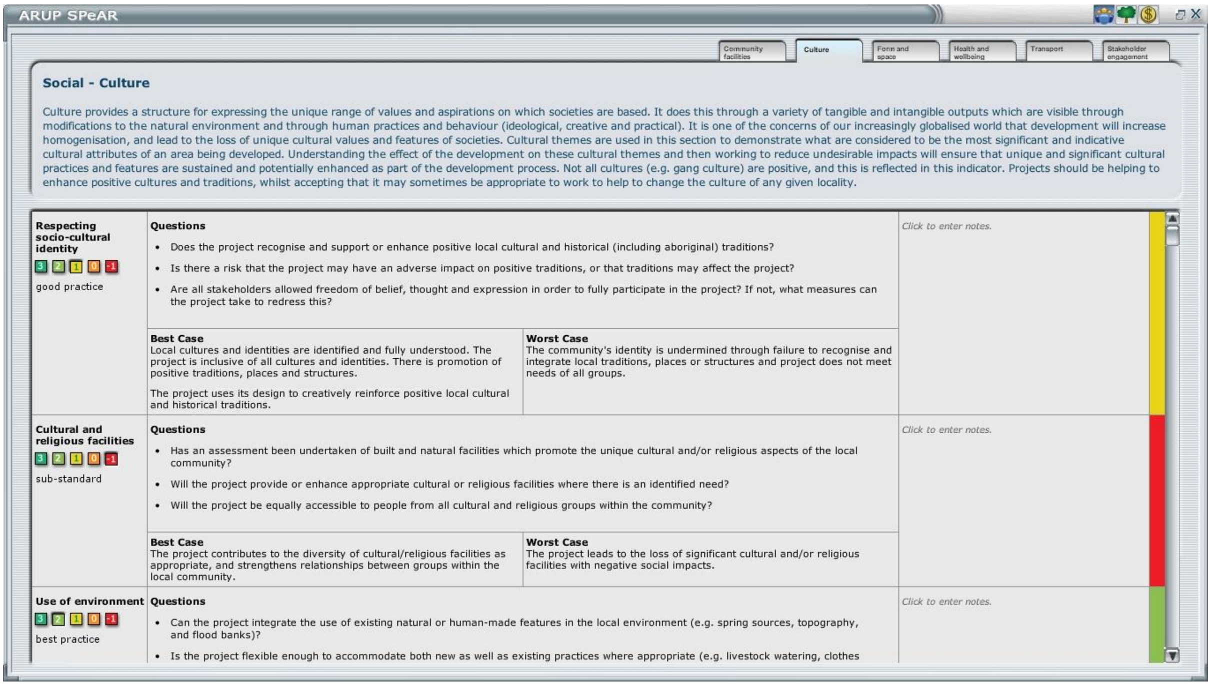


Figure 2.11: A screenshot of the Arup SPeAR software which allows the assessor to rate sub-indicators in response to the relevant questions. The score for a particular indicator is determined by the relative performance of a project or proposal against a pre-defined best case and worst case. The best case is a qualitative statement that represents the best possible outcome of an indicator. Similarly, the worst case represents a negative outcome or non-compliance (Arup, 2012).

can be seen as regulatory compliance or standard practice while ‘sub-standard’ stands for worst case scenario which appears on the outer most rings of the SPeAR diagram (Arup, 2012).

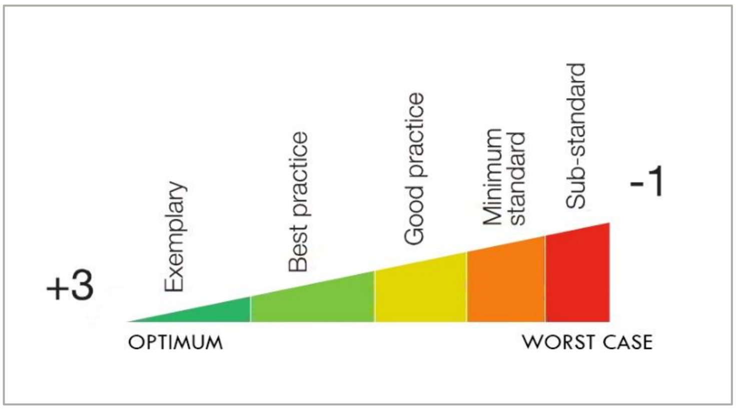


Figure 2.12: Arup’s SPeAR rating system (Arup, 2012)

Despite the comprehensiveness of its approach to include all social, environmental and economic dimensions of sustainability into project life cycle, SPeAR imposes a few limitations as pointed out by McGregor and Roberts (2003). They argue that SPeAR is open to “misuse or bias” as it is an Arup’s in-house sustainability tool while software can be purchased and used by individuals. They also criticised the tool for its "oversimplification" and that comparisons can only be made within a project not between projects. However one may argue that the user-friendly style of the tool can spread the sustainability matter to a broader sectors of the built environment.

2.7.9 Standard Assessment Procedure (SAP)

The Standard Assessment Procedure (SAP) was developed by the BRE for the former Department of the Environment in 1992. Later on, in 1994, it was cited in Part L of the Building Regulations as a means of evaluating energy performance of domestic buildings (DBEIS, 2014). SAP has subsequently introduced an energy efficiency tag called Energy Performance Certificates (EPCs) (see Figure 2.13) in 2007 within the Building Regulations and it has been subjected to all new-built dwellings as well as rental properties (Rydin, 2010). The EPCs include 'energy efficiency' and 'environmental impact' ratings based on an A to G label format in which A represents a 'very energy efficient' / 'very environmentally-friendly' condition and G depicts worst case (BRE, 2005).

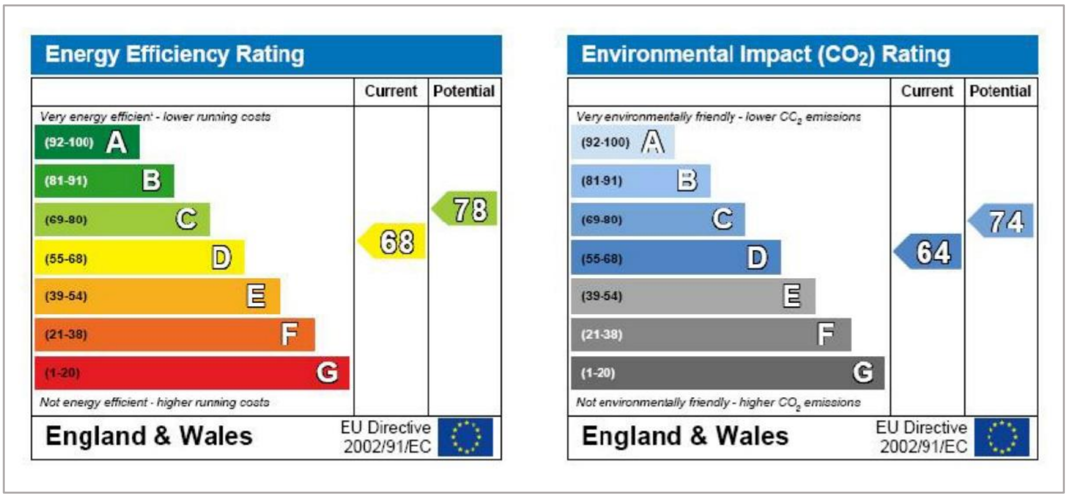


Figure 2.13: An example of how SAP and Environmental Impact Ratings appear on an Energy Performance Certificate (BRE, 2005)

SAP quantifies a dwelling's performance in terms of: energy use per unit floor area, a fuel-cost-based energy efficiency rating (the SAP Rating) and emissions of CO2 (the Environmental Impact Rating) (DBEIS, 2014). To undertake a SAP, it is required to calculate a dwelling's annual energy consumption, based on determined indicators, for the provision of space heating, domestic hot water, lighting and ventilation and so on (DBEIS, 2014). Table 2.19 shows the headline factors that are involved in the SAP calculation processes.

Table 2.19. The headline factors involved in SAP calculation process (BRE, 2014b)

1. dwelling dimensions
2. ventilation rate
3. heat transmission
4. domestic hot water
5. internal gains
6. solar gains and utilisation factor
7. mean internal temperature
8. climatic data
9. Space heating requirement
10. Space cooling requirement
11. Fabric energy efficiency
12. Total energy use and fuel costs
13. Energy cost rating
14. Carbon dioxide emissions and primary energy
15. Building regulations and dwelling emissions rate (DER)
16. CO_2 emissions associated with appliances and cooking and site-wide electricity generation technologies

The SAP can be done through several relevant software, approved by the government, including: Elmhurst Energy Systems; Stroma Certification; JPA TL Ltd; RUSFA; Bryter Digital; and Argyle Software Ltd (BRE, 2017b).

As Rydin (2010) writes, SAP focuses on the energy performance of new dwellings without much taking the behaviour of occupiers into account. She goes on to argue that SAP is making "completely inaccurate" estimates of energy consumption in some areas, as monitoring data show the physical performance, and thus energy use of the building may change in the early months of occupation (AECB, 2006; Lowe et al., 2007; Rydin, 2010).

2.8 Summary

Beginning with a brief explanation of the notion of sustainable development, the chapter provided a description of the matter of the urban sustainability evaluation, as the theoretical cornerstone of the study. It subsequently touched on the role of sustainability evaluation in spatial planning and urban design procedures, followed by reviewing the three key elements of urban sustainability assessment: indicators, data and assessment methods. In terms of data, typical demographics and statistical data sources in the UK (ward, postcode, output area, ordnance survey mastermap) have been discussed. Finally nine sustainability assessment methods widely implemented in the UK have been selected and discussed. These methods include: Sustainable Development Indicators (SDIs); Environmental Impact Assessment (EIA); Strategic Environmental Assessment (SEA); Sustainability Appraisal (SA); Building Research Establishment Environmental Assessment Method (BREEAM); Index of Multiple Deprivations (IMD); Quality of Life (QoF); Standard Assessment Procedure (SAP); and 'Sustainable Project Appraisal Routine' (SPeAR). It is worth noting that these methods, despite sharing some common ground, vary in many respects. For instance, SDIs, like IMD and QoL, measures the sustainability performance of the existing phenomenon but at different boundary levels from national (SDIs, IMD) to urban (Qol, IMD) to Local Authority and LSOA (IMD) levels. On the other hand, EIA analyses the environmental consequences of an action plan (more likely large scale industrial projects) before its implementation. Like EIA, SEA is also a pre-implementation analytical method but unlike EIA, it assesses the environmental impacts of policies, plans and programmes rather than individual projects at a more strategic level. SA is a kind of British version of SEA, with a more comprehensive set of indicators addressing sociocultural and economic issues and it can be used at the local and neighbourhood levels. BREEAM expanded its wings through the years from being a sole environmental assessment tool for individual buildings to an analytical assessment method (e.g. BREEAM Communities) that can be applied at urban and community levels at different stages of design, implementation and post-implementation (see Table 5.26). However this research seeks to define indicators that could deal with the existing situation at the post-implementation stages, it has been imperative to delve into the abovementioned methods so as to build up a genuine foundation for the research and depict a comprehensive picture of sustainability assessment methods in the UK.

Reviewing these methods is part of the process of construction of an indicator set for Iran. The figure below (Figure 2.14), inspired by Yigitcanlar's and Dur's SILENT Model (Yigitcanlar and Dur, 2010), demonstrates the formation process of the urban sustainability assessment model which will be the basis of development of an urban sustainability indicator framework in this study. Consequently, through the review of these methods, a comprehensive UK urban sustainability indicator set will be proposed in Chapter 5. This will subsequently form the basis for comparative research (see Chapter 5).

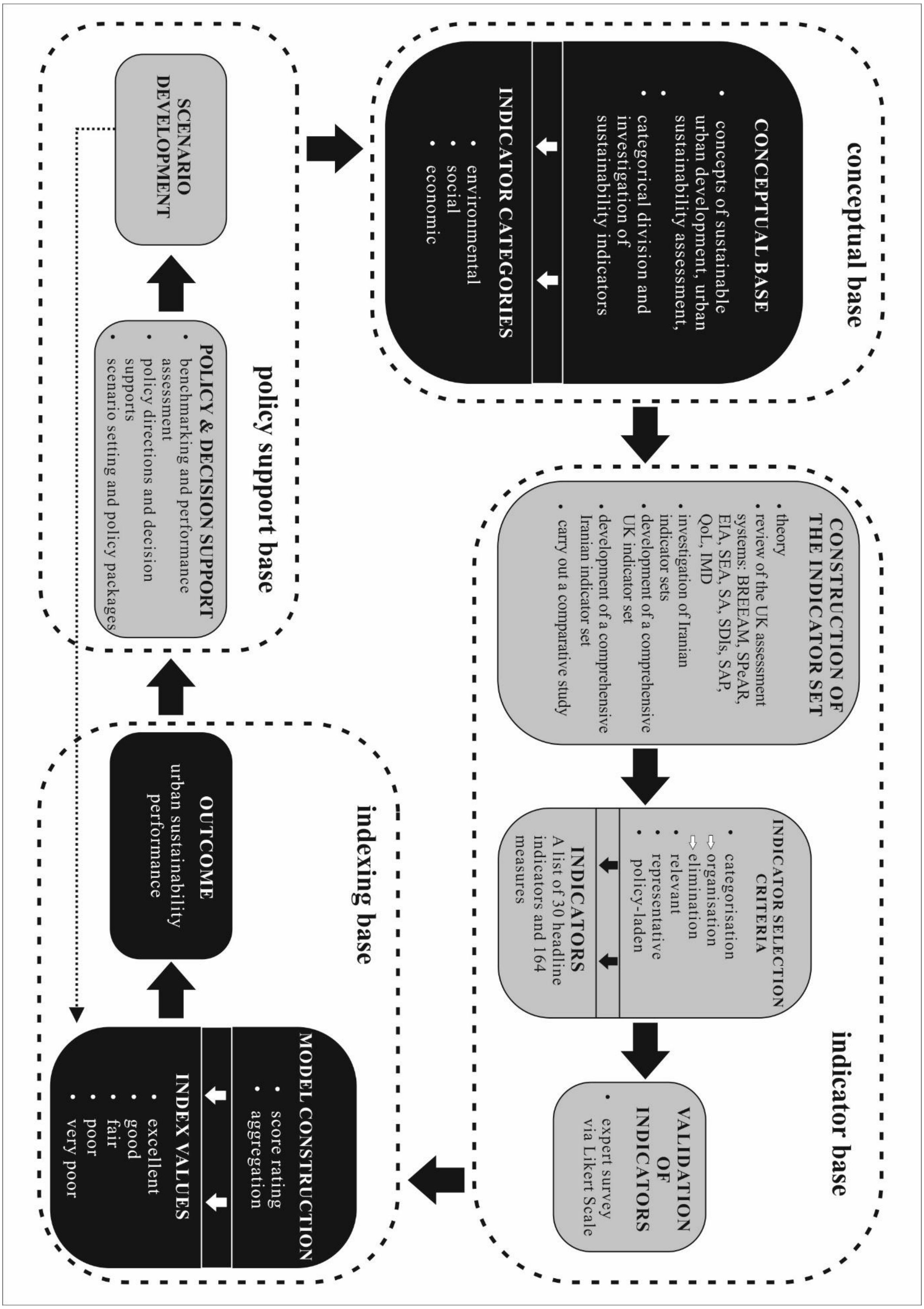


Figure 2.14: The formation process of the urban sustainability assessment model for Iran

Chapter 3: The Case of Iran

3.1 Introduction

As mentioned in the previous chapter, under the umbrella of 'green' politics in western countries in the 1970s, first international gathering: the United Nations conference on the human environment, took place in Stockholm in 1972 to consider the global ecosystem and environment (Mulvaney, 2011). This movement was followed by significant global efforts in the late twentieth century to unite countries around the world to pursue sustainable development together. Since the early 1990s, debates over 'sustainable cities' have been raised among theorists, scientific and academic circles, architects, urban planners and governmental and non-governmental organisations. Iran took this into consideration by establishing the Iranian National Committee for Sustainable Development (NCSD) in 1993, just a year after the UN conference on environment and development (Earth Summit, 1992), which resulted in the emergence of one of the most important sustainability manifestoes: Agenda 21 (Latifian et al., 2014).

This chapter opens with an introduction to Iran's geographical features and its sociocultural and economic context. Furthermore, through the review of literature supplemented by observations from semi-structured interviews with a range of relevant senior officials, academics and industrial practitioners in urban planning and construction, the chapter investigates the current situation and experience of sustainable urban development in Iran in terms of: (a) governmental administrative framework, policies, legislation and regulations; (b) the application and development of sustainable technologies; (c) sustainability assessment mechanisms and tools.

3.2 Iran profile

The following paragraphs will try to give a brief glimpse of Iran's situation in terms of its geographical condition, and also provide the reader with a rather general explanation of its economic and socio-political and cultural context.

Geography and climate

Iran, a prehistoric land with 5,000 years of written history is considered as one of the cradles of human civilisation (Curtiss, 1996). A 'mountainous, arid, ethnically diverse country of south-western Asia' (Afary et al., 2017), which is located in a semi-arid region of the MENA

(Middle East and North Africa) (see Figure 3.1), stretching its southern borders from the Persian Gulf to the Gulf of Oman, while it lies along the world's largest enclosed inland body of water: the Caspian Sea, in the north (see Figure 3.2).

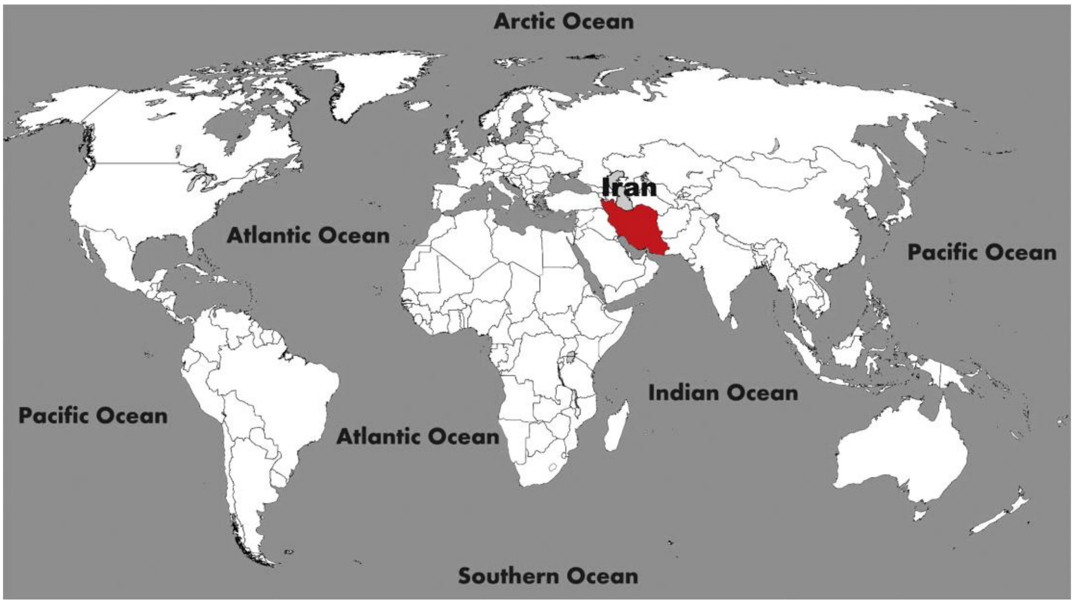


***Figure 3.1**: Iran's location in the world (ontheworldmap.com, 2017)*

Iran, as the 18th largest country in the world (and the second in the region after Saudi Arabia) occupies about 1.6 million km^2 of land area (World Atlas, 2017). Being home to about 80 million, it also is the world's 17th most populated country (second in the MENA region after Egypt) (SCI, 2016). Iran enjoys high levels of sunshine duration and suffers from rainfall scarcity, with an average annual precipitation of about 250 mm, ranging from less than 50 mm in the southeast to about 1,500 mm on the Caspian region (Alizadeh and Keshavarz, 2005; Tabari et al., 2012). Despite the fact that Iran has a diverse climatic nature from 'subtropical' to 'subpolar', more than 25% of the country's land area is covered by two salt deserts that lie within the centre of the Iranian plateau (Foy, 2001), and more than 85% of its land area is considered to be arid or semi-arid (Madani, 2014).

Economic dimension

Cities have turned into the world's largest energy consumers. Buildings consume approximately 40% of the world's produced energy and also account for 24% of global carbon dioxide emissions (CCSD, 2014). In Iran, about 97% of domestic consumption of primary energy originates from petroleum (45% from oil and 52% from gas) (Sabetghadam, 2006). The oil-based economy of Iran has collapsed over the past 10 years due to massive US-led sanctions, which have drastically affected the rate of Iran's oil export, as well as the economic life of Iranian society as a whole. Nevertheless, Iran remains the fifth largest oil exporter of the Organization of the Petroleum Exporting Countries (OPEC) and holds the fourth largest oil reserves and second largest natural gas reserves in the world (Moshiri, 2012). As mentioned above, economic activity and government revenues still depend to a large extent on oil revenues– as petroleum products comprise more than 80% of the country's export – and therefore remain unstable (WBG, 2017). Iran's economy is characterized by the hydrocarbon sector, agriculture and services sectors, and a noticeable state presence in manufacturing and financial services (WBG, 2017). It should be noted that the most challenging barrier facing Iran's economy remains its continuing isolation from the international community. As Afary et al. (2017) contended, this isolation has had severe impacts on the short- and long-term growth of Iran's markets and constrained the country's access to high technology, as well as the foreign investment. Iran's isolation is the consequence of a continuous anti-western sentiment provoked by more conservative politicians, and, as previously noted, sanctions imposed by the international community, particularly the United States (Afary et al., 2017). Despite efforts by Iranian reformists to attract foreign investment to the country, there are still formidable political obstacles to progress (Afary et al., 2017).

Figure 3.2: Iran's location in the Middle East (Afary et al., 2017)

Sociocultural context

Culture is defined as one of the most basic theoretical and sociological terms, and yet it is inherently indefinable. Both in terms of its specific meaning and broad content, there is no comprehensive consensus among sociologists (Dam, 2006). Lee (2001) described culture "as one of the two or three most complicated words in the English language" which its definition "remains elusive and contested". As Bhabha (1994) pencilled in his textbook *The Location of Culture*, the concept 'culture' produces "interstitial spaces" within and among individuals and societies, which do not maintain a single position but form identities in an ongoing process. As Breen (2008) puts it, culture as a socially-constructed concept, is a reflection of that which we want and it can be understood as a "society's answer to a series of fundamental questions about what it values."

It can be said that Iran enjoys a culturally-diverse society. Although native speakers of Persian are the predominant ethnic group in the country, the people who are generally known as Persians are of mixed ancestry (Afary et al., 2017). The other ethnic and cultural groups include Turks, Arabs, Kurds, Lurs, Baloch, Bakhtyārī, in addition to other smaller minorities such as Armenians, Assyrians, Jews, Brahuis, and others. The Shīʿite (Shia) branch of Islam is the official state religion, as for the vast majority of Iranians. The Sunni Muslims are mostly found among Kurds and Turkmen, while Arabs are both Sunni and Shīʿite. Small communities of minority religions such as: Christians, Jews, and Zoroastrians are also found throughout the country.

Considering its contemporary history, Iran has witnessed two revolutions (1906 constitutional revolution and 1979 Islamic revolution) and a coup d'état (1953) which have been the focal points of socio-political life of Iranian society. Although the birth of modernisation in Iran dates back to mid-19th century, it was Reza Shah Pahlavi's enforcement to establish a modern nation-state in the 1920s that shook the tribal, traditional society of Iran (Shahriari, 2017). During the second Pahlavi (Mohammad Reza Shah), the thriving economic boom of 1960s— as a result of steadily rising revenues from oil exports— led to a fast-paced, top-down modernisation and industrialisation process of the country (Pesaran, 1997). This, along with somewhat socioeconomic reforms, resulted in massive urban developments and therefore, created a novel urban culture within Iranian society that subsequently, shaped a social demand for opening up the political space which the autocratic nature of the Pahlavi sovereignty could not let it to happen.

The 1979 revolution had soon got entangled with both a disastrous foreign invasion— which resulted in the eight-year-long Iran-Iraq war— and grisly domestic conflicts and tensions between political parties and the newly formed conservative government. These major events shaped the first decade of the post-revolutionary Iran and it took almost a decade since the end of the war in 1988 that Iranian society learned to resurrect its appeal for socio-political development and cultural reformations by electing the reformist Mohammad Khatami as president in 1997. This turning point has gradually led to a series of structural transformations within the Iranian society in the past two decades. For instance, cultures of individualism, hedonism, pragmatism, changes in youth transition patterns, prevalence of consumer values, emergence of alternative lifestyles (like single person households or opting for celibacy, or cohabiting) are rapidly growing among the post-revolutionary young generation (Zokaei, 2015), all in a country that more than 70% of its population lives in cities today (SCI, 2013). These all can be seen as a kind of social revolt over the 'Islamic government's culture politics', which has systematically implemented the processes of "physical controls, gender segregations and sacralisation of time and spaces" that, as Zokaei (2015) argues, are the foundations of the spatial politics the government has employed since the 1979 revolution.

In this vein, the role of social media should not be ignored. The online social media are profoundly redefining "the way in which societies are organised and publics are formed" (Dijck and Poell, 2015). In Iran, like anywhere else, the emergence of social networks over the past few years utterly changed the way many Iranians interacted with the public domain. Social media has torn apart the traditional notion of public space as a geospatial phenomenon. The boundaries of people's presence (particularly, women) in the public sphere have been widely stretched out insofar the sovereignty had to coin some new policies under the *cyber police of Iran* to control the streets and squares of the cyber-public space. Social media is a magical public platform that sovereignty barely able to restrain. It has given Iranians, especially those of artists, designers, musicians, singers, writers, poets, photographers, activists and so on, a more comfortable space to express themselves in a less-anxiety-laden environment. Within this public sphere, many, in fact, are now able to exercise what could not be conveniently achieved in Iran's urban public domain.

In conclusion, it is safe to say that Iran's sociocultural structure depicts a contradictory image of a society yet in transition from tradition to modernity. The traditional social norms and orders are becoming much less attractive to the young generation. It appears that there is a quest for change toward the way the government defines and implements the sociocultural policies.

3.3 Policies and legislation for sustainable urban development

Regarding sustainable development issues such as air pollution, traffic congestion, building quality control, social disparity, economic welfare etc., most Iranian cities suffer from a lack of effective urban management. It has been suggested that a restructuring of the distribution of power towards decentralisation of central government and empowerment of local authorities and neighbourhood municipalities might be helpful in this regard (Tajbakhsh, 2005). Although many government departments and NGOs, including policy- and decision-makers, architects, urban planners, sociologists, economists and environmental experts are making an effort to achieve some improvement, some city officials and stakeholders assert that Iranian cities require a more comprehensive strategy and governance settlement and a stronger and more democratic leadership (Madanipour, 2011).

3.3.1 The hierarchical structure of the administration system

The emergence of Iran's institutional structure for urban management dates back to 1907 one year after the 'constitutional revolution' (TM, 2014). Although the national parliament (*Majlis*) passed the City Council Law on 2 June 1907, the first *baladieh* (municipality) was not established until 1910 (Vahdat-Zad, 2011). A century later, in 2010, there were 1,113 municipalities around the country (MoI, 2010).

Five-Year Development Plans define the planning system at national level (Tajbakhsh, 2005), with the Ministry of Roads and Urban Development (RUD) and the Ministry of Interior (MoI) the top governmental authorities who set planning legislation at the national level. As one of the most important governmental bodies dealing with urban planning and development, the Management and Planning Organization (MPO) was shut down in July 2007 by order of Iran's former president, Mahmoud Ahmadinejad (Firouz, 2010); however, the next elected president, Hassan Rouhani, ordered the revival of the MPO in late 2014. Alongside the MPO, the Higher Council of City Planning and Architecture, the 'Clause 5' Committee of the City Planning Council, the Provincial Office of the RUD, provincial governors including the provincial governor's technical advisor, the Provincial Development and Planning Council, the Provincial City Planning Council and the County Planning Committee are all involved in the decision-making process of urban planning and development (Tajbakhsh, 2005). There are also some other constituents in the decision-making process, including MPs, the private sector, civil society organisations and other governmental agencies such as the military with a stake in the process (Tajbakhsh, 2005).

As heads of municipalities, mayors play a very critical role in both central government and city councils. In relationship with central government, the mayor is under pressure from a centralized hierarchical system and the municipality acts as a ‘branch of the central government’ rather than an independent role player (Madanipour, 2006). On the other hand, the relationship between the city council and the mayor is also a politically charged one. In Iran, a mayor is not elected democratically, but any Iranian citizen can participate in the mayoral election indirectly through the electoral city council, which recommends candidates and elects the mayor (Rezazadeh, 2011). Due to the force of democratic decentralisation in 2006, elected local advisory councils have been set up as local authorities at the neighbourhood level (Hafeznia and Veicy, 2009).

3.3.2 Sustainable urban development control

Iran’s Department of Environment (DoE) was officially established in 1971 to oversee environmental preservation. After the Islamic revolution in 1979, Article 50 of the new constitution recognised (Khosravi, 1987):

…a public duty to protect the environment so that the present and future generations are to have a thriving social life. Thus, any form of activity, whether economic or otherwise, that causes pollution of and irreparable damage to the environment, is prohibited.

Despite the establishment of the DoE, the first influential step towards sustainable development in Iran dates back to the post Iran–Iraq war period in the early 1990s, just a year after the Rio Earth Summit in 1992, when the Iranian NCSD was established by the DoE. Since then, environmental sustainability has turned into a critical discourse in Iran among green NGOs and activists as well as governmental bodies. In the capital city, Tehran, a committee dedicated to the environment was established by Tehran City Council alongside an Environmental and Sustainable Task Force set up by Tehran Municipality in 2003, headed by the mayor’s special advisor (Madanipour, 2011). The 682-page Green Workbook was published in 2007 by the committee, which defined the municipality’s policies and activities to promote environmental sustainability (TM, 2007). In addition, the Tehran New Detailed Plan – a strategic document for urban management that was revised and approved by the higher council of town planning and architecture in 2007 – outlines the prospects for sustainable development (Andalib et al., 2010).

The Iranian NCSD includes 13 sub-committees covering climate change, jungle and forest principles, biological diversity, rural sustainable development, education, green production and efficiency, urban sustainable development and management and so on. The committee has held 199 commissions since its establishment (DoE, 2013). After the UN conference Rio+20 held in June 2012, the NCSD started to set up a redevelopment and amendment plan for its fundamental structures. Multiple official authorities such as ministries and governmental departments were involved in this committee in the early days but, from an organisational point of view, it is still questionable whether the NCSD, under the shadow of the DoE, spontaneously concentrates more on the environmental aspects of sustainable development than on social and economic concerns.

One of the most important criteria of sustainable urban development is public participation in the decision-making process. In Europe, public participation in decision making and access to justice in environmental matters has been obligatory under an EU directive since 1998. In Iran, although the establishment of local advisory councils has been a great step towards public participation in decision making, the centralised nature of urban governance still remains a major issue in repressing sustainable development.

In this vein, an element of ambiguity can be observed within the sustainability regulations in Iran. Although, theoretically, the holistic urban agenda is defined according to sustainable development goals as specified in the Fifth Development Plan, it is still dubious how these goals could make the built environment – on every scale, from a single building to a neighbourhood to a whole urban area – socially, environmentally and economically sustainable. The UK, one of the most important pioneers of sustainable urban developments, has attempted to set up agendas for the implementation of a new generation of sustainable technologies in the building sector at national, regional and local levels. For example, to assess the energy performance of domestic buildings in the UK, energy performance certificates (EPCs) based on the Standard Assessment Procedure were introduced in 2007 within UK building regulations (Rydin, 2010). By 2016, all governmental building procurement projects will have to use design programmes based on building information modelling, which enables automatic assessment of building energy efficiency and the lifecycle cost of building elements (Ganah and John, 2014). Furthermore, the UK has recently set up an agenda for sustainable housing development to be achieved by 2016. All local council housing developments have to meet level 6 of the Code for Sustainable Homes, which is part of the Building Research Establishment Environmental Assessment Method (BREEAM) (Osmani and O’Reilly, 2009).

Iran urgently needs recognition of legislation for sustainable policies and their implementation. The installation of an EPC programme has been in progress since Shirzad Hasanbeigi, the secretary of energy in the National Standard and Industrial Research Organisation, announced EPC will be legislated and implemented in 2013 (ISNA, 2012). Also, to improve the energy efficiency of buildings in compliance with national building regulations in Iran, Code 19 was passed by the national parliament in 1991. Despite all efforts to revise the code 10 years after its first publication, it still lacks high levels of aims and objectives in addressing the characteristics of Iranian buildings and is not completely implemented in practice (Fayaz and Kari, 2009).

3.4 Sustainable technologies

In recent years, Iran has suffered heavily from a water crisis due to government mismanagement, irresponsible consumption and certain environmental phenomena that led to groundwater depletion and extra pressure on water resources (Madani, 2014). Furthermore, a noticeable increase in energy consumption over recent decades in Iran (WBG, 2011) confirms the necessity of employing sustainable technologies such as renewable energies and energy-efficient methods and techniques.

3.4.1 Energy efficiency

The first Sustainable Energy Watch (SEW) for Iran was launched in 2005 under the terms of an agreement between the Institute for International Energy Studies, the Iranian Ministry of Petroleum and Helio International, an NGO based in Paris (Sabetghadam, 2006). The research was developed based on eight SEW indicators using 1990 data; according to indicators' benchmarks, a value of 1 is considered for either the global average or the historical trend for Iran, while the sustainability target is determined by a value of 0. As the results demonstrate (see Table 3.1), the indicator considered for 'access to electricity' is the closest to the sustainability target. Although not satisfactory, some minor improvements have been observed regarding investment in clean energies as well as the proportion of renewable energies in total primary energy use. According to the research, there has been deterioration in sustainability for indicators related to environmental pollutants and energy intensity (Sabetghadam, 2006). The building sector is the largest energy consumer in Iran. According to a Ministry of Energy report (MoE, 2015), residential and commercial buildings were responsible for about 41% of the country's energy consumption in 2006, while both industry and transport sectors shared less than 50% of energy consumption in the same year.

Table 3.1. Sustainable Energy Watch (SEW) for Iran, reproduced by author (Sabetghadam, 2006)

		Data Points		Result	
Indicator Name	**Unit**	**X(current)**	**X(1990)**	**I(current)**	**I(1990)**
1) CO_2 emissions	kgC/cap	1555	1010	1.486	0.848
2) Ambient pollutant	%	38.80	18.40	2.386	1.000
3) Access to electricity	%	96.70	82.80	0.033	0.172
4) Investment in clean energy	%	0.20	--	0.998	1.000
5) Vulnerability	%	80.00	85.80	0.800	0.858
6) Public sector investment	%	11.60	11.60	1.157	1.157
7) Energy productivity	MJ/$	22.60	20.60	2.248	2.040
8) Renewables	%	2.00	1.00	1.077	1.088

The average rate of energy consumption in the building sector in Iran is reported to be 2·58 times higher than the world's average energy use (Tabatabaei et al., 2013). There is therefore a need for a reduction and better management of energy use in the building sector in both existing and new developments. In recognition of the importance of reducing worldwide primary energy consumption, Iran founded various governmental organisations in 1995 to research energy conservation methods and renewable energies (Nasrollahi, 2009a; Nasrollahi et al., 2013), the most notable of these being the Iranian Fuel Conservation Company (IFCO), Iran Energy Efficiency Organization (IEEO) and Iran Renewable Energy and Energy Efficiency Organization (SATBA, formerly known as SUNA). Following the setting up of these institutions, Iran defined some strategies and plans to reduce the country's energy consumption, including that consumed by buildings. These measures include the introduction of national building regulations for energy savings in buildings (Code 19) and an increase in energy prices (Nasrollahi et al., 2013).

The IEEO, with its four main areas covering energy generation, energy consumption, planning and research, and smart networks, has committed itself to improving energy efficiency in industrial and building sectors in Iran. This has led to some pilot research projects in the country in the past few years. The large-scale pilot project *Faham* (intelligent measuring and energy management system) was launched in 2011 with a budget of around 6,000 billion Iranian Rials (about £120 million) (Sharifian-Attar et al., 2012). Faham is dedicated to installing automatic metering infrastructure for 3,200,000 industrial, commercial and residential buildings in four provinces of Iran (Sharifian-Attar et al., 2012). The aim of the project is to decrease electricity losses by at least 1% per year and achieve a 14% decrease in overall network loss by 2015 (IEEO, 2013). Faham is not only a tool to capture the energy consumption of the building, but also a hardware and software architecture capable of capturing real-time consumption, demand, voltage, current and other information (IEEO, 2013).

Energy-efficient urban and architectural design

Because of very low energy costs in Iran, there has been little interest in energy-efficient buildings in recent decades, but social interest in low-energy buildings has slightly increased since the reduction in energy subsidies in 2010. Due to the high cost of energy-efficient building technologies such as insulation materials and renewable energy systems, there is a lack of interest in using these techniques; the application of cost-neutral energy saving methods is therefore essential. Architectural methods to reduce energy consumption are achieved purely through intelligent design and only rarely increase building costs (Nasrollahi et al., 2013). Poor architectural design that does not take climate conditions into consideration is one of the main causes of high-energy consumption in buildings. A comparative study on heating and cooling energy use in two buildings within the same contextual conditions with similar materials but different architectural designs revealed that a suitable architectural design can reduce energy consumption by almost 48% (Nasrollahi, 2009b).

The geographical and geological situation of Iran depicts a country in a stressed climate. In most parts of the country, heat and dryness of air and soil have prevailed for centuries, which is why wind, water and the sun have played significant roles in traditional Iranian architecture and urban planning. Environmentally responsive architecture and urban planning in historic Iranian cities led to a series of logical solutions to aid human comfort (Eiraji and Akbari Namdar, 2011). At the urban level, the city network, street patterns and urban structure orientation in historic parts of Iranian cities such as Kerman, Isfahan and Yazd were shaped based on geographical and climatic features such as wind direction and sun exposure (Arjomand-Kermani and Luiten, 2009), and the spatial morphology of these cities is compact and dense (see Figure 3.3). It is considered that the application of appropriate urban form, type of construction, spatial distribution of land use and optimal density can reduce energy consumption in urban environments (Owens, 1991). The compact nature of both the urban fabric and individual buildings in older Iranian cities minimises heat gain in summer and heat loss in winter, therefore leading to reduced energy needs for cooling or heating. Such a design also allows for a very noticeable reduction in the whole infrastructure network and transportation system (NematiMehr, 2008).

Figure 3.3: Urban form: Yazd old city (Tavassoli, 2011)

Wind, as a natural cooling system, was widely used in traditional Iranian buildings and the use of wind energy in Iran dates back to the ancient era (17th century BC) (Asadi Asad Abad et al., 2012). According to historical references, windmills were used to grind seeds and pump water (Asadi Asad Abad et al., 2012). Climate-responsive architectural methods employed in Iranian traditional buildings such as *badgir* (wind catchers), courtyards, *hozkhaneh* (places in the lower ground floor with a pond), *ivaan* (verandas), *Shabestan* (a vaulted columned space in the Iranian traditional mosques), *sabaat* (passages) and so on are iconic architectural and urban elements. *Badgir* – vertical shafts that bring prevailing wind into a building – and courtyards are the most characteristic features of Iranian vernacular architecture and have long played a key role in the natural ventilation of residential buildings (Soflaee and Shokouhian, 2005). Regarding the utilisation of water resources in cities in the past, *qanats* (see Figure 3.4) were created as a water management system used to supply water for both human settlements and irrigation purposes. Iran is home to the oldest and largest known *qanat* in the world, which has been situated in the city of Gonabad in the eastern part of the country for almost 2700 years. It still provides drinking and agricultural water to nearly 40,000 people. Its mother well is about 360 metres deep and it stretches 45 kilometres underground (Arjomand Kermani and Luiten, 2009). Traditional building structures such as the *abanbar* (water reservoir) and *yakhchal* (icehouse) combine splendid architectural functionalism with magnificent formal expression in the urban context (Ahmadkhani Maleki, 2011).

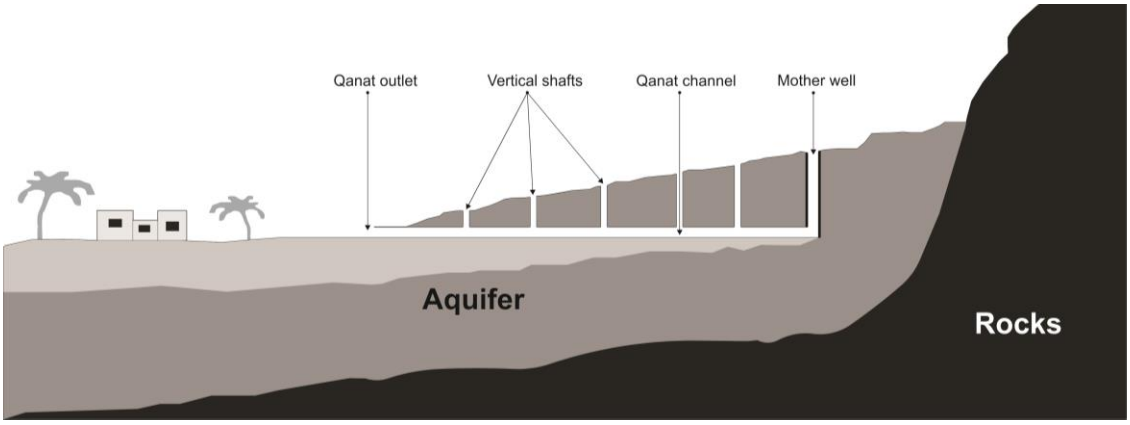


Figure 3.4: General schematic illustration of a qanat system, reproduced by author (Taghavi Jeloudar et al., 2013)

Undoubtedly, learning from the past has the potential to inspire architects and planners by taking geographical and climatic features into account. The intelligent use of natural ventilation at urban and architectural levels through the use of courtyards, roof gardens and even creatively-designed wind catchers, particularly in new developments, can restore environmentally friendly relations between human beings and nature.

3.4.2 Application of renewable energies in Iran

Following the energy crisis in the 1970s, some developed countries decided to invest heavily in the development of renewable energies. Recent research shows that the global spend on renewable energies in 2010 was US$243 billion – a rise of 30% on the year 2009 (Sharifi and Shabanikia, 2012). Following worldwide interest in the subject, as noted earlier, SATBA was established in 1995 for the purpose of assembling updated information and technology in connection with the utilisation of renewable energy resources, the measurement of potentials, and the execution of solar, wind and geothermal, hydrogen and biomass projects (Sharifi and Shabanikia, 2012).

Wind energy

In cooperation with Moshanir Company and by order of SATBA, the potential of wind speed over the whole country was calculated by the German company Lahmeyer International. According to this research, the wind power capacity in Iran was estimated to be around 100 000 MW, clearly demonstrating the huge potential for the development of wind farms (Asadi Asad Abad et al., 2012). In terms of installed wind power capacity, Iran is ranked 51 out of 103 in the world (WWEA, 2014). Based on statistics obtained from SATBA, currently 94 MW of electricity is being produced by existing wind power plants across the country. Manjil wind farm, the largest wind power plant located in Gilan, north Iran, uses 111 turbines with capacities ranging from 300 kW to 660 kW.

The design and manufacture of wind turbines in Iran has been developing since 2008 as SATBA introduced research projects with the aim of localising the production of different parts of wind turbines (see Figure 3.5) (Sharifi and Shabanikia, 2012). According to information published by SATBA, Iran presently has the technology to manufacture 35% of the inner parts of wind turbines, and SATBA is also trying to encourage private sector investment in wind farms.

Figure 3.5: Turbines designed and manufactured in Tehran, Iran (Saba Niroo, 2008)

Solar energy

Average solar radiation in Iran is about 19·23 MJ/m 2 and is even higher in the central part of the country. Calculations show that the amount of useful solar radiation hours in Iran exceeds 2800 h/year (Kazemi Karegar et al., 2005). The first photovoltaic (PV) site, with a capacity of 5 kW DC, was established in central Iran in Doorbid village near Yazd in 1993. The second PV site, with 27 kWAC capacity, was installed in 1998 in the villages of Hosseinian and Moalleman in Semnan, 450 kilometres from Tehran. It is worth mentioning that all the equipment on these sites was made in Iran. However, using solar energy to produce electricity in Iran is not very popular and the cost of these types of sites is relatively high at about US \$3500/kW. There are, however, some projects designed to use solar energy combined with a thermal power plant to produce electrical energy (Kazemi Karegar et al., 2005). According to research implemented by DLR (a government institute based in Germany), Iran has an area of 2000 km^2 with high potential for the installation of solar power plants for 60,000 MW electricity production (SATBA, 2012a). Alongside two established solar power plants in Shiraz (see Figure 3.6) and Yazd, SATBA has defined several research and development projects in cooperation with public and private sectors. The variety of projects ranges from feasibility studies to implementation, construction and utilisation. For instance, research conducted in cooperation with DLR aims to produce a solar map of Iran to show measurements of potential and to specify both the locality and capacity of proposed solar–thermal power plants (SATBA, 2012a). Practical research such as the design and implementation of PV street lights, tunnel lighting and pumps for agricultural purposes has also been considered. It seems that solar village projects are becoming popular for the state due to the very high cost of conventional power plants for remote rural areas. By 2010, 634 rural households in Iran were receiving electricity derived from solar power (IEEO, 2010). It should also be mentioned that the energy generated by solar power in Iran was 53 MW in 2005 and 67 MW in 2011 (Kazemi Karegar et al., 2005).

Figure 3.6. *Shiraz solar power plant, Shiraz, Iran (Shiraz University, 2013)*

Geothermal energy

Geothermal energy development in Iran was initially started by James R. McNitt, one of the UN experts who visited Iran in 1974 and reported that Iran had very promising prospects for geothermal energy development (Fotouhi, 1995). Upon his recommendation, in 1975, a contract between the Ministry of Energy and ENEL of Italy in association with Tehran Berkeley of Iran was signed for the geothermal exploration of an area covering 260,000 km^2 in the northern part of the country. A nationwide geothermal potential survey project carried out by SATBA from 1995 to 1998 suggested ten more prospective geothermal areas in other parts of the country. These areas were assumed to possess reasonable potential and were recommended for power generation and immediate utilisation purposes (Fotouhi and Noorollahi, 2000). A new updated and more accurate digital map of Iran detailing potential geothermal sites using a geographic information system was developed at Kyushu University in 2007. The results indicated 8.8% of Iran's land area as having potential for geothermal energy in 18 promising fields (see Figure 3.7) (Noorollahi et al., 2009). However, Meshkinshahr geothermal power plant, located in North West Iran and with a capacity of 55 MW, is the only operational geothermal power station in the country (IEEO, 2010).

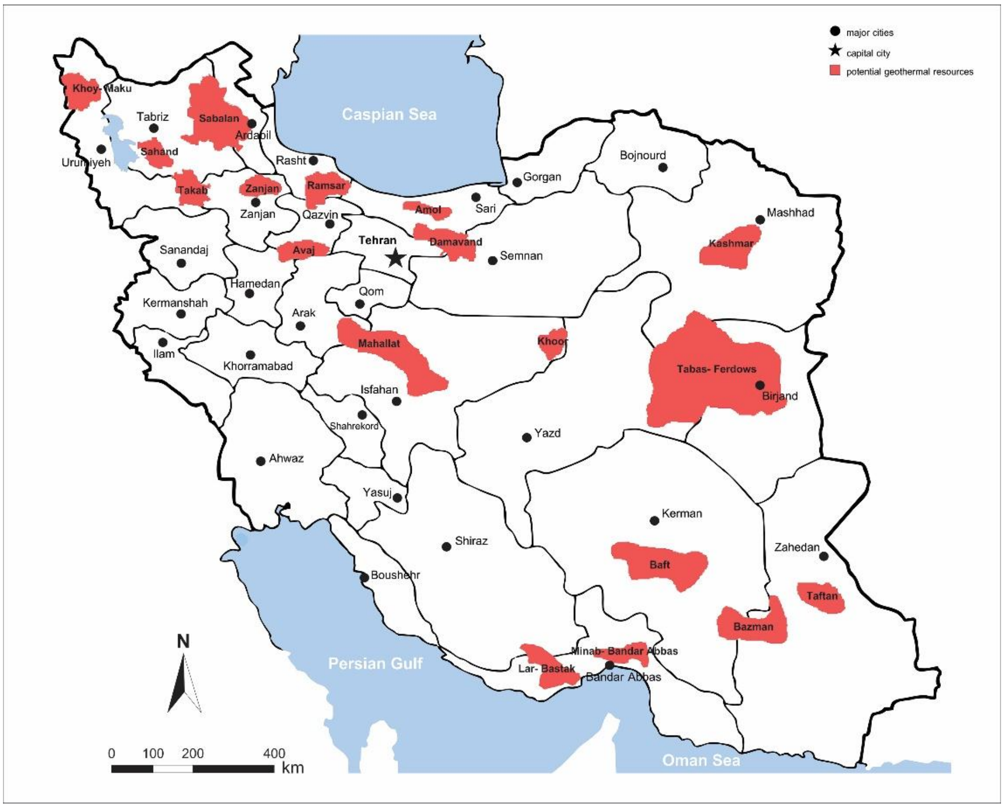


Figure 3.7. *Geothermal resources map of Iran, reproduced by author (Noorollahi et al., 2009)*

Energy from biomass

In 2004, the first potential measurements of biomass were carried out in Iran in the cities of Shiraz and Mashhad, and the first biomass power plant was established in Shiraz in 2009. Ongoing biomass developments led to the establishment of three other power plants in Mashhad (in 2010), Tehran and Sari (in 2012) (SATBA, 2012b). According to research carried out by DLR, the potential of the development of biomass in Iran is estimated to reach 3,390 MW by 2050 (SATBA, 2012b). Generally speaking, the circular metabolism of the biomass system, which obtains energy from waste, is considered to be very sustainable and environmentally friendly.

3.5 A critique of current sustainable technologies in Iran

Despite the fact that Iran consumes less energy in comparison with most developed countries and some oil-based economies in the Middle East, energy consumption is a critical issue and the trends demonstrate a drastic increase in energy demand over recent decades: between 1990 and 2010, energy use per capita rose by 130% (WBG, 2011). According to data released by the Statistical Centre of Iran (SCI, 2013) total energy consumption per capita in 2011 was equivalent to 2222 kg of oil equivalent. Total energy use in the building sector (residential, public and commercial buildings) increased by about 16% within the 6 year period from 2005 to 2011 and, in the same period, there was an increase of about 25% in electricity and 41% in natural gas consumption in this sector (SCI, 2013). Natural gas accounts for about 73% of total energy consumption in the building sector, while electricity has a 12% stake and kerosene 8% of total energy use (SCI, 2012a). Natural gas and electricity are the key energy carriers in the household sector while the proportion of other hydrocarbon carriers (e.g. gas oil, LPG, fuel oil, gasoline and coal) is relatively small (Farahmandpour et al., 2008). The average rate of electric power consumption per household is about 2679 kWh/year (SCI, 2012a) while natural gas use is 2080 m^3/year per household (Abbaspour et al., 2013). The highest proportion of energy consumed by households is allocated to appliances for heating, cooling and lighting (Abbaspour et al., 2013).

The key driving forces behind the ferociously growing trend of energy consumption in Iran are the oil-based economic expansion, considerable population growth in past decades and severely subsidised energy (12% of GDP) (Moshiri, 2012). Such high incremental energy demand, particularly in the building sector, necessitates the recognition of methods for saving energy in building materials, construction systems and end-user behaviour. Effective utilisation of construction materials is one of the key factors in good thermal performance of a building envelope. In the UK, insulated cavity walls are widely used for external walling. Such walls can achieve a U-value as low as 0.2 W/m^2 K. Insulation is also installed in floors, roofs and any possible heat bridges. Typically, windows are double- or triple-glazed with timber or u-PVC frames with a U-value below 1.5 W/m^2 K. All these measures ensure that overall building/house envelopes have a very good energy efficiency profile. In Iran, although Code 19 mandates the installation of insulation in external walls and the employment of double-glazed timber/u-PVC frame windows, deficient implementation and reckless supervision has led to inefficient use. It is worth mentioning that hollow clay blocks (HCB) are the most popular building material used for external walls in Iran; with a U-value of 1.08–1.30 W/m^2 K, walls of this type have a U-value five to six times higher than the materials commonly used in the UK (Mohammad and Shea, 2013).

A culture of reduced energy usage needs to be implemented through social and educational programmes. In Iran, energy is still cheap enough to be ignored. It is probable that most people think they live in a land of infinite 'black gold'. The management, control and improvement of a culture of reduced energy use would lead to a reduction in energy consumption. Energy-efficient buildings derived from architectural solutions should thus be coupled with changing users' behaviour in order to effectively improve energy efficiency in the building sector.

In 2011, renewable energy contributed just 0·61% to Iran's total primary energy consumption (Rezaei et al., 2013). The huge potential of renewable energy in Iran demands serious determination to redefine the proportion of renewable resources in the country's energy production. The government should consider the implementation and development of clean energy infrastructure and technologies by encouraging and supporting the private sector. However, some argue that in the economic structure of Iran, which is heavily dependent on fossil fuels, the development of renewable energies would lead to a conflict of interests.

Iran's Renewable Energy and Energy Efficiency Organization (SATBA) has previously taken the initiative in proposing potential measurements for renewable energy development. According to SATBA, the private sector has submitted a proposal for the generation of 3000 MW from renewable energy industries; however, the needlessly time-consuming process of contracting, insufficient funds, inadequate legislative support and institutional disfunctionality remain fundamental barriers to the development process (Rezaei et al., 2013). Alongside infrastructure development, it is necessary to think through this issue in order to improve the application of renewable energies in urban environments.

3.6 Sustainability assessment methods and technologies in Iran

Sustainable development has become one of the most controversial and leading topics in many research fields. Despite agreement on the main elements of sustainable development, methods for sustainability measurement still remain a key challenge in both research and practice. The purpose of such an assessment is more about discovering methods for improvement rather than judgment of the subject (Badri and Eftekhari, 2003). The term sustainability assessment is applied in two different contexts. Firstly, it is used to assess the lifecycle performance of existing buildings and communities. Secondly, it is used to identify the evaluation of sustainability measures considered for forthcoming projects at pre-implementation stages (Devuyst, 2000).

In 1979, Iran's DoE designated the Environmental Assessment Bureau (EAB) with very limited activities, such as site selection for development projects (Nanbakhsh, 1993). A year later, in 1980, the EAB merged with the Environmental Research Office due to a shrinking of organisational structure. In 1987, the EAB began its activities again in establishing a new framework based on environmental impact assessment (EIA) principles (DoE, 2013). In 1995, EIA was mandated by the High Council for Environmental Protection (HCEP) to be employed in some specific industrial and large-scale projects in 33 categories, including petrochemical plants, refineries, power plants, tourism and eco-tourism sites, mining, steel industries, dams and irrigation, rails and roads, airports, waste sites and landfills, industrial parks and so on. (DoE, 2013). In 2000, environmental assessment was defined in Article 105 of the Third Development Plan: 'all large scale production and service-providing projects must, in the process of the feasibility study and before execution, be assessed from the standpoint of their impact on the environment, on the basis of the criteria that will be proposed by the HCEP and approved by the Cabinet' (Rahbar, 2005).

Due to the fact that sustainability indicators play the main role in the evaluation of urban sustainability, Iran's DoE, in cooperation with some ministries and governmental organisations, under the NCSD, developed 26 national environmental indicators within five categories and 13 sub-categories:

- climate (climate change and air quality)
- water (water quality and water quantity)
- land (desertification, forests and agriculture)
- biodiversity (ecosystem, coasts and seas, and species)

- production and consumption patterns (raw materials, energy consumption and waste management).

The indicators were developed in the light of Iran's local conditions based on three international guidelines – the environmental performance index, the UN Commission on Sustainable Development and the Millennium Development Goals. Although the indicators have been approved by the NCSD, approval from parliament is still awaited.

With regard to the development of social indicators, Tehran Municipality introduced a local version of socio-cultural impact assessment known as ATAF in 2006 (TM, 2013), which has led to the Neighbourhoods Profile project being implemented in some of Tehran's communities and localities. The most recent social indicators developed by the Socio-cultural Deputy of Tehran Municipality include four categories, 31 indicators and 219 objectives. The two abovementioned assessment methods – which are part of the nine Iranian sustainability assessment methods explored – will be discussed further in Chapter 5,

In another development, IFCO developed the simulation software BCS19 in compliance with Code 19 of the national building regulations aiming at improving the energy and environmental performance of domestic building envelopes (IFCO, 2014). Code 19 defines the criteria and regulations for reducing energy consumption in public and private buildings. Its main topics include: external wall insulation; installation of double- glazed windows with thermal brick, wooden or standard polyvinyl chloride (PVC) frames; insulation of air channels, pipe installations and hot water production systems; installation of local control systems such as thermostatic valves on radiators; and the installation of weather compensators. BSC19, as an assessment tool, evaluates the energy performance of a building based on data regarding building elements and specifications and makes suggestions for future improvements. It should be noted that BCS19 is not compulsory in practice in Iran.

That said, research implemented in 2013 by a group of experts introduced Satbir – a sustainability assessment tool for residential buildings in Iran – which, it is claimed, could address 'environmental phenomena from a managerial perspective' (Banihashemi Namini et al., 2013). Satbir covers five categories – resource management, quality management, zone management, environmental impacts management, and risk management – and includes 49 indicators. Satbir tries to identify the role of project manager as the 'authorised assessor' through three phases of design, construction and operation. The tool was developed based on PMBok (project management body of knowledge) criteria. Satbir also takes into account issues regarding the social, economic and environmental aspects of sustainability. It simplifies the scoring methods to reduce the workload and also facilitates the involvement of a project manager with minimum training.

There is a variety of schemes and ways of assessing the sustainability of buildings and developments for both new developments as well as buildings in use. In the UK, the Building Research Establishment (BRE) developed the pioneer of sustainability assessment systems, BREEAM in 1990 (Banihashemi Namini et al., 2013). Similar tools and systems in use elsewhere include Casbee (comprehensive assessment system for built environment efficiency) operated by the Japan Sustainable Building Consortium (JSBC), Leed (leadership in energy and environmental design) developed by the US Green Building Council, the green star system of the Green Building Council in Australia, the Canadian green globe model and HQE (haute qualite environmentale) certification in France (Rydin, 2010). These tools and systems are being applied to evaluate the sustainability performance of different types of buildings and developments within the stages of design, construction and operation based on different criteria. Some of the other assessment tools widely applied in western countries, particularly in the UK, for community purposes at urban and regional levels are the environmental impact assessment, strategic environmental assessment, sustainability appraisal, quality of life indicators and the index of multiple deprivation. These methods have been investigated in Chapter 2.

At present, the only legislated sustainability assessment method implemented in the national construction industry of Iran is the EIA, which is compulsorily applied to the development of industrial buildings and some specific large-scale construction projects. So far, only Tehran Municipality has set up a sustainable development office to assess and monitor the energy performance of buildings, and this is limited to only those buildings owned by the municipality. Many academics and researchers are now looking at urban and building sustainability evaluation, but most focus on theoretical studies rather than the development of practical assessment methods or tools. A lack of collaboration among academics, industrial practitioners and government in the research and development of sustainability assessment is also an issue in Iran.

It is notable that Iran suffers from not having a cohesive strategic plan towards the development of urban sustainability assessment mechanisms. Some organisations and governmental departments that have been involved in developing social, economic and environmental indicators in recent years have dispersed and are now entirely separated from each other. There should be a way to bring all of them under one umbrella to enable a more comprehensive collaboration based on a participatory management system. Additionally, the data sources available considered fragmentary and scattered.

3.7 Summary

In this chapter an in-depth review of sustainable urban development in Iran has been carried out by focusing on urban governance, sustainable technologies and assessment mechanisms based on Iranian national and local characteristics.

In conclusion, it is potentially feasible to implement renewable energy technologies in Iran due to its geographical features, although a more efficient managerial system is needed. There is also substantial potential to improve the energy performance of buildings by considering energy-efficient design and technology and end-user behaviour with regard to energy consumption patterns. While avoiding bureaucratic procedures, the government needs to set up more detailed and practical legislation, regulations and guidance for sustainable urban development associated with more applicable assessment and monitoring procedures, methods and tools. Recognition and investigation of the sustainability features of the rich legacy of traditional Iranian architecture and planning can hopefully lead architects and planners to rethink sustainable design solutions and alternatives. Concerning the long-term history of Iran and its unique culture in the Middle East, sustainable urban development could also better preserve and promote its iconic historical urban and architectural characteristics.

Future economic growth alongside an improvement in people's quality of life in the light of potential broadening of a healthier and greener built environment should definitely encourage sustainable urban development in Iran. However, it is imperative that there should be a more democratic and powerful leadership body in the structure of Iranian urban management in order to achieve integrated and effective sustainable urban development based on monitored and measured data and comprehensive analysis and assessment. Blueprints regarding sustainable urban development in Iran have been delineated in many research projects and academic papers, but it has also been identified that there is a huge gap between academic circles and the authorities in sustainable urban development and environmental management. Dynamism is needed to push these research outcomes forward to gain the attention of relevant governmental organisations.

In Iran, the lack of an integrated urban sustainability assessment framework (such as IMD, QoL, SDIs) is observed. There is no comprehensive, systematic and legislated urban sustainability assessment mechanism developed and implemented for Iran which considers all environmental, social and economic elements. The urban sustainability assessment tools, methods and mechanisms do not play any significant role in current planning process. Therefore, this study demands an investigation of the existing and/or under development assessment methods defined by Iranian local authorities, government departments and non-governmental organisations and aims to shape a comprehensive urban sustainability assessment system for Iran inspired by the UK notable assessment methods discussed in Chapter 2.

Chapter 4: Research Methodology

4.1 Introduction

The word ‘sustainability’ as central keyword of the research topic represents the paradigms of the study. The nature of ‘sustainability’ — which has a close relationship with human interaction and social structures according to all its three social, environmental, and economic aspects — reveals the ‘interpretivist’ character of this study. On the other hand, as noted, sustainability is something measurable. It can be evaluated and measured. This objective quantifiable characteristic leads the research to another paradigm known as ‘positivism’. According to Wong (2006), the contention between empirical measurement and theoretical ideas is strongly manifested in indicator research. The ‘positivist’ holds the view that data collection comes first and working out its meaning comes later, while the theorist (interpretivist) insists on having some sort of theoretical model to guide the selection and interpretation of data. As Wong (2006) noted, according to most social research texts, the measurement should be guided by theories to avoid accretion of data without giving precise definition. This interaction of paradigms is called “paradigm crossing” or “paradigm interplay”, and this, inevitably, leads to a mixed methods approach. In this case both qualitative and quantitative methods are considerable. The nature of this research also demands a cross-national comparative approach between two cases of this study: Iran and the UK. Considering the UK experience in terms of development of urban sustainability assessment mechanisms, the study provides a crucial need for literature review as the first step of the methodological process. The purpose of primary readings is to gain a firm grasp of the issue of the concern within a theoretical framework (Salman and Qureshi, 2009). As the study is mainly carried out through the qualitative and comparative methodologies, this chapter more specifically concentrates on the epistemological perspectives of these approaches.

4.2 Qualitative research methodology

Considering historical transformations of qualitative research, in the textbook*: THE SAGE Handbook of Qualitative Research*, edited by Denzin and Lincoln (2005), it is claimed that the origins of qualitative inquiry returns to the ancient world: the Greek historian, Herodotus, who lived in the fifth century BC, probably has been the first qualitative researcher, although he never knew that what he did was going to be called as a sort of qualitative research 25 centuries later. The Roman physician and philosopher, Sextus Emprícus’s writing in the second century

AD, reveals a kind of sociocultural survey in ancient Rome. It should be noted that descriptive reports of Aristotle in physics and Galen's surveys in medicine could be categorised as 'qualitative research' as well. The trace of these sorts of everyday life, social, historical, and cross-cultural reports can be observed through the history of writing from ancient to renaissance and to the early twentieth century, while 'qualitative research' was recognised as a specific research method. In 1920s and 1930s, the 'Chicago School' established the emergence of qualitative research in sociology (Denzin and Lincoln, 2005). The expression 'qualitative research' was used only to refer to sociological or anthropological disciplines until the 1970s. From then and during the 1980s, this particular type of study was applied to become a very important and critical form of research in a variety of fields of studies such as politics, nursing service, psychology, management, women, disability, information, communication, and education (Denzin and Lincoln, 2005).

The root of the word *qualitative* is derived from the Latin word *qualis*, meaning "what it is" (Jones et al., 2006). Avoiding the complexities, the word 'qualitative' is simply explained by 'Longman': "relating to the quality or standard of something rather than the quantity". It, seemingly, is all about quality and the question is: what the 'quality' is? "Quality is elusive", as Seale (2002), stated, "hard to pre-specify, but we often feel we know it when we see it". Philosophically, 'quality' refers to those "formal attributes" of an object which are ascribable and possessible. 'Quality' is derived from the inside of things. This is exactly how Evered and Louis (1981) describe qualitative studies as "inquiry from the inside". Literary, researching the quality of things, discovering the roots and revealing the hidden layers of phenomena can be a part of the process of a qualitative research.

The subjective nature of qualitative research leads to a variety of definitions of it. It can be said that being subjective apparently is the common key of all definitions. According to Denzin and Lincoln (2005), qualitative research "is a situated activity that locates the observer in the world". Looking closer at Denzin and Lincoln's definition, reveals the relationships between human being (observer / researcher) and the world in qualitative research. Qualitative research specifies the situation of the observer in the world. Observer is a part of the research by itself. In other words, the researcher can be the main "instrument" of the research. Qualitative research makes a strong dialogue with the social reality. Therefore, human is the centre of the subject matter. It focuses on the people's behaviors; experiences; lifestyles; stories; perceptions; perspectives; imaginations; feelings; etc. Atkinson et al. (2001) describe qualitative research as an "umbrella term" which covers the massive number of items under a specific category. The study of cultures, groups and individuals; lies at the heart of the qualitative studies. It involves variety of disciplines. Different fields of social sciences such as sociology, psychology, anthropology and ethnology follow the qualitative inquiry paradigms.

4.3 Qualitative vs. quantitative: paradigms and methodologies

It is argued that there are two main research paradigms: (1) positivism, which appeared in writings of French philosopher, Auguste Comte (1798–1857) who, reputedly, was the founder of discipline of sociology in the middle of the nineteenth century; and (2) interpretivism which was argued by German philosopher, Edmund Husserl (1859–1938) for the first time. These two paradigms are derived from two, significantly, different epistemological perspectives to the world. Positivist approach goes through the materialistic and naturalistic aspects of the things. It refers to the natural and physical sciences. Positivists generate laws from the nature by testing theories and hypotheses. Positivism or so-called naturalism insists on objective reality. Objective reality (external reality) does exist. At this level, the reality is touchable, seeable and measurable. Far from positivists, there are interpretivists who understand the world through a very subjective point of view. In the term interpretivism, the material (substance) is the human being. The paradigm, mainly, concentrates on the social world and social behaviors. The interpretive model has its roots in human sciences, particularly in philosophy, anthropology and history. It is considered that language, culture, perception, feelings, and experience are central in interpretivism. Therefore, it can be understood that qualitative research overlaps with the interpretivist paradigm and the other side of the 'battle': quantitative research, involves with positivist approach. According to Denzin and Lincoln (2005), by the 1960s, struggle lines were drawn within the quantitative and qualitative camps. Quantitative researchers pointed to the weakness of qualitative research in terms of scientific reliability (as it's been called "soft" science), although qualitative researchers insisted of the social and humanistic qualities of their subjective approach to the study of human life.

Although the origins of qualitative inquiry can be returned to the ancient era, qualitative research is mostly known as a 'post-quantitative research' method. In term methodological aspects, qualitative research follows a variety of design methods. They include: case study, grounded theory, ethnography, phenomenological study and content analysis (Leedy and Ormrod, 2005).

Leedy and Ormand (2005), in their work *'practical research, planning and design',* defined the case study as a qualitative research design, although, it is controversial and some may discuss this is an independent research design that can cover both qualitative and quantitative research methods. In a case study, "a specific individual, program, or event is studied in depth for a specific period of time". As they pointed out, in other disciplines, in ethnography, researcher concentrates on the group of people, particularly, a group that illustrates a common culture. Phenomenologists consider the "person's perception of the meanings of an event". In another field, grounded theory as one of the most controversial qualitative research designs uses the data to develop a theory concerning literature and "rhetorical tropes" and the narrative term. Generally speaking, there are three types of data in qualitative research: textual data, visual data, and narrative. Data is achievable through different methods of data collection: observations, field notes, audiovisual materials (photographs, videos, recordings), conversations, interviews (unstructured, semi-structured, or structured interviews), and appropriate written documents.

Some quantitative researchers, critically, put the qualitative research into question. They claim that the world of qualitative research is a "text" and this is why it is likely to be more literature or art rather than science. They believe that qualitative research suffers from the lack of certainty and is more based on probability. Reliability and validity of the qualitative research has always been critical due to its descriptive, interpretive, narrative, and subjective nature. Some experts believe that the qualitative research should have its own criterion for judging and evaluating its results. For instance, Jones et al. (2006) applied the word 'goodness' (instead of the traditional word 'trustworthiness' in quantitative research) to specify quality criteria in qualitative inquiry. To achieve the criteria of *goodness*, researchers need to exemplify, argue, and demonstrate the 'elements of goodness' in a reliable language (Arminio and Hultgren, 2002). These elements encompass ontology and epistemological point of view, method, methodology, and particularly, researcher and participants as 'multicultural subjects'. It is notable that unlike positivism (which is used by quantitative researchers) there is no 'mechanical-making procedure' for testing trustworthiness of the qualitative inquiry. The 'goodness' is specified by the reader and by arguments and by debates within the educational society (Smith, 1990).

As interpretivism is the central paradigm to qualitative inquiry, purist qualitative researchers draw a sharp border between interpretivism and positivism. They hold a "separatist" position and believe that the ideologies of qualitative and quantitative researchers are entirely irreconcilable. They completely reject a mix of the two paradigms (Murphy and Dingwall, 2003). On the other hand, as Jones et al. (2006) stated, these differentiations between two main paradigms in qualitative and quantitative research can be conducted to develop stronger and more consistent research designs. It is suggested that the paradigm wars can be implemented in a "third" type of research paradigm which consists of both quantitative and qualitative methods. It is called 'realism' that serves a mixed methods research paradigm (Denzin and Lincoln, 2005). In qualitative research, in some particular circumstances, ethical obligation draws a very sensitive border that should not be passed by the researcher, although, it should be noted researchers are not always able to control the whole situation.

4.4 The comparative approach: theory and method

This section describes an epistemological understanding of the concept 'comparative approach' as one of the methodological framework of the study. The comparative approach within the socio-cultural studies has a long tradition dating back to Ancient Greece. Since the nineteenth century, philosophers, anthropologists, political scientists and sociologists have used cross-cultural comparisons to achieve various objectives (Hantrais, 1995). For researchers adopting a normative perspective, comparisons have served as a tool for developing classifications of social phenomena and for establishing whether shared phenomena can be explained by the same causes. For many sociologists, comparisons have provided an analytical framework for examining and explaining social and cultural differences and specificity. More recently, as greater emphasis has been placed on contextualisation, cross-national comparisons have served increasingly as a means of gaining a better understanding of different societies, their structures and institutions (Hantrais, 1995).

The 'art of comparison' is inherent in all science, including the social sciences, where comparative research has historically played a significant role in their development as scientific disciplines. While there is little agreement in the social sciences on the question whether the comparative method should be considered a distinct subfield or as methodology (Lor, 2014), Kennett (2001) emphasises that the element of comparison forms a key part in any research, whether it takes place in one country or many. As Oyen (1990) argues, "it is most often the case that in the process of research social phenomena are studied and compared with other social phenomena."

Lijphart (1971) situated the comparative method as a basic method in its own right, alongside the experimental, statistical and case study methods. Sartori (1991) stated categorically that comparative politics is a "field characterized by a method". However, this did not end the disagreement as to the status of the comparative method. Kelly et al. (1982) discussed in some detail the question whether comparative education is a method or an area of content. Mabbett and Bolderson (1999) stated that "many of the issues surrounding the theories and methods in comparative work are not exclusive to cross-national studies. The idea that comparative social science is no different from any other form of social science and that it does not have any unique methodological issues is attractive from a positivist perspective because it suggests that all social sciences use basically the same methods and because it underlines the scientific nature of comparative social science (Ragin,1987). However, Ragin (1987) points to significant differences between the orientations of most comparativists and most noncomparativists. These differences have methodological implications. The distinctive orientation of comparative social science is that it is concerned with what he calls "large macrosocial units", a term he uses to refer to countries, nations and other larger political entities.

Pennings et al. (1999) argue that comparisons are made across political and social systems that are defined in relation to territorial space. Arnove et al. (1982) discuss disagreement in comparative education on whether subunits of national systems can be utilized as units of comparison in addition to the national systems themselves, and whether these can be compared at different points in time. There are advantages and disadvantages to selecting countries as 'comparators' (the units being compared). One disadvantage is that sometimes within-country differences are obscured, since in some national units, e.g. 'postunification' Germany, internal diversity may be greater than the diversity observed when comparing countries with one another, e.g. Germany with other EU countries (Hantrais, 2009). Lijphart (1975) has critically discussed the issue of "whole-nation bias" and the arguments for and against the focus on countries.

4.4.1 Comparative strategy

Lor (2012) points to one of the most prominent issues broadly discussed in comparative methodology texts in the social sciences and that is the question of how many cases (where cases refer mostly to countries) should be studied or compared. In fact, the distinction between studies with many countries (often referred to as large-N studies) and those with few countries (often referred to as small-N studies) has given rise to a major typological division of comparative social science research. For example, Lijphart (1971) distinguished between the statistical, comparative and case study methods. By the latter Lijphart meant single case studies. By the "statistical" method he meant quantitative comparative research using large amounts of data. For Lijphart the crucial difference between the statistical method and the comparative method was that the latter uses fewer cases – too few for the statistical control that can be exercised in the analysis of survey data. Similarly, Landman (2008) adopts a three-part division of comparative studies into "comparing many countries, comparing few countries, and single-country studies". In terms of the number of cases being compared, few-country comparisons are found on the continuum between single-country studies and many-country comparisons. The countries can be as few as two. The deciding factor, however, is not so much the number of countries, but the methodological approach.

A critical question in few-country comparisons, as it is in single-country studies, is which countries to select. In few-country studies the countries are not selected sampling. Instead they should be carefully selected for the purpose of the study (Ragin, 1987). It is intuitively obvious that there is little point in comparing entities that are so different that hardly any commonality can be found. Neither would it be useful to compare entities that are so similar that little difference of interest can be found. When countries are selected for comparison, they should be comparable in respect of the phenomenon or theory that is primary interest in the study. Sartori (1991) has stated that entities to be compared should have both shared and non-shared attributes.

If it is intended to uncover causal relationships or conditions associated with particular developmental pathways, there are two basic design strategies for selecting countries for comparison. These strategies are related to the methods for determining causation that were formulated by the British philosopher J.S. Mill. The basic choice is between the 'Most Different Systems Design' (MDSD), which corresponds to Mill's "Method of Difference" and the 'Most Similar Systems Design' (MSSD) which corresponds to Mill's "Method of Agreement" (Pennings et al. 1999; Landman, 2008; Hantrais, 2009)

4.4.2 Advantages of cross-national comparison

Hantrais (1995) in her writings on the 'comparative research methods' remarks the beneficiary of employment of cross-national comparative approaches. When researchers from different backgrounds are brought together on collaborative or cross-national projects, valuable personal contacts can be established, enabling them to capitalise on their experience and knowledge of different intellectual traditions and to compare and evaluate a variety of conceptual approaches. Comparisons can also lead to fresh, exciting insights and a deeper understanding of issues that are of central concern in different countries. They can lead to the identification of gaps in knowledge and may point to possible directions that could be followed and about which the researcher may not previously have been aware. The cross-national comparison also helps to sharpen the focus of analysis of the subject under study by suggesting new perspectives. Cross-national projects give researchers a means of confronting findings in an attempt to identify and illuminate similarities and differences, not only in the observed characteristics of particular institutions, systems or practices, but also in the search for possible explanations in terms of national likeness and unlikeness. Cross-national comparativists are forced to attempt to adopt a different cultural perspective, to learn to understand the thought processes of another culture and to see it from the native's viewpoint, while also reconsidering their own country from the perspective of a skilled, external observer.

4.4.3 Non-comparative comparison

Pickvance (1986), while arguing that all research is comparative, differentiates between comparative studies, comparative research and comparative analysis and asserts that simply because a study involves data from two or more societies does not guarantee that it is comparative. Not only might issues which are held to be important in one national context not be of significance in another, but also values and interpretations of phenomena differ from society to society (Kennett, 2001). It is vital that the researcher does not assume a 'value consensus' across societies, nor 'impose' meaning and interpretations on particular social phenomenon, influencing interpretations about what is legitimate and normal, and therefore what is deviant (May, 1997). It should be mentioned that the comparative approach could touch both qualitative and quantitative methodologies depending on nature of the research (Lor, 2012).

4.5 Ethics of the study

As far as the material of the research is human being, ethical consideration is vital, specifically, in those researches which are closely related to social sciences and humanities. Depending on the research question sometimes the ethical circumstances define the boundaries for the researchers, particularly, in the social sciences in which there is a sort of human relationships between researchers and participants. The ethical issues can be emerged in all steps of research process, including research question, data collection, data analysis, and interpretation (Creswell, 2003). Regardless of direct human interactions in research, researcher should, seriously, be responsible for what is written. It is not even all about what one writes, but about what one does not write. This *telling or not telling*, significantly, can influence the consequences to the participants and for the research itself. Adding to this, sometimes research might be funded by government or private sector with specific expectations and the researcher might face "pressure to soften or suppress certain findings" (Creswell, 2003; Soltis, 1990). As mentioned earlier, the aim of this research is to delve into urban sustainability indicators, data sources and assessment techniques. In that sense, it is notable that any sorts of questionnaire survey and interviews raise the ethical concerns during the research process. For instance, in interviews, permission; consent of interviewee; confidentiality; location of the interview and its safety are very important. In addition, the researcher should be responsible for protecting data and copyright considerations. In this regard a specific consent form has been provided (see Appendix 4.1).

4.6 Methods for data collection

The research sources of secondary data include textbooks, journal articles, newspapers, printed and digital magazines, dissertations, online resources, as well as unpublished documents and written materials collected from the local authorities in Iran. The primary data obtained through conducting a series of interviews and a questionnaire survey. The experts' thoughts and feedback would work as a guideline to gain a better understanding of the phenomenon and to lead the researcher to draw the final conclusion through analysing the data collected.

The table below (see Table 4.1) shows the order, time and location of data collection processes.

Table 4.1. Order, dates and locations of data collection processes

Survey type	When?	Where?
Survey of 33 local authorities	Summer 2013	Iran
Conducting interviews	Summer 2013 Summer 2014 Summer 2015	Iran
Conducting the questionnaire survey	Fall 2016	Iran

4.6.1 A survey of 33 local authorities and governmental departments

A survey has been carried out in Iran to explore the existing urban sustainability assessment methods which have been officially developed / legislated / applied / implemented or have been under development in the country. To this end, the researcher has referred to a number of governmental organisations, local authority departments, municipalities, ministries, research centres, and so on across the capital city, Tehran (see Appendix 5.1). The survey has resulted in recognition of 9 Iranian assessment systems to be the subject of further investigations aiming at suggesting a comprehensive urban sustainability assessment system for Iran.

4.6.2 Semi-structured interviews

A considerable range of qualitative approaches uses semi-structured and unstructured interviews (Edwards and Holland, 2013). As Mason (2002) explains, in spite of the large variations in style and tradition, all qualitative and semi-structured / unstructured interviewing has certain core features in common:

- The interactional exchange of dialogue (between two or more participants, in face-to-face or other contexts);
- A thematic, topic-centred, biographical or narrative approach where the researcher has topics, themes or issues they wish to cover, but with a fluid and flexible structure;
- A perspective regarding knowledge as situated and contextual, requiring the researcher to ensure that relevant contexts are brought into focus so that the situated knowledge can be produced. Meanings and understandings are created in an interaction, which is effectively a co-production, involving the construction or reconstruction of knowledge.

Holland and Ramazanoglu (1994) describe the process of interviewing as a ‘social event’ that “has its own set of interactional rules which may be more or less explicit, more or less recognised by the participants”. As they put it, it is a ‘particular game’ in which “participants can discover, uncover or generate the rules”.

Notably, semi-structured interviews consider the “particularities of ‘verbatim conversation’ that occurs between interviewee and interviewer” (McNeill and Chapman, 2005; Mojtahed et al., 2014). The flexible nature of semi-structured interview does not limit respondent to a set of pre-determent answers and spontaneously gives interviewer the opportunity to explore responses further (Rabionet, 2011). It also allows respondent to raise issues that may not have been considered by the interviewer.

In that sense, the researcher has conducted 24 semi-structured interviews with mostly high-ranking Iranian officials who have been involved in the process of urban management at different positions: from Regional Municipality mayors, to mayor advisors, to heads of departments, to ministerial officials, to department officers, to official experts and specialists and so on. The interviews aimed at fresh insights based on the interviewees’ first-hand experience to shed light on the issues of and obstacles to current urban managerial structure and the situation of sustainable urban development and urban sustainability assessment in Iran.

4.6.3 Questionnaire construction

The questionnaire survey method is a "well-established tool within social science research for acquiring information on participant social characteristics, present and past behaviour, standards of behaviour or attitudes and their beliefs and reasons for action with respect to the topic under investigation" (Bulmer, 2004; Bird, 2009). Oei and Zwart (1986) stated that, unlike interviews, questionnaires permit a "wide range of responses, of a more cognitively dispassionate nature". While some authors such as Oppenheim (1992) and Bryman (2008) stressed the weaknesses inhabited within the nature of questionnaires including: "faulty questionnaire design; sampling and non-response errors; biased questionnaire design and wording; respondent unreliability, ignorance, misunderstanding, reticence, or bias; errors in coding, processing, and statistical analysis; and faulty interpretation of results", Harris and Brown (2010) insisted that, in spite of the weaknesses, questionnaires are imperative "means of obtaining direct responses from participants about their understandings, conceptions, beliefs, and attitudes" and this is why they "cannot and should not be discarded".

The questionnaire developed by using Bristol Online Survey (BOS) software[1] — which collects answers anonymously — encompasses 19 questions in three parts. Part A was to provide demographic data. Part B comprising 11 questions asked for respondents' general opinions on the situation of sustainable urban development, urban sustainability assessment, and the state of data including data availability, data accessibility, and data quality in the processes of evaluation of urban sustainability in Iran. The part also asked respondents to rate the environmental, social, and economic Headline Indicators suggested by the researcher. Part C investigates the respondents' level of agreement on environmental, social and economic indicators and measures proposed by the researcher. The survey allowed respondents to expand on their ideas about the issues raised in the questionnaire through a specific 'comment box' placed at the end of each question.

To obtain evaluation from trusted sources, the survey tried to be benefited from *the wisdom of the few* (Amatriain et al., 2009) to approach experts, scholars and officials' opinions due to the nature of the research questions. Therefore the BOS-generated survey online link was

1. This software has been used in compliance with the University of West London research and data protection policies.

circulated among known experts, specialists and high profile governmental bodies. The respondents were approached through variety of communicational links which include the officials and experts who were interviewed in earlier stages of data collection, the research advisor's professional associations in Iran as well as the researcher's *ResearchGate* academic circle. Consequently, 40 responses have been collected through the BOS software identifying each respondent by a unique reference number. The findings and results of the process will be explained in the *analysis and discussion* chapter (Chapter 6). The full questionnaire can be found in the appendices section (see Appendix 4.2).

4.7 Methods and tools for data collection and analysing data

The tools and methods that have been employed in the process of data collection and analysing data will be explained in the following paragraphs.

4.7.1 BOS: Bristol Online Survey

The University of Bristol has developed an online survey tool for academic research, education and public sector organisations. It is used by over 300 organisations, approximately 130 UK universities (including the University of West London) plus other public bodies and companies (BOS, 2017). BOS is a user-friendly service that allows researchers to develop, deploy, and analyse surveys via the Web within three types of accounts: Single user, Project, and Organisation. The tool is capable of establishing collaborative surveys in which multiple users or organisations could share the same survey simultaneously to get answers to common questions or issues (BOS, 2017). It also provides a variety of question formats and structures and complex data flows can be built by the use of filter questions. The survey respondents will simply get access to the questionnaire via a designated URL. The BOS is also able to implement initial analyses and visualise survey findings. As mentioned earlier, this tool has been employed for building the questionnaire of the study and generating results through descriptive and cross-tabulation analysis.

4.7.2 Likert-Type Scale

The term Likert Scale was first coined by the American psychologist: Rensis Likert in 1932 to measure people's attitudes on responding to questions of interest (Croasmun and Ostrom, 2011). The typical Likert scale is a 5- or 7-point ordinal scale used by respondents to rate the degree to which they agree or disagree with a statement (see Table 4.1). In an ordinal scale, responses can be rated or ranked, but the distance between responses is not measurable (Sullivan and Artino, 2013). The Likert Scale is, in fact, a method of quantifying the qualitative data to facilitate the statistical analysis. In this study, the research has employed the Likert Scale methodology to seek out experts' opinions on the proposed indicator set.

The data collected through Likert Scale, has been analysed by using the 'IBM SPSS Statistics', a 'Statistical Package for the Social Sciences' software which was initially developed by the American social scientist Norman H. Nie; and his colleagues: C. Hadlai Hull and Dale H. Bent in 1968 and was recently acquired by the giant computing manufacturing company: IBM in 2009 (SPSS Inc., 2009). The software has been widely used for statistical analysis of qualitative data especially in the field of social science.

***Table 4.2**: Typical Likert Scales*

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

4.7.3 Microsoft Excel

Excel, a software of the Microsoft Office, was first developed by suite Microsoft in 1985 (CH, 2017). Excel has been widely used to help researchers interpret and make sense of survey data. These procedures are referred to as descriptive statistics (e.g. spreadsheets, pivot tables, cell-based calculations) and graphs such as: pie charts, bar charts, histograms and frequencies (Comito and Wolseth, 2012). These forms of data interpretations provide investigators with the information needed to make informed decisions about the issues and concerns their research was designed to address. While there are certainly many different statistical procedures that can be utilized, simple descriptive statistics and graphs often provide enough information to address many issues (Comito and Wolseth, 2012). The data collected from the questionnaire survey — which has partly been analysed by BOS and SPSS — has also been visually analysed and presented by Excel. The details of the analysis can be found in Chapter 6.

4.7.4 Content Analysis

The application of content analysis can, perhaps, be traced back through the centuries. For instance, in the 7th century, word-frequency analyses of *Old Testament* texts were carried out by monks (Yule, 1944). As Hsieh and Shannon (2005) state, qualitative content analysis can be defined as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns". It is, in fact, a methodological approach of analysing "written, verbal or visual communication messages" (Cole, 1988; Elo and Kyngas, 2008). According to Weber (1990), in this method, there are six recording units which are commonly used: word, word sense, sentence, paragraph, theme, and the whole text. Content analysis is a more complex analytical process compared to quantitative analysis, for "it is less standardized and formulaic" (Polit and Beck 2004). One of the curtail challenges of content analysis is the fact that "it is very flexible and there is no simple, 'right' way of doing it" (Elo and Kyngas, 2008). Similarly, Hoskins and Mariano (2004) stated that "there are no simple guidelines for data analysis" in content analysis method. As they pointed out, the outcomes significantly rely on the "skills, insights, analytic abilities and style of the investigator". It is the researchers that should decide what kinds of variations are most appropriate for their particular problems (Weber, 1990).

In this study, the inductive content analysis method has been applied for the purpose of analysing interviews transcripts and also delving into the explanatory comments made by the respondents of the questionnaire survey. The process of inductive content analysis includes: open coding, creating categories and abstraction (Elo and Kyngas, 2008). 'Open coding' means that notes and headings are written in the text while reading it. The written material is read through again, and as many headings as necessary are written down in the margins to describe all aspects of the content (Hsieh and Shannon 2005). At this stage the headings can be translated into 'categories' (Burnard, 1991; Elo and Kyngas, 2008) and the lists of categories can be grouped under higher order headings. 'Abstraction' means "formulating a general description of the research topic through generating categories" (Elo and Kyngas, 2008). Each category is named using content-characteristic words. Subcategories with similar events and incidents are grouped together as categories and categories are grouped as main categories. The abstraction process continues as far as is reasonable and possible.

4.8 Summary

This chapter described the methods that have been employed to carry out the research. To this end, it has started with a general overview of theoretical explanation of qualitative methodology which has been followed by delving into quantitative and comparative approaches. Furthermore, the research ethical concerns have been addressed. Finally, the chapter has expanded upon specific survey methods and tools that have been employed in the process of data collection and data analysis. The key methods used within data collection process include: the review of literature; collecting official documents through a survey of 33 authority departments; carrying out a questionnaire survey; and conducting 24 semi-structured interviews. Some analytical tools and methods that have been employed in both data collection and data analysis process, are comprised of BOS (Bristol Online Survey); Microsoft Excel; IBM SPSS Statistics; Content Analysis; and Likert Scale.

Chapter 5: Iran and the UK: A Comparative Study

5.1 Introduction

This chapter discusses the contributions of comprehensive urban sustainability indicator frameworks concluded from the review of the literature and investigation processes in Iran and the UK throughout a comparative methodology approach. As mentioned earlier, the UK played a pioneering role in the development of urban sustainability evaluation mechanisms and has established a relatively powerful set of different methods and systems. Therefore a comprehensive assessment framework is extracted from the UK leading systems (discussed in Chapter 2) by employing the methods of categorisation, organization and elimination. Regarding the case of Iran, also a comprehensive urban sustainability indicator set is derived from different, yet dispersed and scattered data including governmental and non-governmental organisations' documents, papers, unpublished works, under development cases, pilot researches and academic studies. At last, understanding the two systems led the researcher to propose a finalised urban sustainability assessment indicator framework to be set in the Iranian context. Subsequently, the validity of the proposed framework was assessed by relevant scholars and practitioners. These are discussed and explained in chapters 6 and 7.

As discussed in Chapter 4, the nature of comparative study leads the researcher, firstly, to recognise and discuss the possible similarities and differentiations of the two systems in terms of indicators, datasets and assessment methods and techniques. Secondly, it can uncover how and to what extent the UK system could be consistent with Iran's urban sustainability assessment system considering its local characteristics. Consequently, it is to answer this very question that to what extent, learning from the UK as the leading light of the field of the study can improve, enhance and develop the theoretical path into evaluation of urban sustainability in Iran.

5.2 An investigation of the urban sustainability assessment mechanisms in Iran

To develop a comprehensive indicator set that could embody the environmental and socio-economic aspects of measuring urban sustainability, it is required to perceive the existing situation by delving into currently used and/or unused Iranian assessment systems. Therefore, during the data collection processes in Iran, the investigation was carried out through 33 local authorities' branches (see Appendix 5.1) which resulted in exploring 9 specific documents. They are listed in Table 5.1 and discussed in the following subsections.

Table 5.1. List of sustainability assessment methods collected from Iranian sources

	Iranian assessment systems	Source
1	Set of Indicators for Environmental Sustainability (SIES)	Iran Department of Environment
2	Urban Development Index	Tehran Municipality: Department of Performance Assessment and Management Improvement
3	The State of Environment (SoE) Report of Tehran (1998- 2007)	Tehran Urban Planning and Research Centre
4	Iran State of Environment Report 2004 (Iran SoE 2004)	Iran Department of Environment
5	Tehran Annual Air Quality Report (2015-2016)	Air Quality Control Company (AQCC) (subsidiary of Tehran Municipality)
6	Socio-Cultural Indicators for Tehran Neighborhoods (SCITN)	Socio-Cultural Deputy of Tehran Municipality
7	Evaluating the Quality of Tehran's Urban Environment (EQTUE)	University of Tehran, Faculty of Environment
8	Urban HEART Tehran: Urban Health Equity Assessment and Response Tool (UHT)	World Health Organisation, Tehran Urban Planning and Research Centre (Tehran Municipality)
9	Environmental Performance Assessment	Tehran Municipality: Environment and Sustainable Development Management Centre

5.2.1 Set of Indicators for Environmental Sustainability

Due to the fact that indicators play the key role in the process of evaluation of urban sustainability, Iran's Department of Environment, in collaboration with some ministries and governmental organisations, under the National Committee for Sustainable Development (NCSD) has developed 26 national environmental indicators within 5 categories and 13 sub-categories as shown in the Table 5.1 (DoE, 2014).

It is claimed that the indicators have been developed in the light of Iran's local conditions based on three international guidelines: EPI (Environmental Performance Index), CSD (UN Commission on Sustainable Development) and MDG (Millennium Development Goals). Although the indicators have been approved by NCSD, it is still awaiting approval by the *Majlis* (parliament). Six government departments are expected to act as providers of data sources in the evaluation process. They are as follows:

Table 5.2. *Environmental sustainability Indicator set (DoE, 2014), Translated and reproduced by the author.*

Set of indicators for environmental sustainability													
Weather		**Water**		**Land**			**Biodiversity**			**Production & consumption patterns**		
Climate change	**Air quality**	**Water quantity**	**Water quality**	**Desertification**	**Forests**	**Agriculture**	**Ecosystem**	**Coasts and seas**	**Species**	**Raw materials**	**Energy consumption**	**Waste management**
-Carbon dioxide emissions per capita -Carbon dioxide emissions for generating electricity -Intensity of carbon dioxide emissions in industry	-PM_{10} -Emissions of sulfur dioxide -Emissions of nitrogen oxides -Emissions of volatile organic compounds (non-methane)	-Access to clean water -Access to sanitation facilities -Intensity of water use in agriculture -Water stress	-Refer to Iran water quality indicators for surface/ground water resources *(developed by Department of Environment, 2014)*	Land affected by desertification	-Percentage of forest area to the total area of the country -Rate of growing stock (Standing Volume) -Carbon sequestration rates	-Efficient use of fertilizers (organic and chemical) -Use of agricultural pesticides	Percentage of the land protected area	-Percentage of marine protected areas -Percentage of sustainable exploitation of fish stocks	Percentage of endangered species	-Raw material consumption intensity in the economy	-Energy consumption intensity	-Waste generated per capita per day -Percentage of waste recycled (recycling rate)

- Department of Environment (Office for Water and Soil, Office for Air)
- The Forest, Rangeland and Watershed Organisation;
- Ministry of Agriculture;
- Ministry of Interior Affairs;
- Ministry of Energy;
- Ministry of Industry, Mine and Trade;

Further details of the indicator set can be found in Appendix 5.2.

5.2.2 Urban Development Index

The Department for Performance Assessment and Management Improvement (DPAMI) under Tehran Municipality's Deputy of Coordination and Planning, has been working on a project called *Urban Development Index* (UDI) since 2011. 12 experts have been involved in the process so far under consultancy of Radmer Sadeh Engineering Company. The DPAMI released the project progress report in July 2014 (TM, 2014a). Focusing on Tehran, the report suggests that the scheme aims to perceive what kinds of visions and principles dominated Tehran's urban management system "from an urban development point of view", and how this process of development are examined. As the report asserts, this is perhaps the first ever indicator set developed by an official urban administration that is defined at the urban level in Iran. The *urban development index* offers 31 "sub-indicators", 161 "measures", and 468 "variables" within 6 "headline indicators" including: sociocultural; urban services; traffic and transport; safety and disaster management; architecture, planning and urban infrastructures; and managerial development, smartisation and organisational transformation. Table 5.3 shows the 6 headline indicators and 31 sub-indicators of Tehran UDI. More details can be found in Appendix 5.3.

Searching report of the in-progress project raises concerns in terms of the way UDI has been cooked up. The ambiguity and complexity of literature and wording structure of the set, particularly in the 'measure' and 'variable' sections is noted. The extensive number of indices that should be assessed – which is 468 – is questionable. Considering the content of the UDI, specifically in the 'sociocultural' part, it characterises a top-down state-oriented style which fails to be inclusive and representative of all layers of the social spectrum. For example, composing phrases such as 'Promoting Islamic-Iranian identity and strengthening revolutionary values' as a sociocultural sub-indicator, or introducing 'measures' like 'family-

Table 5.3. Tehran Urban Development Index (TM, 2014a), translated and reproduced by author

Indicator	Sub-indicator
Sociocultural	Promoting Islamic-Iranian identity and strengthening revolutionary values
	Health
	Neighbourhood management and local capacities
	Research
	Entrepreneurship and dealing with social pathology
	Physical development
Traffic and transport	Public transport
	Traffic management
	Environmental pollutants
	Road safety
	Active transportation (non-motorised transport)
Urban services	Waste management
	Green space development
	Sustainable urban environment
	Organising pollutant businesses and industries
	Beautification and urban space management
	Supply of goods and services management
	Cemetery management
Safety and disaster management	Safety hazards
	Fire and rescue infrastructures
Architecture, planning and urban infrastructures	Fulfilment of urban development vision
	Lawfulness of physical development and image of the city
	Urban traffic infrastructures
	Surface water management
	Innovative and knowledge-oriented urban development
Managerial development, smartisation and organisational transformation	Strategic planning and management
	Financial resources management
	Rule of law and legal systems
	Knowledge-based and research-oriented management
	Good urban governance
	International cooperation

oriented promotion and development of the culture of citizenship' which concentrates on two specific variables – 1) number of workshops, gatherings, and educational trips to familiarise families with Islamic values and Islamic nurture, 2) number of educational and consultancy courses with focus on religion and morality, nurture, creativity, and learning– are critical. The expression "revolutionary values" mentioned above within a sociocultural sub-indicator is a well-known expression used by the state media and promoted across the governmental departments in Iran to sustain an ideological narrative. Carving further details of UDI sociocultural indicators sheds light on the one-dimensional characteristics of the set. One of the 'measures', defined as "enrichment of leisure activities with cultural packages" — which in fact is a verbatim translation of the original source — regardless of its eccentric phraseology, highlights a ‘variable’ worded: “implementation of *Rahian-e Noor* Plan (number of tours)”. Rahian-e Noor (literary ‘passengers of light’ in Farsi) is a title for the Iran-Iraq battlefield tours organised by Iran’s *Basij* militia; an auxiliary branch of the Islamic Revolutionary Guard Corps. Apart from the ideology-driven style of the tour, the organisation performance raised concerns in public domain by virtue of several traffic incidents led to loss of lives of dozens of students in recent years (Almonitor, 2014). The question is not only that how state-oriented ideological tours could be considered as leisure activities, but also it is the evaluation method that is problematic. In this regard, the criteria introduced to measure the variable, solely addresses the ‘number’ of tours, without taking the ‘quality’ or ‘state’ of them into account.

In the ‘urban services’ category, one of the seven sub-indicators suggested is ‘green space development’ in which include a specific ‘measure’ which is: “development of women-only parks”. It might sound quite feminist, something analogous to *La Escalera Karakola* (The Karakola House) in downtown Madrid where women established a sole-female space in 1996 to raise their voices against oppression and discrimination women face in society. It can be said that *Karakola* was, perfectly, a city of “feminist” women in full swing (Schmidt, 2003). However this has not been the case in Iran. The appearance of these women-only parks in Iran’s urban structure – which first appeared in 2001 in the city of Borujerd, Lorestan province (Hashemi et al., 2014) and since then they mushroomed across many cities around the country — comes out of the same idea that led to the forceful hijab in 1984; the idea of ‘body as temptress’. A so-called moralistically hygiene utopia– which heavily being prescribed and advertised by the sovereignty– is where women are not being able to be “cause of sin”. This notion seeks a neutral and monotone society in which women are considered as “temptress” and the magic tool of the temptress is nothing but her ‘body’. So it should be hidden from the theatrical scene of the city. Women’s park, ironically, introduces a novel *Andarouni*[1], although the characteristics of the space remain intact. In this instance, *Andarouni* transforms from ‘a place in the house’ to ‘a place in the city’ yet following the same agenda: women should not be seen by men.

The sub-indicator: ‘strategic planning and management development’, in one of its introduced ‘measures’, emphasises on a vocabulary that has been widely used by the state as an ideological and religious-specific form of action towards development: “plan-oriented and *jihadi* management”.

---

1. Purdah; literally inner house where women cannot be seen by men

Despite all fundamental issues mentioned above, that needs to be addressed, revised and to be considerably improved, it is worth noting that recognising a need for developing an urban development index by local authorities is yet an important stride.

5.2.3 The Tehran State of Environment (SoE) Report

In May 2011, The Tehran Urban Planning and Research Centre — a supervisory council under Tehran Municipality's Deputy of Coordination and Planning — released a 273-page report of the State of Environment of Iran's capital city. Subsequently an English version summary report was published in 2012. The project focused on Tehran's environmental situation from 1998 to 2007. Several partners including academics, governmental and professional bodies were involved in the project. Tehran-based Shahid Beheshti University (SBU), as the academic arm of the project, was assigned as the program executive. Tehran Islamic City Council, alongside with Tehran Department of Environment; and Tehran Municipality's Environment and Sustainable Development Centre were among the key local authorities involved in the process. The project followed the DPSIR model (Driving forces; Pressures; States; Impacts; Responses) derived from European Environment Agency (EEA) which is itself an extended version of PSR (pressure-state-response) initially implemented by the Organisation for Economic Co-operation and Development (OCED) in 1980s (EEA, 2014). However, according to the report, as the possibility of applying the 'I' factor (Impact) was not available, therefore this model was changed to DPSR (Tehran SoE, 2012). Kristensen (2004) refers the DPSIR framework to:

"a chain of causal links starting with 'driving forces' (economic sectors, human activities) through 'pressures' (emissions, waste) to 'states' (physical, chemical and biological) and 'impacts' on ecosystems, human health and functions, eventually leading to political 'responses' (prioritisation, target setting, indicators). Describing the causal chain from driving forces to impacts and responses is a complex task, and tends to be broken down into sub-tasks, e.g. by considering the pressure-state relationship."

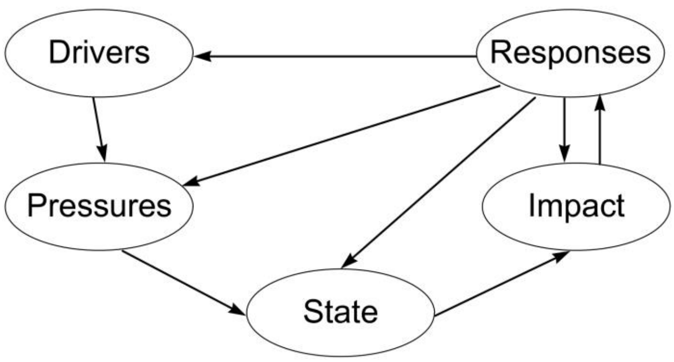


Figure 5.1. The DPSIR Framework for Reporting on Environmental Issues (Smeets and Weterings, 1999)

The SoE report of Tehran, opens its first chapter with an explanatory overview of the capital's demographical, geographical, social, and economic condition. In the second chapter, it identifies seven key environmental categories including Air, Water, Land, Biodiversity, Natural Disasters, Waste, and Human Settlements based on the DPSR model. Finally, the third chapter proposes the "Integrated Management of Tehran's Urban Environment" (IMTUE) in which a new trans-organisational headquarter is introduced to act as the central core authority offering an integrated environmental database for Iran's capital. The IMTUE is derived from the Sustainable Urban Environmental Management Approach (SUEMA), incorporating the Environmental Management System (EMS) with the Strategic Environmental Assessment (SEA). This approach, according to the report, would coordinate and facilitate interactions between organisations and local authorities involved in the process.

As the report asserts, providing data was the key obstacle that "caused the process' decline". These are five specific challenges highlighted in the report:

- Part of the required information was not provided.
- The authority for some part of information remained unknown and thus the information was not accessible.
- Part of required information couldn't be find in any organization, or the organization lacked data bank.
- Part of information was lacked periodically.
- Part of information were inaccessible because they were confidential, or sensitive information, or could cause problems for the authority.

The Table 5.4 details selected indicators based on the DPSR model.

Table 5.4. Tehran SoE indicators (Tehran SoE Report, 2011), translated and reproduced by the author

Category	Driving forces	Pressures	States
Air	-resident population -daytime population -population growth rate -number of active vehicles -number of daily journey in Tehran -number of industrial workshops by region -fossil fuel consumption (total amount) -fossil fuel consumption by sector	-total amount of air pollutant emissions -air pollutant emissions by type -air pollutant emissions by sector -CO_2 emissions -CO_2 emissions by sector	-distribution of air quality based on PSI (Pollutant Standards Index) -concentration of CO (annual distribution of air quality) -concentration of CO (monthly distribution of air quality) -concentration of PM (annual distribution of air quality) -concentration of PM (monthly distribution of air quality)

Water	Water quantity	-resident population -population growth rate	-precipitation in Tehran's catchment and storage dams -surface and groundwater resources -groundwater share in Tehran drinking water -total water consumption per year -water consumption growth rate -water consumption per capita per day -total water loss -percentage of water losses from the volume of water entering the water supply system -share of subscribers' water consumption	-the volume of water stored in dams -the volume of existing groundwater resources -water flow rate and the capacity of Tehran's river basins
	Water quality	-resident population -population growth rate	-volume of household sewages -sewage disposal methods -volume of industrial sewages -oil spill pollution -physico-chemical specs of wastewater entering the water plants	-nitrate levels in well water -physico-chemical specs of water in selected deep wells -heavy metal pollution in urban canals' selected monitoring stations
Land		-resident population -population growth rate -population density by region -migrant population by region	-land use change -excavation, embankment and bridge building activities -asphalt roads by region -the area specified in planning permissions for demolition and development (by region) -industrial activities -urban waste -residential density -salting roads -acid rain	- existing land use - physico-chemical state of soil - soil morphology
Biodiversity		-urban and sub-urban population increase -lack of awareness (public and authorities) towards the matter of biodiversity -existing administrative barriers to implementation of regulations which targeted the protection of urban biodiversity and ecosystems -lack of competent management of urban biological and ecological resources -lack of data on urban flora and fauna -lack of data about the endangered species -lack of monitoring systems for urban biodiversity	-land use change specially gardens and agriculture lands in inner city and periphery areas / urban sprawl -destruction of natural habitats and resources in the city and peripheries -increasing industrial units in the city and peripheries -air, water, and soil pollutions - soil degradation -excessive use of chemical fertilizers, pesticides, and insecticides -use of incompatible and exotic species (against the environmental conditions) - use of transgenic species -removing trees and plants in domestic gardens and buildings' side-lines in the course of development	-Tehran region habitats -Tehran region vegetation -total number of flora species and indigenous flora species in Tehran and Iran -total number of bird species identified in Tehran region -total number of indigenous bird species/ summer birds / winter birds / passing birds -bird species identified in Tehran habitats -fish species identified in Tehran protected areas -amphibious species identified in Tehran protected areas -reptile species identified in Tehran protected areas -mammal species identified in Tehran protected areas -status of species protection -state of species in national parks and protected areas
Natural Disasters		-weather -geology -tectonic -population density (by region)	-number of buildings by structure type -building stability in deteriorated urban fabrics -gas network vulnerability -water network vulnerability -rivers and watercourses spec	-seismic profile due to activation of the main faults -human loss prediction due to earthquake (by main seismic faults) -prediction of damage to the built- environment due to earthquake (by main seismic faults)
Waste		-resident population -population density by region -number of households per year -household welfare	-number of residential units (by region) -number of commercial/educational/cultural/office units (by region) -number of industrial workshops (by region) - number of healthcare centres by type	-total waste produced by region -hospital waste produced daily -hospital waste produced annually

	-long-term change rate in waste production -long-term change rate in composition of waste produced		-hospital waste per capita -total waste produced in building sector -total waste produced in industry -households waste composition
Human Settlements	-population growth rate (census periods) -population density by region -industrial workshops -Poor urban planning regulations	-waste, residual water, runoff -decayed urban fabrics -inner-city journeys	-housing and building -transportation -green space -public health -energy -pollution (air, water, soil, noise, light, visual/view) -attitudes/opinions towards environment

5.2.4 Iran State of Environment Report 2004

As part of its effort towards sustainable development, Iran Department of Environment launched plans to produce the country's State of Environment Report in collaboration with the United Nations Environment Programme (UNEP)'s *State of the Environment*. To this end, Iran DoE assigned the National Committee for Sustainable Development (NCSD) to carry out the project in cooperation with Deputy Office for Research and the Deputy for Education and Planning of SBU. The first official SoE report for Iran was prepared and published in Farsi in August 2004, based on, as claimed, experiences from other countries and the recommendations of international agencies such as UNEP and UNDP (DoE, 2004). The Farsi version has been

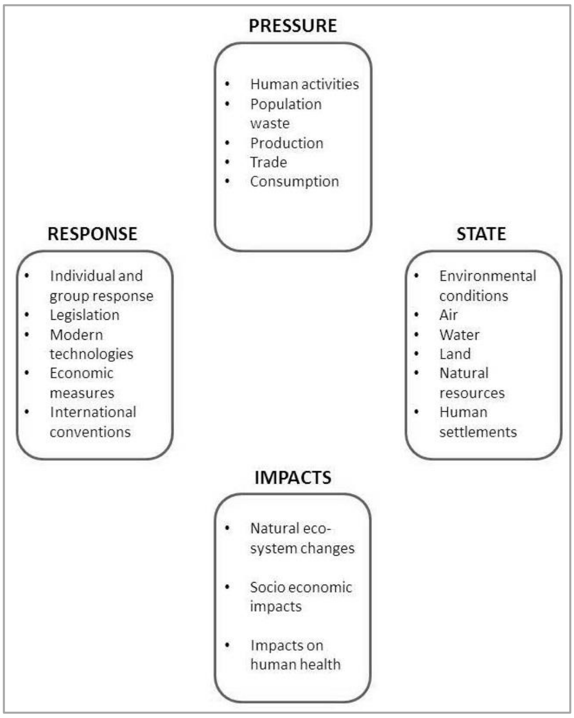


Figure 5.2. PSIR model (Iran SoER, 2004)

obtained from NCSD and investigated for the purpose of this research, however the English version of the report — which was a brief version of the Farsi publication and updated to 2005/2006 taking UNEP's recommendations into consideration — was published in October 2016 by the UNEP (UNEP, 2016).The first three chapters of the report depicts the socio-economic conditions of the country, discussing Iran's natural resources, and reviewing existing environmental laws and legislations in the national level (DoE, 2004). In the later seven chapters, it identifies seven key environmental issues for Iran, including Air, Land, Inland Waters, Coastal Waters, Biodiversity, Natural Disasters and Human Settlement. The report reviews their status and recommends measures to prevent or minimize their negative impacts based on the United Nations PSIR Model (Figure 5.1). 37 experts, academics, and officials including contributors, translators, and reviewers have been involved in preparation of Iran DoE report. Table 5.5 elaborates on seven environmental categories' driving forces, pressures, states, impacts, and responses introduced in the Iran State of Environment Report.

Table 5.5. Iran SoE indicators based on PSIR Model (DoE, 2004), translated and reproduced by the author

Category	Driving force	Pressure	State and Impact	Response
Air	- urban population growth - energy consumption increase - increase in motor vehicles - inefficient fuel consumption patterns - industry	-pollutants emission -greenhouse and pollutants gasses emission by energy-consuming sectors -consumption of ozone depleting substances -other pollutants	-nitrogen oxides -sulfur dioxide -carbon monoxide -particle matters -air quality of Tehran	-DoE activities (monitoring air pollution / monitoring motor vehicle pollution/ pollution from fixed sources/ environmental activities and international co-operation) -environmental performance of organizations and ministries
Land	-climate -population growth -economic activities	-agriculture -urbanization and land use changes -forest exploitation (commercial / non-commercial / land clearance / fire) -rangeland utilization -Burning Crop Residues -mining	-chemical properties (soil nitrogen/ available phosphorus/ available potassium/ soil organic carbon) -physical properties (soil specific gravity/ soil salinity/ plaster soils) -water and wind erosion	-governmental organizations and ministries (Ministry of Agriculture / DoE) -international environmental cooperation -training activities

Inland waters	**water quantity**	-uneven distribution of water resources -water shortage -overuse of groundwater resources -agriculture, industry and mining -urban and rural water consumption	-precipitation -surface water -dams	-public and the authorities' awareness -adaptation of national water supply and sewage disposal approaches in urban and rural areas: (comprehensive approach to resource utilization, giving priority to the supply of healthy drinking water) -long-term planning for quantitative and qualitative preservation of drinking water resources -Iran-Netherlands cooperation committee on the water sector - establishing healthy consumption patterns for drinking water based upon the climatic conditions of each region and to reduce per capita use of water within the framework of existing regulations -applying a water pricing system -encouraging and supporting the manufacturers -establish correct water-use practices in future generations (especially children and young adults)
	water quality	-industrial pollution -agricultural chemicals -household sewage -solid waste	-rivers -lakes -groundwater -drinking water	-activities and studies (ministry of energy/ DoE)
Coastal waters	**Caspian Sea**	- population growth -marine resource exploitation -exotic migratory species -pollution dispersion: (industrial effluent/ agricultural run-off / household sewage / tourist and recreational centres)	-physical factors: (salinity /water temperature / evaporation/ wind and waves/ tides /water currents) -coastal rivers: (concentration of chlorine pesticides/ concentration of phosphates and nitrates) -water quality -heavy metals	-DoE – national and provincial projects -international environmental cooperation and activities -international projects -establishing coastal reserves -environmental performance of other organizations: (ministry of energy/ Iranian harbours and shipping organization)
	Persian Gulf and Sea of Oman	-population growth -water resources -pollution: (industrial effluent/ household sewage/dredged substances/crude oil leakage/major accidents and other incidents)	-physical factors (salinity /water temperature / evaporation/ wind and waves/ tides /water currents) -qualitative factors (petro-hydrocarbons/ heavy metals/ coastal eco-system)	

Biodiversity	-inappropriate resource management -population growth -extension of human activities especially in ecologically-sensitive regions -land use change and encroachment of forest land -overuse of chemical pesticides, fertilizers and similar substances -overexploitation of floral and faunal resources -water and soil pollution due to various agricultural and industrial activities -weakness and ineffectiveness of existing rules and regulations -use of genetically manipulated (gm) species without due consideration -illegal trade in animal and plant seeds -poaching and the introduction of exotic species -abundant availability of illicit arms	-Flora (distribution of floral species in Iran's vegetation zones / floral species at risk of extinction) -Fauna (mammals / birds / reptiles / amphibians/ fish) -invertebrates -vertebrates at risk	-DoE's activities at the national level -DoE's activities at the international level: • adoption of a national action strategy to preserve biodiversity • Asian cheetah and its related ecosystems protection project • preservation of the biodiversity of the Zagros mountain ecosystems • expansion of the wetland regions and flight networks to protect the Siberian crane and other aquatic birds • protection of Iran's wetlands • protection and management of Anzali wetland • Iran-Saudi Arabia cooperation for wildlife protection • joint studies project for the protection of slender-billed curlews • workshops, seminars and international meetings
Natural disaster	-geographical situation -deforestation -low precipitation -water shortage -desertification -heavy rainfall	-earthquake -flooding -drought -landslides -heavy snowfall	-Organizational Activities and Achievements: (DoE / International Research Centre/ Ministry of Agriculture/ Other Achievements) -International projects -The International Institute of Earthquake Engineering and Seismology (IIEES)

Human settlements	-population: (population distribution / population annual growth/ population age average/ population density) -transportation: (mileage/ vehicle's age/ type of fuel/ vehicle type) -energy resources use: -solid wastes: (urban waste/ hospital waste/ industrial waste/ wastewater/ dangerous wastes) -water consumption -waste -public attitude to environmental problems	-air, water and soil quality -noise pollution -light pollution -green spaces -urban habitation: (management of urban areas/ un-authorized settlements/ state of urban and rural settlements due to disasters/ density of urban housing) -access to public services: (drinking water/ urban waste recycling/ transportation network) -healthcare	-policies and strategies implemented by DoE: (prevention and decrease in destruction and pollution of water and soil resources / ongoing projects due to water quality management / quality standards /monitoring and assessment) -performance of other organizations and ministries

5.2.5 Tehran Annual Air Quality Report (2015-2016)

Established by Tehran Municipality in 1993, the Air Quality Control Company (AQCC) has the mandate of measuring and reporting Tehran air quality. But it was not until 2013 when major organisational change took place and AQCC transformed into a knowledge base company in which several researches and studies have been carried out (AQCC, 2014). Tehran Annual Air Quality Report (2015-2016) is the fifth comprehensive report document the AQCC released since 2012. The AQCC defined its indicators based on the Air Quality Index (AQI) of U.S Environmental Protection Agency (EPA) which is, itself, a progressive version of Pollutant Standard Index (PSI). The AQI delineates a color-coded criteria based upon the citizens' health concerns within 6 levels: good; moderate; unhealthy for sensitive groups; unhealthy; very unhealthy; and hazardous (Figure 5.2). According to the report, 21 air quality monitoring stations installed around the city of Tehran, measuring concentrations of carbon monoxide, nitrogen dioxide, ozone, particulate matters, and sulfur dioxide, gather the pollutants' data and report the results to the public through 40 digital screens (AQCC, 2016). The *Table 5.6* explains the pollution indicators, their standard limits and the periodic cycle in which they were assessed.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health warnings of emergency conditions. The entire population is more likely to be affected.
Hazardous	301 to 500	Health alert: everyone may experience more serious health effects

Figure 5.3. *Air Quality Index (AQCC, 2016)*

Table 5.6. *The standard levels used for Tehran air quality assessment by AQCC (AQCC, 2016)*

Pollutant		Standard level	Period
Carbon monoxide (CO)		9.4 (ppm)	8 hours
		35 (ppm)	1 hour
Nitrogen dioxide (NO_2)		100 (ppb)	1 hour
		21 (ppb)	annual
Ozone (O_3)		124 (ppb)	1 hour
		75 (ppb)	8 hours
Particulate Matters	$PM_{2.5}$	35 (mg/m^3)	daily
		10 (mg/m^3)	annual
	PM_{10}	154 (mg/m^3)	daily
		20 (mg/m^3)	annual
Sulfur dioxide (SO_2)		144 (ppb)	daily
		7 (ppb)	annual

Since 2012, the AQCC has developed an online reporting platform which include commentaries, charts, tables, histograms and graphical presentations of the current situation, so as to raise the public awareness of Tehran's citizens about the quality of air they breathe (AQCC, 2016).

It is worth mentioning that the AQCC has also, produced six substantial reports so far under the title: 'Air and Noise Pollution Reports of Tehran's Municipal Regions', concentrating on the level of noise pollution in Tehran's urban regions 1, 2, 3, 4, 11, and 16. The company now operates 43 noise monitoring stations across the capital. The efforts to reduce the levels of noise pollution in Iran dates back to 1999 while the Ministerial Board passed the Noise Act regulations (AQCC, 2015). Following this, the standard limits of noise pollution was determined and approved to be implemented in the country. The noise pollution needs to be measured due to functions of the buildings and areas such as residential; commercial; industrial; and mixed use. According to these regulations, Tehran Municipality's AQCC carried out a pilot project among some of municipal regions of Tehran, mentioned above, investigating the noise pollutions in those areas. The analysis is shaped based on GIS maps and the research outcomes emerged as noise maps and charts showing the different levels of noise bands in the studied areas. Noise maps have two main purposes. Firstly, they can be used to provide information on noise levels that can be linked to population data to estimate how many people are affected. This leads to the second use –and the main point of noise mapping– to help in the production of noise action plans to manage noise and reduce noise levels where appropriate. The noise maps have been made using computer modelling techniques, based on information such as traffic flow data, road/rail type, and vehicle type data. The modelling, where necessary, also took account of features which affect the spread of noise such as buildings and the shape of the ground (e.g. earth mounds), and whether the ground is acoustically absorbent (e.g. fields) or reflective (e.g. concrete or water). This pilot research can be developed to provide a far better understanding of the state of Tehran noise pollution by expanding on the monitoring mechanisms across all regions and neighbourhoods of the city.

Table 5.7. National standards for noise pollution in Iran (AQCC, 2015)

Typology	**Day (7.00 – 22.00) L_{eq} (30) dB (A)**	**Night (22.00 – 7.00) L_{eq} (30) dB (A)**
residential	55	45
residential-commercial	60	50
commercial	65	55
residential-industrial	70	60
industrial	75	65

The Air Quality Control Company has emerged as a well-established, research-based organisation which provides substantial amount of air quality data, alongside with continuous monitoring and reporting since 2012. The AQCC can play a significant role in evaluation of urban sustainability, namely for environmental indicators such as air and noise in Iran's capital. Although there is a need for instalment of further air and noise monitoring stations to provide a more precisely-depicted perspective of Tehran's air and noise quality, the procedures of data collection, evaluation mechanisms and public reporting applied in the process, could be exemplary.

5.2.6 Socio-Cultural Indicators for Tehran Neighborhoods (SCITN)

Under the resolution of the Islamic City Council, Tehran municipality introduced a local version of Social Impact Assessment (SCI) called 'ATAF' in 2006 (Tehran Municipality, 2013). ATAF was set up to investigate and to measure the sociocultural consequences of planned interventions (policies, programs, plans, projects) in Tehran. Consequently, this led to implementation of the *Neighbourhood Profile*; a project that is to depict a sociocultural picture of Tehran at the neighbourhood level. The Neighbourhood Profile has been implemented in some of Tehran's communities and localities so far. Accordingly, in 2014, Tehran Municipality's Office for Sociocultural Studies developed a social indicator set including 4 categories; 31 headline indicators; and 218 indicators (Tehran Municipality, 2014b).

Table 5.8. Sociocultural indicators for Tehran neighborhoods (Tehran Municipality, 2014b)

Distribution / dispersion	**Security / insecurity**	**Participation/ isolation**	**Cultural homogeneity / diversity**
• Housing • Food, services and consumer goods • Medical services and healthcare • Education • Cultural and leisure facilities • Public transport • Communication equipment • Neighborhood pleasantness • Social service • Environment	• Traffic safety • Health & safety • Delinquency (public safety) • Financial security • Family safety • Social security • Gender security • Nutrition security • Judicial security • Cultural security • Environmental security • Natural disaster	• Economic/ environmental participation • Political participation • Social engagement • Cultural engagement	• Type and extent of cultural consumption • Cultural engagement • Ethnic background • Sense of belonging • Appearance and similarity

As shown in Table 5.8, the indicator set introduces four dichotomy categories which includes: (1) distribution / dispersion; (2) security / insecurity; (3) participation / isolation; 4) cultural homogeneity / diversity. The first category looks into distribution of resources such as housing; food; education; healthcare; environment; leisure; public transport; social services; and 'neighbourhood pleasantness'. The second category emphasises on sociocultural and economic security. Its 12 headline indicators are as follows: traffic safety; health and safety; public safety; financial security; family safety; social security; gender security; nutrition security; judicial security; cultural security; environmental security; and natural disaster. The third one with concentration on social participatory processes, introduces 4 headline indicators such as: economic and environmental participation; political; social; and cultural engagement. The last and fourth category titled as 'cultural homogeneity and diversity' suggests 5 headline indicators which are as follows: type and extent of cultural consumption; cultural engagement; ethnic background; sense of belonging; and 'appearance and similarity'. The complete indicator set is available in appendices section (see Appendix 5.4).

Digging into the SCITN posed a number of challenges to the proposed set, such as: comprehensiveness of the indicators; the literature and wording processes; the elements of ambiguity; inclusiveness; and repetitiveness. It is observed that there are 18 twin indicators across the four categories, using exactly the same words that could have been possibly merged. The Headline Indicators that encompass these analogous measures are: medical services and healthcare; environment; health and safety; environmental security; and cultural engagement. To draw a clear picture of the set contents, the Headline Indicators such as cultural and leisure facilities (category 1); financial security (category 2); social security (category 2); political/managerial participation (category 3); cultural engagement (categories 3 and 4); ethnic background (category 4); and appearance and similarity (category 4), are discussed in the following paragraphs.

In the Headline Indicator *cultural and leisure facilities*, indicators referring to young men and women or adolescents (such as: 'percentage of young women who visit libraries' or 'percentage of adolescents who visit cinemas') are open to interpretation as the boundaries of childhood, adolescence, and youthfulness can be ambiguous. For the matter of precision and to avoid such vagueness, a specific age reference coding could be suggested. Several indicators from the same headline, are set to evaluate the number of people who have access to the developing public and private charity organisations such as: *Khaneye Farhang* (house of culture); *Khaneye*

Quran (house of Quran); *Khaneye Mashq* (house of practise); *Khaneye Javan* (youth club); and *Khaneye Asbabbazi* (house of toys). While measuring the quantitative aspects of these associations is essential, there, also, could be a procedure to assess their qualitative characteristics such as their performance; the visitors' satisfaction; and so on.

The *financial security* headline, including 8 indicators, highlights the average costs of

- hairdressing (men and women);
- home cleaning;
- home moving;
- repairing an electric fuse;
- repairing a tap;
- shoe repair (men);
- and the average cost of taxi for a ride within the neighborhood (due to taxi agencies' tariffs).

According to Kozera et al (2016), financial security – which may refer to 'economic security' as well– should be perceived from two points of view: macroeconomics and microeconomics. The former defines the economic security as "the stability of employment, low unemployment and predictable prospect for economic development", while the latter refers to the affluence of an enterprise or household (Kozera et al., 2016). As Espinosa et al (2014) puts it, the concept of economic security refers to "the concept of economic stability and the ability to guarantee a particular living standard in households with different amounts of income". It is realised that the SCITN's *financial security* factor refers to the household economic stability, however the selected indicators are not thoroughly definitive and it is not crystal clear that how the cost evaluation of these hand-picked activities could shed light on the household financial security. There are, obviously more holistically defined indicators such as 'average household income'; 'average household expenditure'; or for instance, 'average renting cost' and 'average property price' that could comfort a genuine assessment of the economic security.

The *social security* factor explores the levels of trust in "government employees"; media; and the citizens. Five indicators were defined to assess the levels of trust between people including neighbours; local residents; ethnic groups; citizens; and countrymen and women. It might sound more explicit if the indicator seeks the levels of public trust in 'government' instead of the 'government employees' which may mislead the respondents' judgements. The indicators need to be precisely defined to circumvent any sorts of ambiguity.

The headline *political / managerial participation* include three indicators, among them: 'the number of active-duty *Basij* members'. The *Basij*, as explained earlier, is an auxiliary arm of the Iranian Revolutionary Guard, and as many believe, infamous for being an anti-social militia which undermines any sorts of political engagement. If it is essential at all to define a headline indicator such as 'political engagement', so it may be useful to introduce indicators that refer to freedom of press; freedom of political parties; freedom of expression; number of political prisoners; free election; number of people who participate in elections; and so on; the indicators that may pursue a sustainable political engagement and draw a more realistic portrait of the situation.

Two categories of 'participation' and 'cultural homogeneity' include the same Headline Indicators termed 'cultural engagement'. It is to evaluate the neighbourhood's cultural participatory level through three criteria:

- percentage of people who participate in the religious mourning ceremonies
- percentage of people who participate in the public prayers
- percentage of people who are members of the local sport teams

The indicators mentioned above, specifically target the religious and sporting activities and do not further the broad spectrum of what is called 'cultural engagement'. The 'cultural engagement' indicator is basically designed to gauge the level of interaction between people and culture, in two ways of participation in and/or attendance at a cultural activity or event (Scottish Government, 2015). The Scottish Government has traced the levels of 'cultural engagement' since 2007 through calculation of the "percentage of people who have either *participated* in a cultural activity or who have *attended* or *visited* a cultural event or places of culture in the last 12 months" (Scottish Government, 2015). The former— participation in cultural activities— includes indicators such as read for pleasure; creative work on social media; crafts; dance; played instrument/written music; photography/making films; art/sculpture; creative writing; performance with audience; other cultural activity; and 'none'. The latter –attendance at cultural events and visiting places of culture– introduces 15 indicators which are: cinema film; museum; library; live music event; galley; theatre; historical/archaeological place; exhibition; street arts; culturally specific festival; dance show/event; classic music performance/opera; book festival/reading group; archive; and 'none'. Hence the SCITN's *cultural engagement* factor could be expanded on the variety of cultural activities to settle its comprehensiveness and to further its inclusion. It can also be merged with some of the relevant indicators observed in the headline *cultural and leisure facilities*.

The category of 'cultural homogeneity/diversity' suggests Headline Indicators such as '*ethnic background'* and '*appearance and similarity'*. The *ethnic background* is evaluated through:

- percentage of people who was born in Tehran
- percentage of people who was born in the neighborhood
- percentage of people who speak Farsi

Considering the three recommended indicators mentioned above, the way the verbal elements are formed here could be debatable. For instance, the indicator of "percentage of people who was born in Tehran" could be simply rephrased with 'place of birth'. Or rather than asking for "people who speak Farsi", it would be appropriate to define an indicator like 'mother tongue' or 'first language' which undoubtedly offers a more comprehensive definition of the proposed indicator. The *appearance and similarity* category introduces four indicators which are as follows:

- percentage of women over 20, who wear *Chador*
- percentage of people who use domestically-produced vehicles
- percentage of households who have home-cinema setup
- percentage of buildings with stone façade

Seemingly, the proposed indicators fail to remain cohesive and relevant. It is hard to make any sense of connectivity between "buildings with stone" cladding and "women who wear" a specific type of hijab, and then combining these two and concluding the "appearance" of the neighbourhood. On the other hand, the indicators which investigate the number of users of "domestically-produced vehicles" and "home cinemas" perhaps aim to depict the economic *appearance* or *similarity* of the neighbourhood. If so, the level of economic integration and similarities may be defined through more comprehensive indicators such as 'household's annual income' or 'household's number/type of cars'. Therefore, there is no evidence whatsoever, to illuminate how these four specific indicators are being pooled under the headline of *appearance and similarity*.

The Tehran Municipality's move towards introducing these sociocultural measures at the urban neighbourhood level is notable, although the indicator set, as discussed above within several examples, needs to be polished, revised and yet to be passed by the parliament to be transformed from a rough unpublished draft into an appropriate legislation in force.

5.2.7 Evaluating the Quality of Tehran's Urban Environment (EQTUE)

In the year 1996, the University of Tehran's Faculty of Environment (department of environmental planning), in collaboration with Management and Planning Organisation of Iran, launched a research project titled *evaluating the quality of Iran urban environment* (Tabibian and Faryadi, 2002). The scheme suggested the evaluation of the urban environment of the major Iranian cities such as Tehran, Shiraz, Isfahan, and Yazd based on the sustainability indicators. Iran's capital was chosen as the first city to be investigated and this was how the

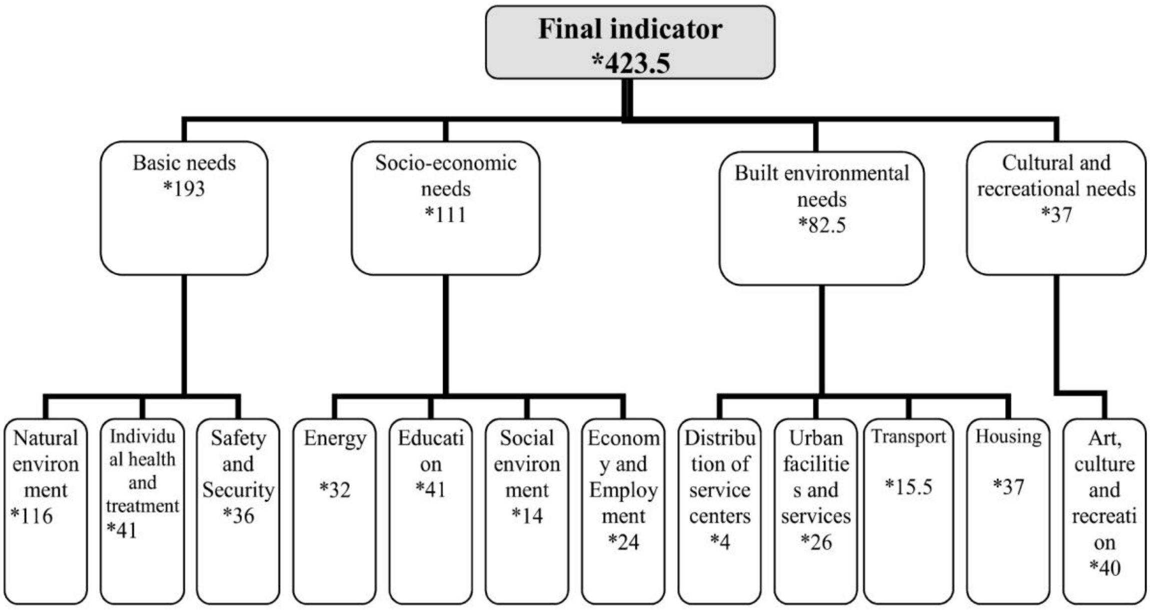


Figure 5.4. The EQTUE's 4 categories and 12 headline indicators (Seifollahi and Faryadi, 2011)

EQTUE (Evaluating the Quality of Tehran's Urban Environment) was born. The project, initially defined an indicator set including 12 *headlines* and 123 *measures* within the three *categories* of 'basic needs'; 'socio-economic needs'; and 'cultural needs' (Tabibian and Faryadi, 2002). However an updated and revised version of the set was introduced in 2006, adding the new *category* of 'built environment', slightly amended the wording of the 12 *headlines* and reduced the number of *indicators* down to 54. The indicator set were derived from studying and investigating several national and international guidelines and researches (Seifollahi and Faryadi, 2011). The model consisting of six layers; follows a bottom-up hierarchical calculation system. In the first layer there is the "final indicator" which depicts the

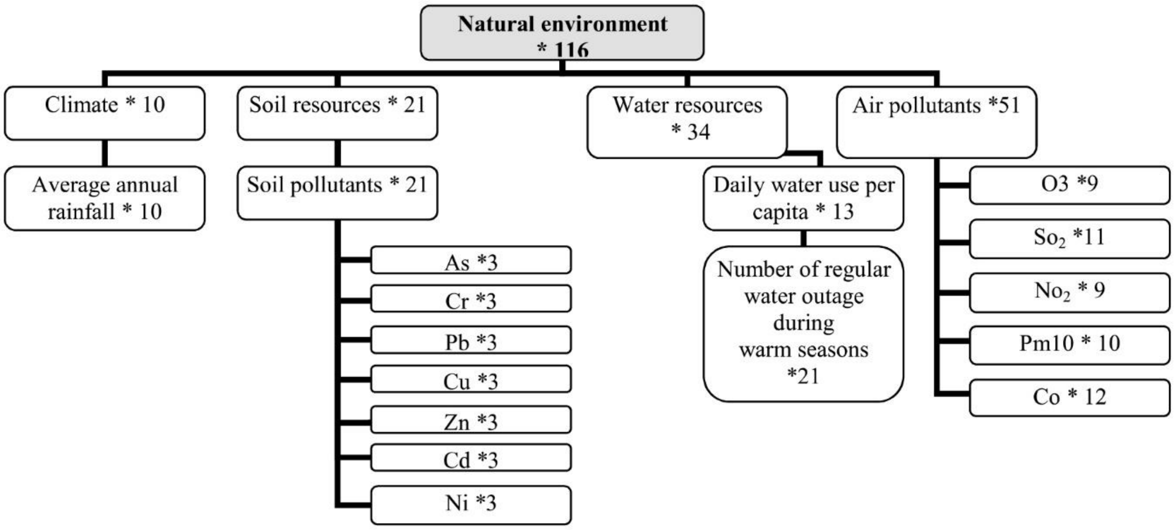


Figure 5.5. Tree chart for 'natural environment' headline indicator (Seifollahi and Faryadi, 2011)

total quality factor with a single figure. The final indicator's importance coefficient is reached from the sum of the measures' importance coefficients (which has been arbitrarily considered for each measure) in the lower layers. The second layer suggests four groups of aforementioned categories: "basic needs; built environmental needs; cultural and recreational needs; and socioeconomic needs". So the 12 headline indicators mentioned above, would fall into the third layer. They are as follows: natural environment; individual health and treatment; safety and security; energy; education; social environment; economy and employment; distribution of service centres; urban facilities and services; transport; housing; and 'art, culture and recreation' (Figure 5.4).

In the fourth layer each of the headline indicators has been divided into "secondary indicators". In the fifth layer the subdivision of the secondary indicators has been divided to smaller sections, if necessary. Finally, the sixth layer contains "measures" which are the vital means of evaluation such as: "the number of general practitioners", "the amount of carbon monoxide", "the average amount of rainfall", and so on (Seifollahi and Faryadi, 2011). Giving an example, Figure 5.5 demonstrates the 'secondary indicators' and 'measures' for the headline 'natural environment' which is defined within the category of 'basic needs'. As shown in Figure 5.5, the 'natural environment' introduces four indicators: climate; soil resources; water resources; and air pollutants. The EQTUE suggests a descriptive ranking procedure to represent the final outcome of the evaluation process. Therefore, the quality of Tehran's urban environment will fall into one of these five categories: best quality/very desirable (80% and more); desirable (60-80%); middle ranking quality (40-60%); low quality (20-40%); and no quality/undesirable

(20% and less) (Tabibian and Faryadi, 2002). Figure 5.6 shows the mathematical methodology applied in the assessment processes.

N: Total number of measures in the each Headline Indicator

$\mathbf{E_{i2}}$**:** Raw weight of each measure in 4 hierarchical orders: i=1-5

$\mathbf{E_{12}}$= 60**:** The raw weight of each measure in its best condition

D: importance coefficient, which has been arbitrarily considered for each measure

Current situation of indicator

$\Sigma \mathbf{E}_{i3} = F_{i2} \times \Sigma D$

i=1-5

Best situation of indicator

$\Sigma \mathbf{E}_{13} = E_{12} \times \Sigma D = 60 \Sigma D$

$\mathbf{Q}$ = The amount of Quality: $\frac{\text{Current situation}}{\text{Best situation}} \times 100$

Figure 5.6. Calculation method applied in the EQTUE (Seifollahi and Faryadi, 2011)

By and large, the EQTUE provides a well-researched, mathematically-enhanced set of indicators in which the categories, headlines, measures, and assessment methods are clearly described and presented. Adding to that, the bottom-up hierarchical calculation method used in the process, comforts the way the final outcome (i.e. quality level of the urban environment) is understood through a sole numerical expression. However, it is noted that some of the international guidelines applied in the research, are relatively outdated (i.e. from the late 1990s). Considering the main categories (which are: basic needs; socioeconomic needs; built environmental needs; and 'cultural and recreational' needs), there seems to be still room for improvement of their selection, categorisation, and wording processes. For example, 'natural environment' could be introduced as a "main category" factor as the whole idea is to evaluate the quality of the urban "environment". So the 'environment' could be an independent category itself. Indicators such as 'individual health and treatment'; 'safety and security'; and 'culture' could be placed under the 'social' category. These careful changes may lead to improve the precision and conciseness of the set and to decrease its level of ambiguity. Furthermore, the headline indicators, sub-indicators, and measures suggested in the set, seems insufficient. For instance, within the headline 'natural environment', there is no evidence of the indicators such as noise; biodiversity; and natural disaster. Even in the ‘water resources’ indicator, any kinds of measure related to ‘water quality’ is missing.

5.2.8 Urban HEART Tehran (UHT)

Since 2006, the World Health Organisation (WHO)’s Centre for Health Development, has developed an assessment system called Urban Health Equity Assessment and Response Tool (a.k.a Urban HEART) to scrutinise the health inequalities of the world cities (Asadi-Lari et al., 2010). Iran has joined the club in October 2007 when the WHO Country Office of Iran offered the Tehran Municipality (TM) to introduce an Urban HEART pilot research in Iran (WHO, 2013). As a result, Tehran Urban Planning and Research Centre – a subsidiary of TM– was assigned to carry out the project. Therefore the working groups including 65 officials, academics, and experts were organized and several workshops were conducted. Respectively, 42 indicators (the initial set included 65) within 6 domains were developed: physical environment and infrastructure; governance; economics; human and social development; health; and nutrition (WHO, 2013) (Table 5.9). To assess the indicators, a comprehensive questionnaire consisting of 12 sections was developed by the UHT’s Technical Advisory Committee. Prior to the implementation of the project, a preliminary data collection process was carried out to test the recommended questionnaire. Hence, in June 2008, 250 households, within five districts of Tehran, were randomly selected through using GIS data to carry out the test (WHO, 2013). After the implementation of the pilot study, the questionnaire was revisited and one section was added to it (see Table 5.10). Finally, based on socioeconomic and geographical conditions, through a ‘stratified sampling’ methodology, 120 blocks including

Table 5.9. UHT domains and indicators, reproduced by the author (WHO, 2013)

Domains	**Physical environment infrastructure**	**Human & social development**	**Economic development**	**Governance**	**Health**	**Nutrition**
Indicators	Healthy water	Education: -net enrolment ratio; -gross enrolment rate; -primary school completion; -higher education	Employment	Annual reports (by Municipality)	Vaccination	Calorie poverty
	Accidents and injuries	Violence (domestic; street)	Residency in normal homes /persons per room	Satisfaction	Teenage pregnancy	Wasting
	Air pollution	Smoking/addiction	Fair Financial Contribution Index (FFCI)	Lawfulness	Safe delivery	Stunting
	Noise nuisance	Smoke-free places	Household costs	Responsiveness to citizens’	Breastfeeding	Low Birth Weight

				complaints (hotlines)		
	Access to public transport	Mental health	Absolute/partial poverty	Contracts transparency	Mortality ratio (infant/under 5/ maternal)	Food cost
	Solid waste management	Social capital	Social Welfare Index	Community participation	Health-related quality of life	Cereal cost
	Health centre utilisation		Human Development Index	Standard activities	Disability	Food diary
						Body Mass Index: obesity/underweight

eight households each, were selected in each and every district of the city. Therefore 21,120 questionnaire-based interviews were conducted by 532 surveyors within 22 districts of Tehran (WHO, 2013). It should be noted that 676 surveyors were initially involved, however 80 surveyors cancelled the contract before starting, 51 quitted the job and 13 persons were fired due to a variety of reasons such as "difficulties with the questionnaires and workload; inappropriate acceptance and behaviour of some respondents; and unwillingness to answer the questions in some districts" (WHO, 2013). According to the head of TM Health Department, the UHT implemented its second phase in 2012 throughout 374 neighbourhoods of the Iran's capital (ISNA, 2012). The survey covered almost 1% of Tehran's population including 34,700 households, with the involvement of 1490 surveyors, academics, experts and officials (Tehran Municipality, 2016). Although it was claimed that the UHT's second phase has been implemented at the neighbourhood level, it seems safe to say that the project has been fairly carried out at the district level as some of the neighbourhoods have been ignored due to their low population density. For instance in one case, only one block (eight households) was selected to be surveyed across the eight neighbourhoods (Tehran Municipality, 2016). For the matter of accuracy, each neighbourhood could be independently surveyed based on its socioeconomic situation.

Table 5.10. Headlines of UHT questionnaire

1	Identification form	8	Responsiveness, satisfaction
2	General particulars of the family members	**9**	Mental health
3	Home facilities and assets	10	Quality of life
4	Health, vaccinations and mortality	11	Household costs
5	Accidents and injuries	12	Smoking and addiction
6	Domestic violence	13	Social capital
7	Disabilities		

The Urban HEART consists of two major determinants: 'assessment' and 'response' (WHO, 2007). As noted in the UHT report, what has been done in Tehran is about ‘assessment’, and the ‘response’ part has been neglected so far (Asadi-Lari et al., 2010). The UHT suggests that the 'response' can be categorised into four sections: evidence-based policy making (in the level of the parliament, City Council, or the government, to endorse relevant acts, regulations, etc.); evidence-based practice (local authorities performance in response to the gaps in their local areas); inter-sectoral collaboration; and ‘community-based initiatives’ that could be carried out by the communities and non-government organizations (Asadi-Lari et al., 2010).

The Urban HEART Tehran can be termed as an exemplary urban assessment scheme in which local authorities, academics, and experts could pursue a collaborative mechanism towards achieving the project goals. The implementation of the project in a broad scale of a city like Tehran, with an intricately complex urban management structure, is fairly compelling. Although the project, predominantly follows the WHO’s Urban HEART agenda, the core indicators suggested by WHO were discussed and processed by 65 experts and members of local authorities within a six-month period. The UHT reveals this very fact that there is a considerable lack of an integrated, well-established urban database in Iran. This is why UHT have had to conduct a massive survey to gather the data required for the purpose of this project.

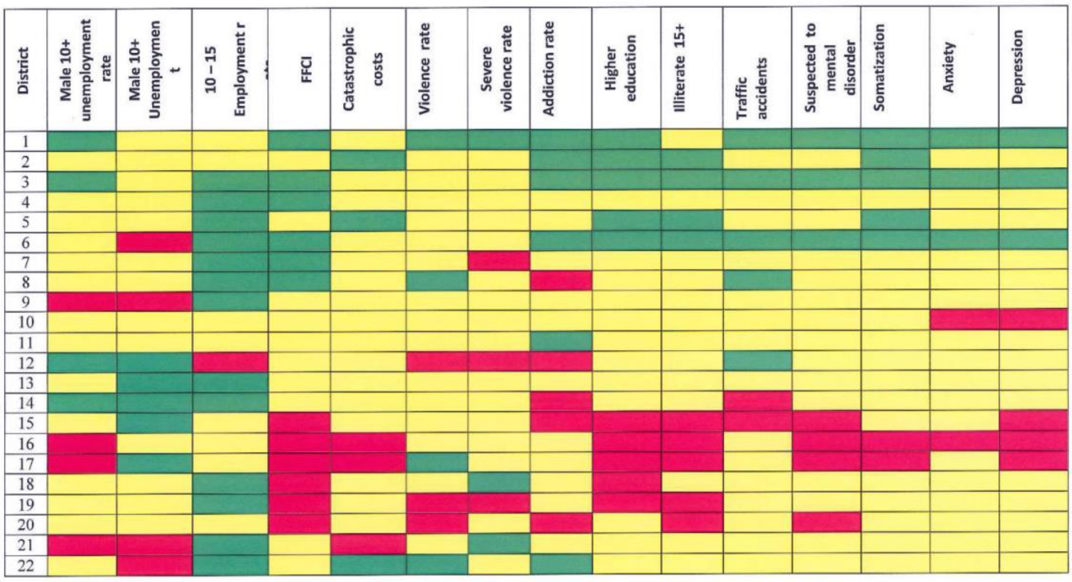


Figure 5.7. *Presentation of the results: color-coded matrix of UHT indicators for 22 municipal districts of Tehran (WHO, 2013)*

UHT unveiled the final results through a trio color-coding matrix in which ‘green’ indicates “good performance”; ‘yellow’ delineates “moderate”; and ‘red’ shows the “poor performance” of the indicators (Figure 5.7). Although this matrix introduces a relatively new way of representing urban assessments' outcomes in Iran, learning from enhanced methods such as the ARUP's 'SPeAR' (Sustainable Project Appraisal Routine), could undoubtedly lead to a more advanced, user-friendly demonstration which, in fact, improves the readability of the final results.

5.2.9 Environmental Performance Assessment

In 2003, the Office for Environment and Energy was established as a subsidiary of TM's Urban Services Department to tackle the capital's environmental issues. The department was gradually expanded in 2005 by forming new management offices: waste, air pollution, and IT. A year later, it renamed Office for Environment and Sustainable Development (OESD) and the 'Assessment Committee and Environmental Standards' was added (Tehran Municipality, 2017). The OESD aimed to "establish an environmental management system and carry out environmental studies for the urban projects". In 2013, "through a major organisational transformation", the OESD was incorporated into seven sectors including two deputies of 'Monitoring and Development' and 'Leadership and Coordination', and five "specialised departments": 'resource management and environmental indicators'; 'assessment and environmental standards'; 'energy management'; 'planning and resource development'; and 'empowerment and environmental contributions' (Tehran Municipality, 2017). The OESD was subsequently redefined as 'Environment and Sustainable Development Management Centre' (ESDMC) in 2016.

In 2014, the department developed an initial indicator set including 36 "sub-indicators" within six "main indicators" to evaluate the environmental performance of the urban developments. The six headlines were as follows (TM, 2014c):

- Maintenance of, and improving environmental management system and supplying environmental approvals and standards;
- Maintenance and environmental management of surface and groundwater resources;
- Modification of consumption patterns (management and optimization of water, electricity, gas and paper consumption);
- Environmental management of processes of collection, transfer and disposal of waste; prevention of environmental pollution in related fields (transfer stations, recycling and workshops);
- Cultural awareness and environmental education for TM's employees and citizens;
- Urban "harmful animals".

It is noted that the set was subsequently revised and, finally, 39 indicators within eight categories were introduced (see Table 5.11). Although the revised set is appeared to be much less redundant and ambiguous (considering the abovementioned six headlines), some of its “main indicators” may still need to be improved in terms of wording and categorisation. A “main indicator” or ‘headline’ may not exceed two or, at most, three words due to its clarity and readability characteristics. Also, the lengthy “sub-indicators” appear to be far descriptive.

During an interview conducted on 8 September 2014 with the ESDMC’s Environmental Assessment Committee, it was stated that the assessment processes are carried out under Tehran City Council and Tehran Municipality resolutions. The evaluations were initially limited to some of the premises owned by Tehran Municipality as 30 projects were introduced and four were chosen to be assessed so far. The committee stated that the environmental performance assessment reports of the municipality buildings are not publicly published, however they might be shared with some of the governmental organisations on demands. One of the committee members were concerned about the levels of precision and accuracy of the assessment outcomes as “the criteria used for the assessments did not really meet the standards”. It was mentioned that the ESDMC is in the process of establishing an integrated biodiversity database of Tehran in collaboration with Tehran Parks and Green Space Organisation.

Highlighting a recent progress, the ESDMC published a 33-page report in 2015, titled ‘Tehran State of Environment 2014’. The environmental state of the 22 municipal districts of Tehran were assessed according to 12 ‘headline indicators’ (Table 5.12). The AHP (Analytic Hierarchy Process) methodology was applied to weight the headlines. The ESDMC, by providing constantly-produced reports and tracing Tehran state of environment, aims to identify “the environmental strengths and weaknesses of each district and offer the necessary solutions and strategies to the identified problems” (TM, 2015).

Table 5.12. Headline Indicators for ‘Tehran State of Environment 2014’ (TM, 2015)

Headline Indicators			
1	air pollution	7	urban sewage network
2	noise pollution	8	state of hospitals sewage
3	quality and quantity of water	9	state of urban cleanliness
4	quality and quantity of soil	10	waste management
5	green space per capita	11	intensity of energy consumption
6	state of public transport	12	urban image (visual nuisance)

The abovementioned headline indicators, may draw one's attention to the problem of 'overlapping'. For instance, there is a correlation between headline indicators such as "urban sewage network" and the "state of hospitals sewage" which could be incorporated into a single

Table 5.11. List of Environmental Performance Indicators for Tehran Municipality's Urban Services Department (TM, 2014c), Translated and reproduced by the author

N	Main Indicator	Weight	Sub-indicator	Weight of sub-indicator
1	Maintenance of and improving environmental management system	10	Implementation of a comprehensive environmental management system to manage all processes affecting the environment	2
			Developing, monitoring and reviewing policies, goals and programs, tailored to the distinctive aspects	2
			Follow up on corrective measures to the violation of environmental management system	2
			The development, implementation and following up executive controls in environmental management system	2
			Effective communication and the procedures of monthly reporting	2
2	Controlling soil and water pollution	15	Proposing and follow-up the implementation of strategies and programs to reduce and eliminate water and soil resources pollutants	2
			The use of novel methods for water supply and consumption efficiency	3
			Controlling pollution of surface water resources through research, design and implementation of waste removal systems	2
			Quantitative and qualitative assessment of consumer water resources	3
			Supporting the research projects and creative schemes to improve environmental indicators related to soil and water	2
			Effective communication and the procedures of monthly reporting	3
3	Monitoring environmental pollutants	10	Holding monthly meetings of Monitoring Committee, providing meeting minutes, follow-up and implementation of Directives	2
			Identifying sources of pollution of air, water, soil and noise, establishing a database	4
			Measuring parameters of air, water, soil and noise pollutants; hydrocarbons and asbestos	2
			Effective communication and the procedures of monthly reporting	2
4	Environmental assessment of urban development plans	15	Controlling the environmental indicators of urban management projects	5
			Implementation of environmental guidelines for urban management projects	7
			Effective communication and the procedures of monthly reporting	3
5	Controlling air, noise, and light pollution	10	Identifying the environmental aspects of air, noise and light pollutions emanating from the municipality activities / defining goals and developing applicable plans	2
			Proposing and follow-up the implementation of strategies and programs to reduce and eliminate air, noise and light pollutants	2
			Implementation of effective measures to reduce pollution (technical inspection of vehicles, , state of noise and air assessment stations, development of cycling paths, expanding green spaces, etc.)	4
			Effective communication and the procedures of monthly reporting	2
			Examining, recommending, and implementation of innovative ways of reducing air, noise and light pollution	1(incentive point)
6		15	Energy consumption optimization	4
			Implementation of guidelines of modifying consumption patterns	4

	Energy consumption efficiency and development of renewable energies		Development of renewable energies	5
			Effective communication and the procedures of monthly reporting	2
			Proposing, reviewing and implementation of innovative approaches in order to optimize energy consumption and to use renewable energies	1(incentive point)
7	Environmental education	15	Personnel training	4
			Citizenship training (holding training courses)	6
			Effective communication and the procedures of monthly reporting	1
			Encouraging citizen engagement	4
8	Biodiversity management	10	Effective communication and the procedures of monthly reporting	2
			Implementation of research projects related to biodiversity	1
			Using effective species to promote and improve the urban environment	2
			Increasing green spaces per capita with an emphasis on using indigenous species	1
			The use of natural elements in the urban landscaping	2
			The progress of establishing a comprehensive database of biodiversity	1
			Implementation of strategies to protect flora and fauna	1
	Total weight	100		100

headline, say, 'urban sewage'. Therefore the indicators such as: 'urban sewage network'; 'hospital sewage' and so on could be categorised under the suggested headline. The same is true for the interrelationship between the "state of urban cleanliness" and "urban image/visual nuisance". Other examples include indicators such as "quality and quantity of water" or "quality and quantity of soil". For instance, the latter could be reworded into 'water' or 'water resources' considering the fact that the 'headline indicator' is an inclusive, comprehensive, and explanatory kind of keyword that should be carefully worded.

It is observed that five different ranking models have been used in the assessment processes:

- very good / good / average / weak
- low / average / high / very high
- inappropriate / acceptable / appropriate / desirable
- very good / good / appropriate / inappropriate
- appropriate / partly appropriate / inappropriate

This is when all of the 12 headline indicators could apparently be assessed by a sole rating system. While the variety of criteria used for the rating purposes, seems unnecessarily irrelevant, their wording make them lopsided. For example, words like "appropriate", "desirable", and "good" may convey analogous meanings and should not be abreast.

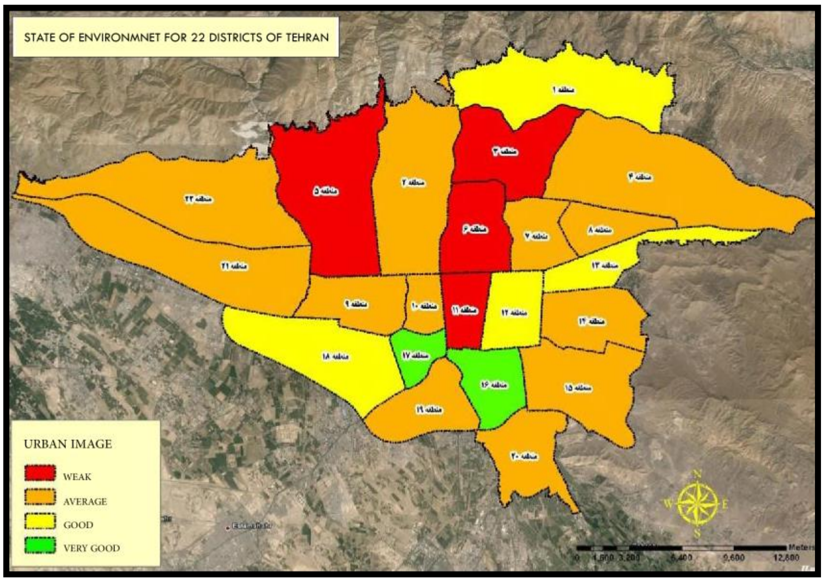


Figure 5.8. A sample representation of the results: The state of 'Urban Image' for 22 municipal districts of Tehran (TM, 2015)

The results of 'Tehran State of Environment 2014' have been presented thorough 11 color-coded maps of Tehran demarcated by 22 municipal districts (Figure 5.8). The 10 maps illustrate the state of the 12 headline indicators, while a final conclusive diagram pictures an aggregate of the 12 indicators for each district.

5.3 Comprehensive indicator sets: Iran and the UK

Reviewing and investigation of the existing assessment methods in Iran and the UK has resulted in the development of two comprehensive indicator sets for the purpose of this study. This approach helps to draw a clearer baseline for comparison, and suggest a finalised set for Iran. As explained earlier, the UK set is derived from the reviewed sustainability assessment systems and methods discussed in Chapter 2. Accordingly, the UK comprehensive framework was formed of 28 headline indicators comprising 127 measures within the three environmental, social and economic categories of sustainability (see Figure 5.9). For the full indicator set, see Appendix 5.5.

Iran's comprehensive indicator set, concluded from the nine Iranian documents discussed earlier in section 5.2 of this chapter, contains 22 headline indicators, comprising 104 measures. Figure 5.10 shows the 22 headline indicators being categorised into environmental, social and economic aspects of sustainable development. The full indicator set including measures can be seen in appendices section (see Appendix 5.6).

Table 5.13. The number of headlines and measures; Iran and the UK comprehensive Indicator Sets

	Iran comprehensive set		The UK comprehensive set	
Category	No. of Headline Indicators	No. of Measures	No. of Headline Indicators	No. of Measures
Environmental	7	49	9	61
Social	10	43	10	49
Economic	5	12	9	17
Total	22	104	28	127

5.4 A comparative study between Iranian and the UK comprehensive indicator sets

This section pens a comparative narrative of the two aforementioned comprehensive sets in terms of indicators, data sources and assessment methods.

5.4.1 Indicators

As mentioned earlier, the UK comprehensive set include 127 measures within 28 headlines, while Iran's comprehensive set is formed of 22 headline indicators comprising 104 measures (see Table 5.13). Where appropriate and comparable, the indicators of the two sets are discussed according to the environmental, social and economic categories in the following paragraphs.

Environmental indicators

In terms of environmental indicators, it can be said that the similarities between the two frameworks prevail. Iran and the UK comprehensive sets share headlines such as air, water, noise, natural disaster, land, waste, and biodiversity, however in the case of Iran, the headline 'waste' has been incorporated within the headline 'production and consumption pattern'. The UK set, in addition to the aforementioned headlines, include other headlines such as 'traffic' and 'access to nature'. 'Access to nature' is measured based on the "Areas of Deficiency (AoD) in access to nature by borough". Quality of Life method defined the AoD in access to nature as:

"localities where people live more than 1km walking distance from a green space, which is designated as a Site of Importance for Nature Conservation (SINC) at borough level or higher."

'Access to nature' is a useful environmental indicator that can be adapted to the Iranian framework. The headline 'traffic' is formed of two measures: 'traffic volume' and 'estimated daily average number of passenger journey' by modes of transport including: public transport,

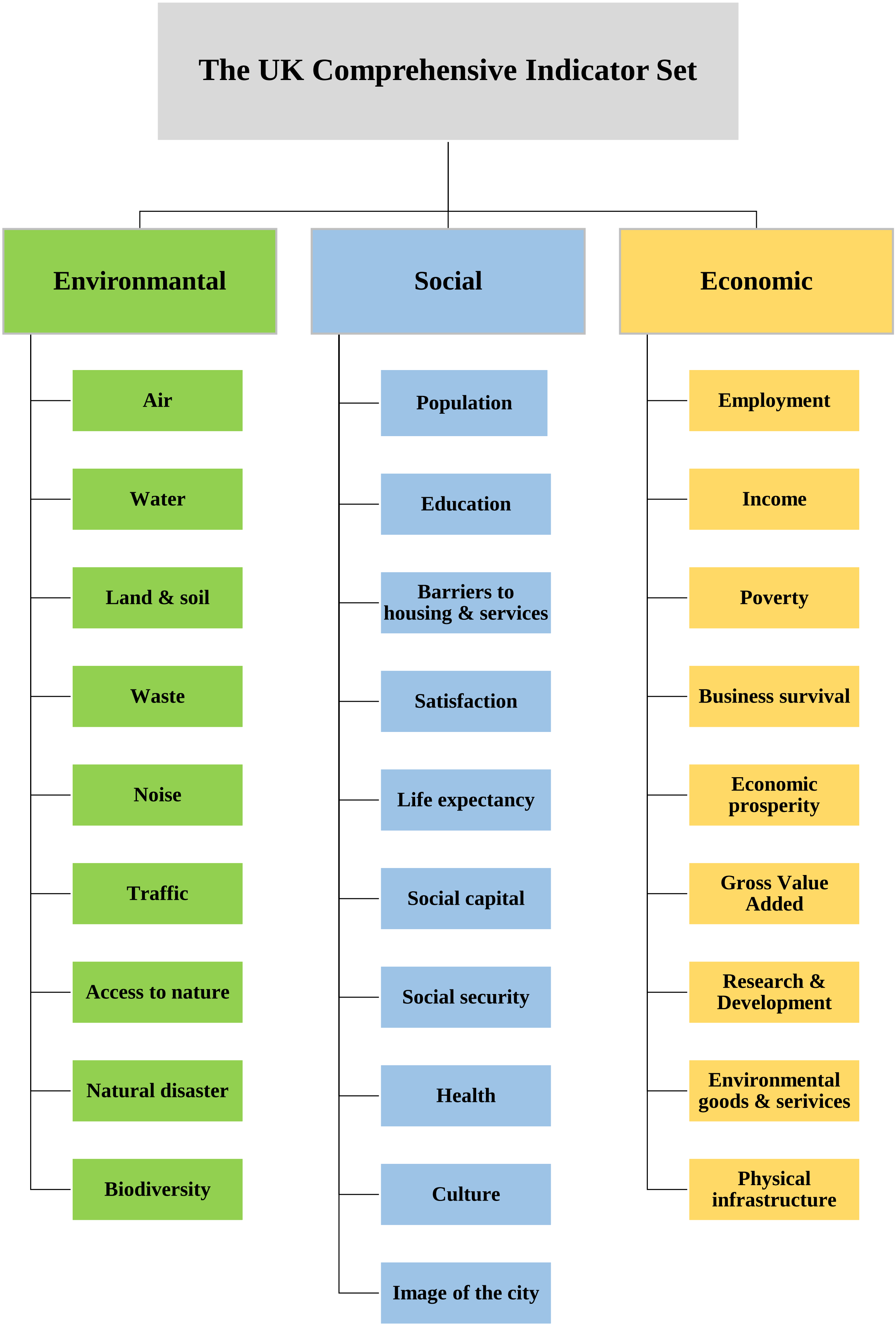


Figure 5.9: The UK comprehensive Indicator Set (headline indicators)

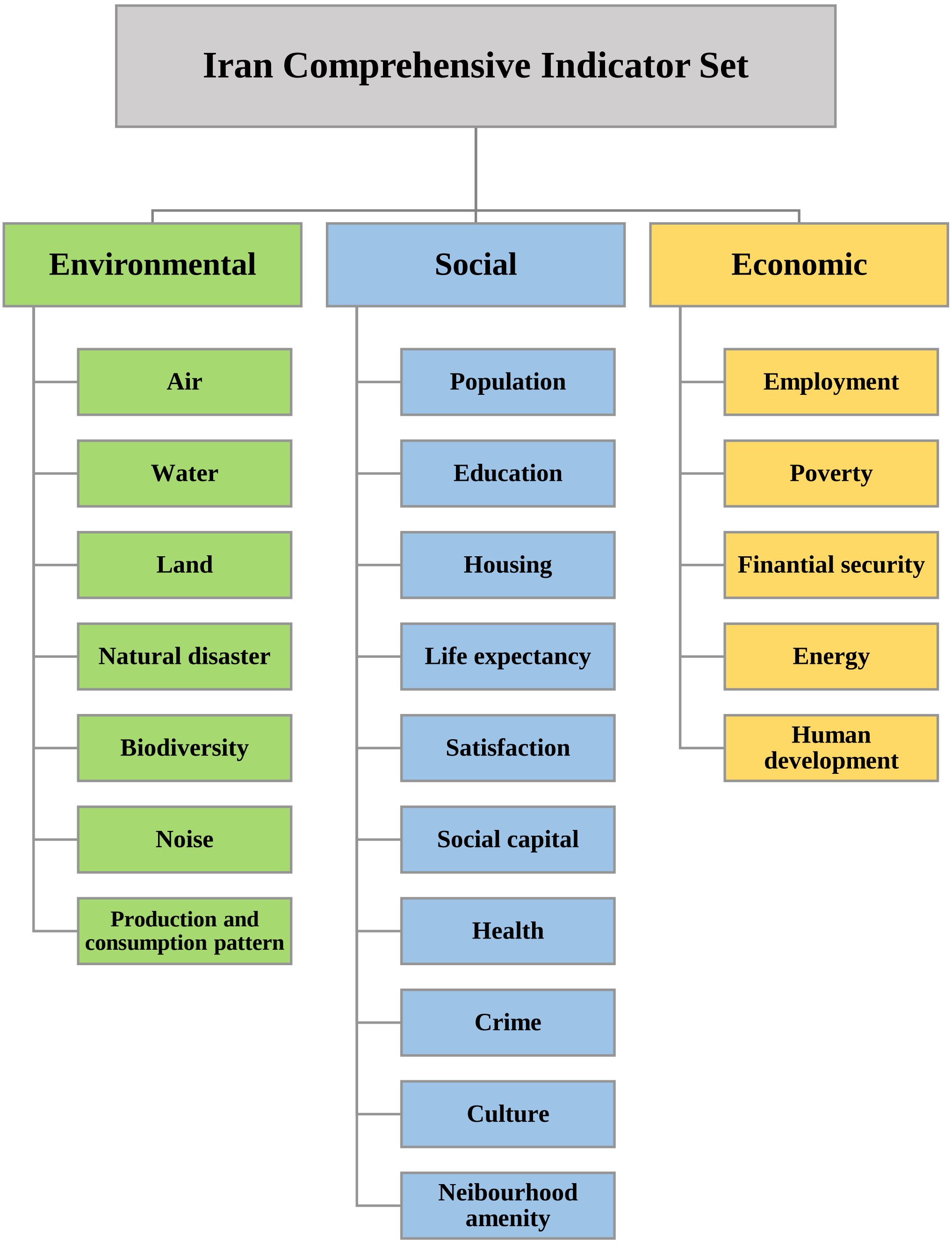


Figure 5.10: Iran comprehensive Indicator Set (headline indicators)

private transport, and walking and cycling. As urban traffic is the main cause of air pollution in cities, this indicator, with no doubt, can contribute to the environmental quality of urban regions.

Under the headline 'air' of the Iran's set, there is a specific measure called 'vehicles fuel consumption inefficiency'. It is to evaluate the vehicles performance in terms of fuel consumption which is severely related to the air quality. The poor quality of domestically-produced cars in Iran plus the international sanctions on the sustainable technologies make this measure very significant. On the other side, the headline ‘air’ of the UK set, highlights two measures which are as follows:

- Population living in the Air Quality Management Areas (AQMAs)
- The number of AQMAs.

Since December 1997 each local authority in the UK has been carrying out a review and assessment of air quality in their area. This involves measuring air pollution and trying to predict how it will change in the next few years. If a local authority finds any places where the objectives are not likely to be achieved, it must declare an ‘Air Quality Management Area’ there. This area could be just one or two streets, or it could be much bigger. Then the local authority will put together a plan (Local Air Quality Action Plan) to improve the air quality of the infected zones.

Within the headline ‘water’, the Iran comprehensive indicator set suggests measures such as: ‘water stress’; ‘water use in agriculture’; and ‘number of regular water outage in warm seasons due to water ration’.

‘Water stress’ is a definition for excessively water extraction in a country. This measure is well suggested by the Department of Environment as Iran is placed among top 25 countries under the mode of ‘water stress’ in the world, according to the World Resources Institute (Reig, et al., 2013). The ‘water stress’ in Iran is considered “extremely high” (Reig, et al., 2013) as Iran using more than 80% of its renewable freshwater resources, while the threshold to enter the ‘stress mode’ is as low as 40%.

Also, Iran rations water mostly during summer time and affects many in cities and villages across the country. The regular water outage in warm seasons remains an issue in Iran and this is why this measure is crucial.

Iran has always suffered from a seriously inefficient agriculture that heavily relies on irrigation and consumes most of the country’s limited water resources (Madani, 2014). While only 15% of the country’s area is cultivated, this sector is responsible for 92% of the water consumption (Madani, 2014). To prevent further economic and water losses, the government has slightly raised energy prices in recent years. Also, in different parts of the country, smart groundwater monitoring devices have been installed with the potential for real-time control of energy and water use (Moazedi et al. 2011; Zekri, 2009). Nevertheless, the effectiveness of these actions are yet unknown. What is known is that the continuation of the current water use trends in the agricultural sector will worsen the situation and that, evaluating and monitoring water usage in agriculture sector is vital to Iran's ecosystem life cycle.

Under the headline 'water', what is missed in the Iranian system is a measure which have been mentioned in the UK framework called: 'the use of sustainable drainage solutions in the new developments'. The rainwater harvesting and grey water recycling could significantly reduce the water consumption specifically within the urban regions.

Regarding the headline 'natural disaster', it is observed that there is a serious lack of a comprehensive indicator system in Iran. Natural disasters in Iran include: earthquake, drought, flood, and landslide. Iran is one of the most seismically active countries in the world, being crossed by several major fault lines that cover at least 90% of the country. As a result, earthquakes in Iran occur often and are destructive. Therefore, some relevant organisations such as: International Institute of Seismology and Earthquake Engineering; Natural Disaster Research Center; and Building and Housing Research Center; have carried out some pilot researches concerning seismic vulnerability assessment of buildings and retrofitting methods for the city of Tehran. These researches could lead to define a holistic set of natural disaster indicators. For instance, a research (Panahi et al., 2014) which evaluates the seismic vulnerability of school buildings in Tehran, carried out geotechnical and structural vulnerability analyses of buildings to develop a seismic vulnerability map based on AHP and GIS. Therefore, it represents a model for determining the degree of vulnerability of school buildings in Tehran on the basis of spatial analysis. This could expand to all buildings within the urban and rural areas.

In the UK, flood is the most noticeable natural disaster. According to the Sustainability Appraisal (SA) method, the 'flood risk' indicator should highlight the 'number of properties at risk of flooding more often than once every 100 years'. This is how this indicator plays its role in relation to urban planning. In the UK, the Environment Agency, publicly, provides geospatial data throughout online interactive flood maps (at largest scale of 1:10,000) illustrating the risk of flooding from rivers and seas, reservoirs, and surface water. The level of flood risk varies from 'very low' to 'low', to 'medium' and to 'high'. For example a 'very low risk' area has a chance of flooding of between 0.1% and 1% annually while a 'high risk' area stands for a chance of flooding of greater than 3.3%. All urban and built environment developments must refer to Environment Agency's "Flood Map for Planning". This map applies to the land-use planning and regulations. For the purpose of planning a development, it is required to undertake a more detailed flood risk assessment to show how the flood risk to the site, or elsewhere as a result of proposed changes to the site, can be managed as part of the development proposal. The main data sources of the indicator include 'National Flood Risk Assessment' (Nafra) and 'Environment Agency'.

In Iran There are several large rivers throughout the country. Only one river is navigable, and the others are too steep and irregular. Streams are seasonal and variable. They normally flood in spring (with the ability to create some damage), but have little or no water in summer (Madani, 2014). Although Iran is not prone to catastrophic floods, the number of cities in some parts of the country — north and southeast — suffer from seasonal floods every year. Learning from the UK system, it is possible to develop the flood risk indicators at least at the regional level for those areas which are under threat.

As the table below (Table 5.14) shows, Iran and the UK comprehensive sets share two analogous measures within the headline 'biodiversity'. One is the 'percentage of fish stocks harvested sustainably', and the other is 'endangered / priority species', however they fall under different categories: 'sustainable fisheries' (the UK set) and 'coasts and seas' (Iran set). In addition to these, the UK biodiversity indicators include: 'population of wild birds', and the 'number of developments that have incorporated green roofs, landscaping or open space to improve the diversity', while Iran measures the percentage of terrestrial and marine Protected Areas.

Table 5.14. Biodiversity measures for the UK and Iran comprehensive indicator sets

Biodiversity measures			
Iran		**The UK**	
Theme	**Measure**	**Theme**	**Measure**
Ecosystems	- Percentage of Terrestrial Protected Areas	Population of wild birds	- Water and wetland birds - Seabirds - Woodland birds - Farmland birds
Coasts and seas	- Percentage of Marine Protected Areas - Percentage of sustainable exploitation of fish stocks	Priority species and habitats	- Percentage of UK habitats of European importance in improving or declining conservation status - Percentage of UK species of European importance in improving or declining conservation status
		Sustainable fisheries	- Percentage of fish stocks harvested sustainably and at full reproductive capacity
Species	- Percentage of endangered species		- Number of developments that have incorporated green roofs,

Under the environmental headline: 'land', the UK comprehensive set offers two interesting themes: 'cultural heritage and landscape' and 'open space' (see Table 5.15). These categories, as their titles convey, were designed to evaluate the state of public and open spaces, as well as buildings, structures, and areas with special architectural and historic interest. Among the 16 measures, two indicators specifically address the issue of preservation of trees:

- Number of Tree Preservation Orders (TPOs)
- Number of applications affecting trees protected by TPOs

According to DCLG (2014), a TPO is:

"an order made by a local planning authority in England to protect specific trees, groups of trees or woodlands in the interests of amenity. An Order prohibits the cutting down, topping, lopping, uprooting, wilful damage, wilful destruction of trees without the local planning authority's written consent. If consent is given, it can be subject to conditions which have to be followed."

As another example, one measure was defined as 'extent of Archaeological Priority Areas (APAs)'. The APA, developed by public bodies including the Historic England and the Mayor of London, "is a defined area where, according to existing information, there is significant known archaeological interest or particular potential for new discoveries" (Booth and Kidd, 2015). These measures, undoubtedly could pursue a novel approach in the development of environmental sustainability indicators in Iran.

Table 5.15. Soil and Land measures for the UK and Iran comprehensive indicator sets

Soil and Land measures			
Iran		**The UK**	
Theme	**Measure**	**Theme**	**Measure**
Forest	- Rate of growing stock (Standing Volume) - Percentage of forest area to the total area of the country - Carbon sequestration rates		- soil quality
Agriculture	- Efficient use of fertilizers (organic and chemical)	Land contamination	- Number of sites of potential land contamination
		Cultural Heritage and Landscape	- Number and area of Conservation Areas - Number of listed buildings and Listed buildings at risk - Extent of Archaeological Priority Areas - Number and condition of scheduled ancient monuments
Urban land	- Urban land use by type	Open space	- Number and area of Registered Parks and Gardens - Area of designated open space /improvements to open space - Public opinion of open spaces - Number of Tree Preservation Orders (TPOs) - Number of applications affecting trees protected by TPOs and number of applications permitted that involved the loss of trees protected by TPOs
		Land use by type	- Total Croppable Area - Permanent Grassland and Rough Grassland - Forestry and woodland - Inland water - Other land (including urban land and built up areas)

Social indicators

Iran comprehensive set is comprised of 10 social headlines with 43 measures, whereas the UK set include 49 measures under 10 headlines. Both sets share seven headlines with the same wording. These include: employment, education, health, satisfaction, life expectancy, social capital, and culture. It should be noted that same headlines do not necessarily share similar measures, except for the three headlines: population; life expectancy; and satisfaction. The UK set include three other social headlines which are as follows: barriers to housing and services; social security; and 'image of the city'. The other social headlines for Iran's set include: housing; crime; and 'neighbourhood amenity'.

As Table 5.16 demonstrates, the UK set introduces five measures under the headline 'education' that could be novel to the Iranian framework. These measures include: number of NEETs (NEETs is an acronym for people who are Not in Education, Employment or Training); area of new education facilities created; number of public schools; number of school places; and number of pupils enrolled per year. The last three measures are categorised as 'school capacity'.

Table 5.16. 'Education' measures for the UK and Iran comprehensive indicator sets

Education		
Iran	**The UK**	
Measure	**Theme**	**Measure**
- Rate of primary school completion		- The proportion of working age adults aged 25-54 with no or low qualifications
- 15-24 year-olds literacy rate	Primary education	- The proportion of pupils making expected progress from Key Stage 1 to Key Stage 2 in English and Maths
- Adult literacy rate	Secondary education	- The proportion of Key stage 4 pupils obtaining at least 5 GCSE passes at A*-C or equivalent
- Proportion of people over 18 who are in Higher Education		- Number of NEETs (people who are Not in Education, Employment or Training)
		- Area of new education facilities created
	School capacity	- Number of state-funded schools - Number of school places - Number of pupils enrolled per year

Regarding the headline 'health', the UK set contains 10 measures under four themes which are: mortality; life style; obesity; and community (see Table 5.17). While the theme 'life style' addresses behavioural patterns such as: smoking, exercise, mode of transport, and fruit and vegetable nutrition, 'community' focuses on care homes, sport and recreation spaces. The theme: ‘mortality’ is shared between the two sets, although it is evaluated with different measures. It means that the UK set looks into mortality rate from causes considered preventable, whereas Iran’s set measures infant and maternal mortality ratio. Furthermore, Iran’s set offers the theme: ‘smoking and addiction’ with measures including adults’ and adolescents’ smoking, drug addiction, and smoke-free places. Other measures for Iran’s set include: disability; number of public toilets; number of people with mental illness; number of healthcare facilities and so on (see Table 5.17). It is worth mentioning that in the UK set ‘disability’ has been categorised under the headline ‘social security’ instead.

Table 5.17. ‘Health’ measures for the UK and Iran comprehensive indicator sets

Health			
Iran		**The UK**	
Theme	**Measure**	**Theme**	**Measure**
Mortality	- Mortality ratio (infants) - Mortality ratio (maternal)	Mortality	- Mortality rate from causes considered preventable
Smoking and addiction	- Drug Addiction - Adult smoking - 13-15 year-old smoking - Smoke-free places	Obesity	- Proportion of children overweight and obese (2-15 year olds) - Proportion of adults overweight and obese
Disability	- Number of disabled people - Number of Public toilets - Number of GPs per 1000 people - Number of people with Mental illness	Lifestyles	- Prevalence of smoking in adults - Proportion of adults doing 150 minutes of exercise per week - Proportion of urban trips under 5 miles taken by sustainable methods: walking, cycling, public transport - Average daily consumption of fruit and vegetables
	- Number of healthcare facilities	Community	- No. of care homes for older people - No. of care homes for mental health - No. of sports/playing fields and outdoor recreation spaces

Within the Iran’s set, the social headline ‘crime’, drawn from the Urban HEART Tehran (UHT), is comprised of five measures: domestic violence, street violence, death due to suicide, death due to intentional accidents (homicide), and ‘disabilities due to violence’. For the UK set, ‘crime’, together with childcare, disability, and ‘form and space’ are themes which shape the headline ‘social security’ (see Table 5.18).

The Iran’s set evaluates disability with two measure: ‘number of disabled people’ under the headline ‘health’ and, as mentioned above, ‘disabilities due to violence’ under the headline -

Table 5.18. 'Social security' measures for the UK comprehensive indicator set

Social security (UK)	
Theme	**Measure**
Crime	- Total recorded crime - Fear of crime
Childcare	Total places available per 100 children for children under 8
Disability	Proportion of disabled people in the social activities
Form and space	- Public lighting by neighbourhood - Area of public spaces with poor lighting - Visibility and natural surveillance by neighbourhood - Mix of uses by neighbourhood - Number of places complied with design guidance such as CPTED (Crime Prevention Through Environmental Design) or SBD (Secured By Design) by neighbourhood

'crime'. Seemingly, the UK set looks at disability from a different point of view. Being extracted from the SA indicators, it analyses the engagement of disabled people with society by simply measuring the 'proportion of disabled people in the social activities'. Although it is important to document the number of disabled people and types of disabilities within a community, it is even more vital to assess their share of activities in the society. For, the level of their engagement could simply reflect the level of safety and security of our streets, neighbourhoods, towns and cities and show how prepared and facilitated they are to deal with disability.

One of the themes under the headline 'social security' is 'form and space' which was derived from the SPeAR. Highlighting public safety and security of the built environment at the local level, it includes measures such as: public lighting; area of public spaces with poor lighting; visibility and natural surveillance; mix of uses; and lastly the 'number of places complied with design guidance such as CPTED (Crime Prevention through Environmental Design) or SBD (Secured by Design). CPTED initially developed in the 1960s, has been implemented in the UK by some of the borough councils and the local authorities in collaboration with the Metropolitan Police. As defined by London Borough of Barking and Dagenham, it comprises nine factors: layout; public and private space; natural surveillance; landscape design; building design; shop frontages / town centres; lighting; CCTV; and parking (LBBD, 2008). The concept of CPTED applies the principles of 'Designing Out Crime' developed by Design Council (design strategist of the UK government) "to influence crime levels, the fear of crime and anti-social behaviour within the built environment" (LBBD, 2008). The official police security initiative: 'Secured by Design' (SBD) is also combining the principles of 'Designing

Out Crime' with physical security. In a nutshell, measures mentioned above under the theme: 'form and space' try to provide answers to these key questions:

- Are there opportunities to increase the mix of use to encourage greater activity at varying times of the day and night?
- Do public areas allow good open visibility with minimal dark or hidden areas?
- Is there a clear definition between public and private areas?
- Are public areas appropriately lit to deter anti-social behaviour and improve perceived levels of safety, whilst minimising trespass of light to surrounding areas?
- Has appropriate design guidance been adopted, e.g. Secured by Design, Crime Prevention through Environmental Design (CPTED), etc.?

Regarding the headline 'social capital', similarities between the two sets prevail (see Table 5.19). They both include same themes with analogous measures namely: voting; volunteering; and trust, with the UK set having an extra measure: 'relationship'.

Table 5.19. 'Social capital' measures for the UK and Iran comprehensive indicator sets

Social capital			
Iran		**The UK**	
Theme	**Measure**	**Theme**	**Measure**
Voting	The proportion of people engaging in elections	Voting	The proportion of people engaging in actions designed to identify and address issues of public concern at least once a year
Volunteering	The proportion of people engaging social activities like NGOs	Volunteering	The proportion of people engaging in any volunteering activity at least once a year
Trust	The proportion of people agreeing that people in their neighbourhood can be trusted	Relationship	The proportion of people, who have a partner, family member or friend to rely on if they have a serious problem
		Trust	The proportion of people agreeing that people in their neighbourhood can be trusted

Within the UK set, the headline 'image of the city' derived from Sustainability Appraisal (SA), measures the 'number of tourism visits to the city'. The SPeAR also suggests an indicator called 'public art' that could be incorporated into this headline. This indicator aims to evaluate the role of public art within the city / neighbourhood by answering the following questions:

- Has public art been used to make the public realm more attractive?
- Does art reflect local culture effectively?
- Has art been leveraged to enhance safety, security and usability of public spaces (e.g. for climate comfort, lighting, etc.)?

The Iran's set also, suggests a headline — produced by the SCITN — called: 'neighbourhood amenity' that could semantically be equivalent to the headline 'image of the city'. The headline comprises four measures which are as follows: area of green spaces per capita; number of industrial workshops / vehicle repair shops per 1000 household; percentage of buildings without façade; and area of motorways and pathways.

As the table below shows, Iran's comprehensive set offers four measures under the headline 'housing'. The measures which defined by EQTUE include: average area of residential units; ratio of households per residential unit; housing production per 1000 people per year; and the ratio of durable buildings. The same category for the UK set called 'barriers to housing and services' encompasses seven themes with seven measures derived from IMD, QoL, and SA methods. Measures which were designed to be implemented at the LSOA level, address issues of overcrowding households, homelessness, housing affordability, as well as accessibility to groceries, schools, GPs, and post offices within a neighbourhood (see Table 5.20).

Table 5.20. 'Housing' measures for the UK and Iran comprehensive indicator sets

Housing	**Barriers to housing and services**	
Iran	**The UK**	
Measure	**Theme**	**Measure**
- Average area of residential units	Household overcrowding	- Proportion of all households in a LSOA which are judged to have insufficient space to meet the household's needs
- Ratio of households per residential unit	Homelessness	- The rate of acceptances for housing assistance under the homelessness provisions of housing legislation
- Housing production per 1000 people per year	Housing affordability	- Proportion of households under 35 unable to afford to enter owner occupation
- The ratio of durable buildings	Road distance to a GP surgery	- The mean distance to the closest GP surgery for people living in the LSOA
	Road distance to a food shop	- The mean distance to the closest supermarket or general store for people living in the LSOA
	Road distance to a primary school	- The mean distance to the closest primary school for people living in the LSOA
	Road distance to a Post Office	The mean distance to the closest post office or sub post office for people living in the LSOA

Economic indicators

The UK comprehensive set include 9 economic headline indicators comprising 17 measures, while the Iran set encompasses 12 measures under 5 economic headlines. Although the two sets share headlines such as 'employment' and 'poverty', the measures they represent are relatively distinct. For instance, under the headline 'poverty', Iran's set offers two measures derived from Urban HEART Tehran (UHT): 'rate of absolute/ relative poverty' and 'social Welfare Index'. The same headline for the UK set suggests two measures under 'child poverty' and 'fuel poverty'. The former measures 'proportion of children in low-income households', while the latter evaluates the 'number of households living in fuel poverty under the low income high cost (LIHC) definition' (see Table 5.21). Also, under the headline 'employment', the UK set introduces two measures derived from QoL and SDIs: 'the rate of employment', and 'proportion of economically active adults unemployed for over 12 months', while Iran's set suggests 4 measures including: rate of economic engagement; consumer goods and services price index; dependency ratio; and share of women in employment.

The UK comprehensive set suggests an economic headline called 'business survival' in which the durability of 'new businesses' is considered. This headline is to make sure that the emerging businesses can survive for more than three years. The evaluation of this indicator could reveal the level of economic stability and viability of the studied society. Also, there is a measure under the headline 'environmental goods and services' that addresses the monetary performance of environmental goods and services sectors such as: low carbon and renewable energy industries. Another headline include 'research and development' which concentrates on the share of R&D in the business in general and environmental sector in particular. Other measures include: pension provision, income inequality, debt, Gross Value Added and so on. Table 50 shows details of economic indicators for the UK comprehensive indicator set.

In the Iran's set, Human Development Index (HDI), derived from 'Urban HEART Tehran', was introduced as an economic measure. The HDI, which was developed by the United Nations Development Programme (UNDP), is defined within three dimensions including: life expectancy, education, and GNI (gross national income) (UNDP, 2016). It should be noted that its first two indices (life expediency and education) are usually categorised within social indices. The headline 'energy' was also considered under the category of economic. This headline derived from EQTUE method, specifically address the use of solar energy.

Reviewing economic indicators of Iran's comprehensive set (see Table 5.22) and comparing it

Table 5.21. The 'economic' factors for the UK Comprehensive Indicator Set

Economic (The UK)				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment method**
Employment		Rate of employment	ONS	QoL
		Proportion of economically active adults unemployed for over 12 months	ONS	SDIs
Business survival		Percentage of new businesses still trading after 1 year	ONS, Business Demography	QoL
		Percentage of new businesses still trading after 3 years	ONS, Business Demography	QoL
Income	Pension provision	Percentage of eligible workers in a workplace pension	ONS, DWP (Department for Work and Pension)	SDIs
	Income inequality	Decile distribution of net disposable household income for individuals	DWP, Households Below Average Income (HBAI)	QoL
	Debt	Public sector net debt (percentage of GDP)	Office for Budget Responsibility	SDIs
		Public sector net borrowing (percentage of GDP)		
Poverty	Child poverty	Proportion of children in low-income households	DWP, Households Below Average Income (HBAI)	QoL, SDIs
	Fuel poverty	Number of households living in fuel poverty under the low income high cost (LIHC) definition	Department of Energy & Climate Change (DECC)	QoL, SDIs
Economic prosperity		Indices of Gross Domestic Product (GDP), GDP per head and median income	ONS	SDIs
		Income distribution of the whole population, before housing costs	DWP	SDIs
Gross Value Added		Gross value Added per capita	ONS: Regional GVA NUTS1	QoL
Research and development		Expenditure on R&D performed in businesses (£ millions)	ONS, Defra	SDIs, SPeAR, QoL
		Expenditure on R&D related to environmental expenditure (£ millions)	ONS, Defra	SDIs, SPeAR, QoL
Environmental goods and services		Total sales in the environmental goods and services sector: environmental/ low carbon/ renewable energy	K-Matrix	QoL, SDIs
Physical infrastructure		Asset net worth by structure type: dwelling/ other buildings and structures/ total non-financial assets/ machinery and equipment	National Balance Sheet, ONS	SDIs

with measures derived from the UK sustainability assessment methods, shows that Iran needs to develop a more enhanced and more sustainability-laden economic indicators that will help to analyse the state of economic sustainability more rigorously and move toward a more viable and more sustainable economy. Furthermore, in an oil-based economy like Iran in which market fluctuation is considerable, measures related to non-oil exports and inflation could also be taken into consideration.

Table 5.22. The 'economic' factors for Iran Comprehensive Indicator

Economic (Iran)				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment methods**
Employment		Rate of economic engagement		Urban HEART, EQTUE
		Share of women in employment		EQTUE
		Dependency ratio		EQTUE
		consumer goods and services price index		EQTUE
Poverty		Rate of absolute/ relative poverty		Urban HEART
		Social Welfare Index		Urban HEART
Financial security		Fair Financial Contribution Index (FFCI)		Urban HEART
		Household costs		Urban HEART
		Average cost of: home moving / home cleaning /hairdressing / taxi per ride		SCITN
		Residency in normal homes /persons per room		Urban HEART
Energy		The use of solar energy		EQTUE
Human development		Human Development Index		Urban HEART

5.4.2 Data

As previously mentioned in Chapter 2, data plays a crucial role in the development of urban sustainability assessment mechanisms (Wong, 2006). In this respect, World-Wide-Web has become a genuine platform for hosting many governments' official, as well as non-governmental organisations' databases. It hugely helped to ease frustrating and often complicated processes of getting access to data dusted in the governments' departments.

In many developed countries, the right to information became an indispensable part of the Rights of Man (Singh, 2014). The UK parliament passed the 'Freedom of Information Act 2000' in 2000 and the full provisions of the act came into force on 1 January 2005. The Act creates "a public 'right of access' to information held by public authorities on a national level

(Crown, 2000). To this end, the UK government introduced the 'Click-Use Licence' which has been used since 2001 across most of the UK public sector and required users to register (Cabinet Office and Maude, 2010). In 2010, the 'Click-Use Licence' has been replaced by the Open Government Licence (OGL) which is a "simple set of terms and conditions that facilitates the re-use of a wide range of public sector information free of charge" (TNA, 2017). The OGL which is defined within the UK Government Licensing Framework (UKGLF), has considerably relaxed the processes and procedures of access to public sector information— information produced by central and local government or any public body (Cabinet Office and Maude, 2010).

In Iran, the parliament passed the 'Freedom of Information Law' on 25 January 2009 and it was subsequently approved by the Expediency Discernment Council on 22 August 2009 (IPRC, 2017a). The law came into effect by the government in July 2015 (IRNA, 2015a). According to the FOI Law, all state departments and organisations are obligated to provide the general public with the data they produce, unless otherwise data are ranked as 'classified information'. However, it is observed that there are substantial challenges regarding the implementation of this law across the state organisations; especially those state-controlled departments which are not defined under the government. It is considered that around 40% of the governmental ministries— including Ministries of Petroleum, Agriculture, Roads and Urban Development, Ministry of Justice, Ministry of Defence and Armed Forces Logistics, and Ministry of Industry, Mine and Trade— are yet to be subscribed to the FOI pilot website (FNA, 2017). In a nutshell, although the legislation of the FOI Law is a major breakthrough, there is still a high level of ambiguity in how this law is being implemented in practice, given the complexities and contradictions of power structure in Iran.

The Iran comprehensive indicator set (see Appendix 5.6) could be supported by 26 major data resources of which 14 provide environmental data, 7 recognised to maintain social information and 5 address the economic data (see Table 5.23). The number of major data sources that would contribute to the UK comprehensive indicator set (see Appendix 5.5) is 46, comprising 23, 17, and 6 environmental, social and economic data providers respectively (see Table 5.24). The non-ministerial department of the 'Office for National Statistics' (ONS)— formed in 1996 by the merger of the Central Statistical Office (CSO) and the Office of Population Censuses and Surveys (OPCS), is the major data provider and the "largest independent producer" of official statistics in the UK (Pullinger, 1997). Operating within the UK Statistics Authority, the ONS

Table 5.23: Data sources for Iran comprehensive indicator set

Iran data sources
Environmental data
Department of Environment (DoE) Office for Air, Office for Water and Soil,
Air Quality Control Company (AQCC)
Iranian Fuel Conservation Company (IFCO)
Ministry of Energy Water and Wastewater Company (ABFA), Atlas of Water Resources
Ministry of Health and Medical Education
Statistical Centre of Iran (SCI)
National Cartographic Centre (NCC) National Atlas of Iran,
Ministry of Agriculture Jihad
Japan International Cooperation Agency (JICA)
Ministry of Roads and Urban Development
Ministry of Interior
Ministry of Industry, Mine and Trade
Tehran Municipality (Tehran Detailed Plan)
Forest, Rangeland and Watershed Organisation (FRWO)
Social data
Statistical Centre of Iran (SCI)
Iranian National Centre for Addiction Studies (INCAS)
Ministry of Health and Medical Education
Tehran Municipality
Iranian Police Criminal Investigation Department (NAJA)
Expediency Discernment Council
Iran Cultural Heritage, Handcrafts and Tourism Organisation
Economic data
Ministry of Economic Affairs and Finance
Ministry of Cooperatives, Labour and Social Welfare
Statistical Centre of Iran (SCI)
Ministry of Energy
Central Bank of Iran (CBI)

is responsible for conducting decennial census in England and Wales, as well as collecting and publishing social, economic and demographic data at different scales, from national, to regional, to local levels. The UK's official statistics are also available through the government official dataset website: data.gov.uk, in which data are freely available within 12 categories: business and economy; crime and justice; defence; education; environment; government; government spending; health; mapping; society; towns and cities; transport. Another massive online dataset in the UK include the UK Data Service, funded by the Economic and Social Research Council (ESRC), providing data for all sectors, including academia, central and local government, charities, foundations, independent research institutes, businesses, think-tanks and the commercial sector (UKDS, 2017a). The UK Data Service collections include major UK government-sponsored surveys, cross-national surveys, longitudinal studies, UK census data, international aggregate, business data and so on. Data can be searched by themes including: aging; crime; economics; education; environment and energy; ethnicity; food and food security; health and health behaviour; housing and the local environment; information and communication; labour market; politics; and poverty and social exclusion (UKDS, 2017a).

Iran's version of ONS is called: *Markaz-e Amār-e Iran* (Statistical Centre of Iran (SCI)); a major governmental body in producing official statistics, which produces and releases data at the national, provincial and urban levels, however, the data are predominantly produced and made available at the provincial level. Succeeding the previously established ministerial department: Office of Public Statistics, the SCI was derived from the implementation of the Third National Development Plan (1962-1967) and approved by the National Consultative Assembly in July 1965 (SCI, 2017a). The SCI was assigned to collect data through implementation of sampling surveys and censuses and all government departments and public bodies were duty-bound to provide the SCI with its required statistics (SCI, 2017a). Although, the first national population census in Iran was implemented between 1939 and 1941 and remained unfinished, the first SCI 'Population and Housing Census' was carried out in 1966 and consequently, the SCI published its first National Statistical Yearbook in the same year (SCI, 2017a). The census has been carried out every 10 years until it has changed to a quinquennial census in 2007 (SCI, 2017a).

Although the census data were used to be collected based on previously-defined geographical boundaries, it was not until 2005 that Iran started to define a GIS-based census boundary based on a 19-digit code number called *Address- e Amāri* (statistical address), which refers to the hierarchical subdivisions going from *Keshvar* (country) to *ostān* (province) to *shahrestān* (county) to *bakhsh* (district) to *shahr* (city) to *houzeh* (area, which is comprised of several blocks) to *bolook* (block) at the lowest level (SCI, 2017b). Similarly, the UK's census geography follows a hierarchical pattern going from Country to Local Authority (LA) to Middle Layer Super Output Area (MSOA) to Lower Layer Super Output Area (LSOA) to Output Area (OA) at the lowest level (UKDS, 2017b) (see Figure 5.11). For the 2011 census, there were 404 LA, 8,436 MSOA, 42,143 LSOA and 232,296 OA (UKDS, 2017c). In the UK, the geospatial data (also referred to as Digitised Boundary Data (DBD), or 'boundary data') are made available through several major websites such as: the ONS Open Geography portal;

Table 5.24: *Data sources for the UK comprehensive indicator set*

The UK data sources
Environmental data
Environment Agency
Department for Environment, Food & Rural Affairs (Defra) Noise for Action Plan Local Authority Collected Waste Management Statistics
Department of Energy and Climate Change (DECC)
Travel for London (TFL)
National Heritage List for England (NHLE)
Department for Communities and Local Government (DCLG)
Centre for Ecology and Hydrology
Forestry Commission
English Heritage
Public Health England Public Health Outcomes Framework (PHOF)
The Chartered Institute of Environmental Health (CIEH)
British Trust for Ornithology (BTO)
The wildlife and Wetlands Trust (WWT)
Royal Society for the Protection of Birds (RSPB)
Join Nature Conservation Committee (JNCC) UK Biodiversity Action Plan (UK BAP)
Natural England
Green space Information for Greater London (GiGL)
British Geological Survey (BGS)
UK Soil Observatory
Department for Transport
Greater London Authority (GLA)
Centre for Environment, Fisheries and Aquaculture Science (Cefas)
International Council for the Exploration of the Sea (ICES)
Social data
Office for National Statistics (ONS) Family Resources Survey, Regulated Mortgage Survey, Annual Population Survey, Annual Survey of Hours and Earnings Integrated Household Survey
Department for Education
Education & Skills Funding Agency
Department for Communities and Local Government (DCLG) Citizenship Survey
Department for Work and Pension (DWP) Family Resources Survey, Office for Disability Issues
Health and Social Care Information Centre (HSCIC)
Post Office Ltd
Greater London Authority (GLA) Annual London Survey
Cabinet Office Community Life Survey, Social Action
Public Health England

Continued

Table 5.24: *Data sources for the UK comprehensive indicator set*

Sport England Active People Survey
Department for Transport National Travel Survey
Department of Health National Diet and Nutrition Survey
Metropolitan Police British Crime Survey
Office for Standards in Education, Children's Services and Skills (Ofsted)
Understanding Society
UK Data Service
Economic data
Office for National Statistics (ONS) National Balance Sheet, NUTS1 Regional GVA, Business Demography
Department for Work and Pension (DWP) Households Below Average Income (HBAI)
Office for Budget Responsibility
Department of Energy & Climate Change (DECC)
Department for Environment, Food & Rural Affairs (Defra)
K-Matrix Data Services

data.gov.uk; Ordnance Survey (e.g. OS MasterMap and OS OpenData); and the UK Data Service. The Ordnance Survey (OS)— a non-ministerial department owned by the UK government, is the UK's national mapping agency which implements the official surveying of the UK, providing geographic data to meet the needs of the government, business and individuals (GOV.UK, 2017).

In Iran, the National Cartographic Centre (NCC), which was established in 1953, is now affiliated to Vice-Presidency for Iran Management and Planning Organisation (IMPO) (NCC, 2017a). The NCC is, in fact, the Iran's version of 'Ordnance Survey' which is responsible for official surveying of the country and producing geospatial data. The NCC is comprised of several departments including: Research and Planning; Cartography; Land Surveying; Photogrammetry; National Spatial Data Infrastructure and so on (NCC, 2017b). Although Iran has been involved in the development of National Spatial Data Infrastructure (NSDI) since 1998 (Baktash, 2003), the NCC was assigned to lead the NSDI project in 2010, following the approval of Iran's Fifth Development Plan (NCC, 2017b). The NSDI aims to reduce parallelism and redundancy in the process of collecting, editing, customising, and producing data; and provide users with a comprehensive geospatial dataset (Baktash, 2003). In 2016, a

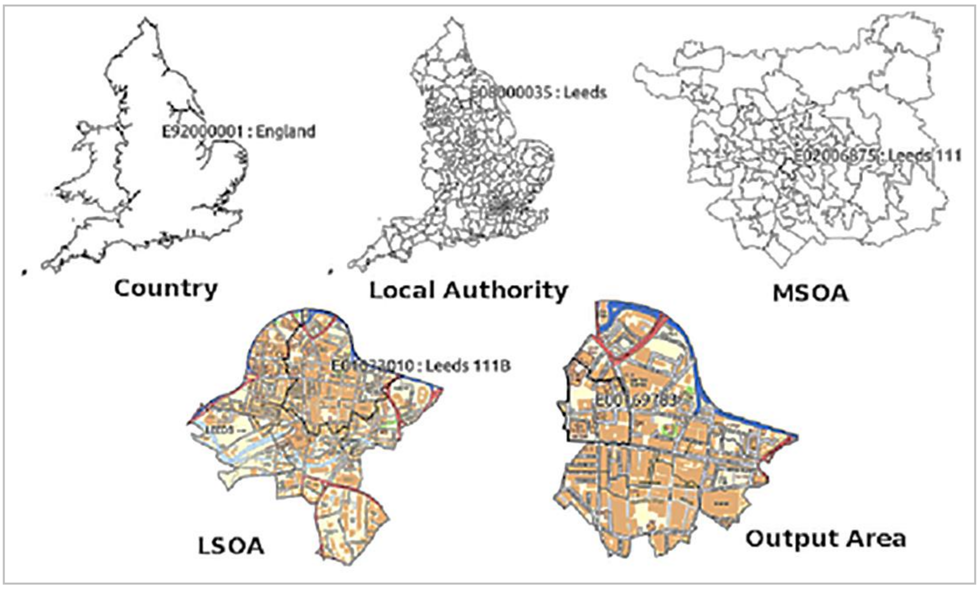


Figure 5.11: Census Geography hierarchy in the UK (UKDS, 2017b)

study (Shahidi Nejad et al., 2016) analysed the performance of learning and growth. With a performance ratio of 41.2%, the study concluded that the situation of implementation of NSDI in Iran is not satisfactory and that, more efforts are needed in all directions to improve this condition (Shahidi Nejad et al., 2016).

Among the NCC's several committees and councils, the National Council of GIS Users (NCGISU) — established in 1993; has also been responsible for policy-making, planning and coordination of Geographic Information System activities at the national and local levels (Baktash, 2003). 24 years after the establishment of National Council of GIS Users and making significant progress, the accessibility of the geographic data in Iran remains a challenge. As a GIS officer based in Andisheh New Town Development Company puts it:

"The biggest problem with urban map production is that each and every organisation provides their own version of maps. I think the NCC should act as a mapping headquarter and feed other organisations, as well as the general public on demands. This will help to establish a unified, integrated and comprehensive source of maps and GIS data"

Several organisations and government departments such as: SCI; Tehran Municipality; Ministry of Roads and Urban Development; Ministry of Agriculture; International Institute of Earthquake Engineering and Seismology; Forests, Range and Watershed Management Organization; and Ministry of Industry, Mines and Trade, have contributed to the development of GIS, facilitating geospatial data within public and private sectors in Iran. It is worth noting that the SCI does not currently provide the general public with a geographic dataset through its website, except for the boundary maps of the country's rural areas at the scale of 1:50,000. In contrary, the Islamic Parliament Research Centre (IPRC) has recently launched a trial geographic dataset called: 'geospatial data of economic variables', comprising 139 measures such as: budget allocations, income distribution, poverty, employment, and so on (IPRC, 2017b). The data are available at predominantly provincial and in some cases urban levels through Google Maps-based colour coded maps (see Figure 5.12). Presently, the program is defined as "preliminary and experimental" which means that it cannot be cited officially and can only be used for research purposes (IPRC, 2017b).

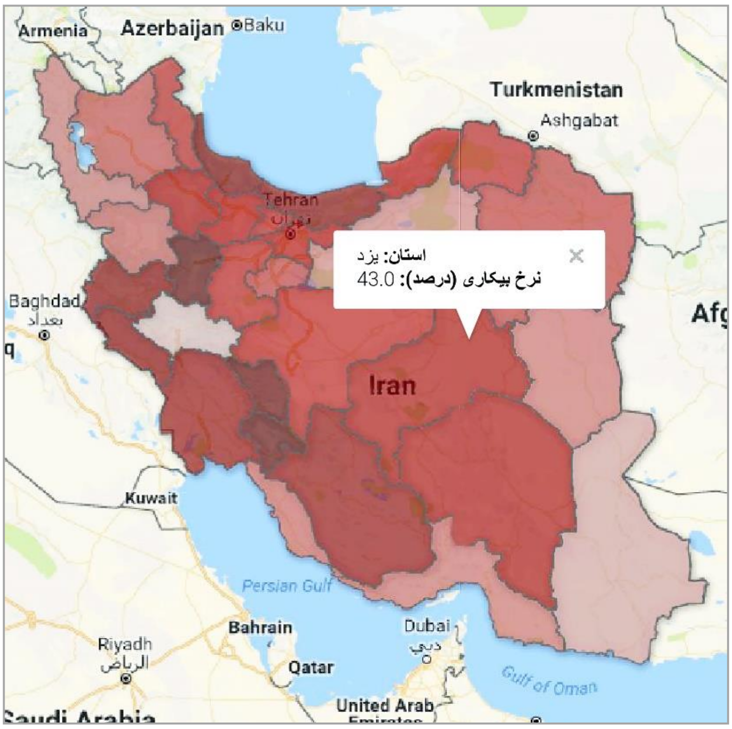


Figure 5.12: The map represents 'women unemployment rate aged 15-29' at the provincial level. The statistics for each province appears by clicking on the required province (IPRC, 2017b)

In the name of transparency and accountability and in the light of 21st century's fast-paced development of Information Technology and undeniable necessity of World-Wide-Web, Iran needs to establish its own Open Geography Portal; a comprehensive and integrated geospatial database which can be accessed through a website and also can be used within Geographical Information Systems (GIS) and/or Computer Aided Design (CAD) systems. It appears that the SCI, as the Iran's official data provider, is well-positioned to establish such database, in collaboration with the NCC and other relevant public and private bodies. Investigating the UK's major datasets suggests that Iran needs to enhance the availability and accessibility of data in general, and reinforce the practicality and functionality of boundary data. It should be noted that the state of data in Iran, in terms of its quality, accessibility and its role in urban planning and management will be discussed in detail in Chapter 6.

5.4.3 Sustainability assessment methods

As mentioned earlier, a number of sustainability assessment methods have been selected and investigated for the purpose of this study, of which the proposed comprehensive indicator sets for Iran and the UK were derived. This section aims to draw a comparison between Iranian and British sustainability assessment methods previously discussed in Chapter 2 and section 5.2 of this chapter. To this end, it was essential to provide a detailed overview of abovementioned sustainability assessment systems for the two countries (see Tables 5.25 and 5.26).

As shown in Table 5.25, among the nine Iranian sustainability assessment methods studied, five have been developed by different sectors and departments within Tehran Municipality (TM) including: Environment and Sustainable Development Management Centre; Department of Performance Assessment and Management Improvement; Tehran Urban Planning and Research Centre; Air Quality Control Company (AQCC); and Socio-Cultural Deputy of Tehran Municipality. TM has also been involved in development of 'Urban HEART Tehran' (UHT) in collaboration with the World Health Organisation (WHO), while Iran Department of Environment and University of Tehran's Faculty of Environment have been responsible for the rest. Among the nine, only four have been, either fully or partially in practice. There were three assessment methods under development, one in the form of research and one considered as in-progress pilot project. On the other side, except for the two methods (SPeAR and BREEAM) which have been developed by the private sector including Arup and the Building Research Establishment (BRE) respectively, the other seven UK assessment methods selected for the purpose of this research, have been produced by the public sector. Furthermore, all of the UK assessment methods investigated, have been used in practice, except for the SDIs (Sustainable Development Indicators) which has been stopped due to "limited engagement" in July 2016 (ONS, 2016).

It is observed that six Iranian methods (SIES, AQCC, Tehran SoE, Iran SoE, SCITN, EPA) solely address one aspect of sustainability while only two methods (UHT, EQTUE) touch on

Table 5.25: Comparison of selected Iranian sustainability assessment methods

Assessment Method	**SIES**	**UDI**	**Tehran SoE**	**Iran SoE**	**AQCC**	**SCITN**	**EQTUE**	**UHT**	**EPA**
Developer	Iran Department of Environment	TM: Department of Performance Assessment and Management Improvement	TM: Tehran Urban Planning and Research Centre	Iran Department of Environment	TM: Air Quality Control Company (AQCC)	TM: Socio-Cultural Deputy	University of Tehran, Faculty of Environment	WHO & TM	TM: Environment & Sustainable Development Management Centre
Launch	N/A	N/A	2011	2004	2012	N/A	N/A	2007	2014
Level	National	Urban	Urban	National	Urban	Urban	Urban	Urban/ Local	Individual project
Scope	Environmental	Environmental, social	Environmental	Environmental	Environmental	Social	Env, social, economic	Env, social, economic	Environmental
No. of main criteria	5	6	7	6	5	4	4	6	8
Main criteria	-Weather -Water -Land -Biodiversity -Production and consumption pattern	-Sociocultural -Traffic & transport -Urban services -Safety & disaster management -Architecture, planning and urban infrastructures -Managerial development, smartisation and organisational transformation	-Air -Water -Land -Biodiversity -Natural disaster -Waste -Human settlements	-Air -Water -Land -Biodiversity -Natural disaster -Human settlements	-Carbon monoxide -Nitrogen dioxide -Ozone (O_3) -Particulate Matters -Sulfur dioxide	-Distribution / Dispersion -Security / Insecurity -Participation / Isolation -Cultural homogeneity/ Diversity	-Basic needs -Socio-economic needs -Built environment needs -cultural and recreational needs	-Physical environment infrastructure -Human & social development -Economic development -Governance -Health -Nutrition	-Maintenance of and improving environmental management system -Controlling soil and water pollution -Monitoring environmental pollutants -Environmental assessment of urban development plans -Controlling air, noise, and light pollution -Energy consumption efficiency and development of renewable energies -Environmental education -Biodiversity management
Characteristics	Quantitative	Quantitative/ qualitative	Quantitative	Quantitative	Quantitative	qualitative	Quantitative	Quantitative/ qualitative	Quantitative
Rating system	Weighting for each individual indicator	AHP	DPSIR model	DPSIR model	AQI: Air Quality Index	N/A	Percentage	Colour-coded matrix	Weighting for each individual indicator (aggregate indices)
Status	Under development	Under development	In practice	In practice	In practice	Under development	Research project	Pilot research (in progress)	In practice

Table 5.26: Comparison of selected UK sustainability assessment methods

Assessment Method	**EIA**	**SEA**	**SA**	**SDIs**	**BREEAM Communities**	**IMD**	**QoL**	**SPeAR**	**SAP**
Developer	National Environmental Policy Act of USA / UK: Office of the Deputy Prime Minister (ODPM)	EU Directive / UK: Office of the Deputy Prime Minister (ODPM)	EU Directive / UK: Planning and Compulsory Purchase Act (2004)	Department for Environment, Food and Rural Affairs (Defra)	Building Research Establishment (BRE)	Department for Communities and Local Government (DCLG)	London Sustainable Development Commission (LSDC)	Arup	Department of Energy and Climate Change (DECC)
Launch	1966 / UK: 1988	2001 / UK: 2005	2001/ UK: 2004	2001	2009	2007	2004	2000	1995
Level	Individual Project	National/ Regional / Local	Urban / Local	National	Urban /Local	National / Urban / Local	Urban	Urban/ Local	Individual Project
Scope	Env., social (to a limited extent)	Env., social (to a limited extent)	Env, social, economic	Env, social, economic	Envi, social, economic	Envi, social, economic	Env, social, economic	Env, social, economic	Environmental, economic
No. of main criteria	8 (Anjaneyulu & Manickam, 2007)	9 (ODPM, 2005a)	3	3	5	7	3	3	16
Main criteria	-Air -Surface water -Groundwater -Noise -Biological -Historical/ archaeological -Visual -Socioeconomic (Anjaneyulu & Manickam, 2007)	-Biodiversity, fauna and flora -Population & human health -Water -Soil -Air -Climatic factors -Cultural heritage -Landscape -Material assets (ODPM, 2005a)	-Environment -Society -Economy	-Environment -Society -Economy	-Governance -Social and economic wellbeing -Resources and energy -Land use and ecology -Transport and movement	-Income -Employment -Health deprivation & disability -Education, skills and training -Barriers to housing and services -Crime -Living environment	-Environment -Society -Economy	-Environment -Society -Economy	Dwelling dims/ Ventilation rate/ Heat transmission/ Domestic hot water/ Internal gains/ Solar gains/ Mean internal temperature/ Climatic data/ Space heating requirement/ Space cooling requirement/ Fabric energy efficiency/ Total energy use-fuel costs/ Energy cost rating/ CO_2 emissions/ Building regs & dwelling emissions rate/ CO_2 emissions associated with appliances and cooking and site-wide electricity generation technologies
Characteristics	Mainly quantitative / qualitative	Mainly qualitative/ quantitative	Quantitative/ qualitative	Quantitative/ qualitative	Quantitative/ qualitative	Quantitative/ qualitative	Quantitative/ qualitative	Qualitative/ quantitative	Quantitative
Rating system	Impact assessment matrix	Impact assessment matrix	descriptive rating scores (color-coded)	Traffic light	Percentage	Aggregate indices: weighting for each individual criteria	Traffic light	Colour-coded SPeAR diagram	Point-based
Status	In practice	In practice	In practice	In practice until 2016	In practice	In practice	In practice	In practice	In practice

Table 5.27: *Comparison: number of methods addressing 1, 2, or 3 dimensions of sustainability*

	Iran	UK
No. of methods addressing 3 aspects of sustainability (environmental, social, and economic)	2	6
No. of methods addressing 2 aspects of sustainability	1	3
No. of methods addressing only 1 aspect of sustainability	6	0
Total	9	9

all three dimensions: environment, society, and economy. One of the methods: Urban Development Index (UDI) covers environmental and social matters, but fails to consider economic indicators. For the UK, six (out of nine) methods (SA, IMD, QoL, SDIs, SPeAR, BREEAM Communities) address all three dimensions while the other three methods (SAP, EIA, SEA) only focus on two aspects of sustainability, with the EIA and SEA considering the social issues to a very limited extent. Tables 5.27 and 5.28 and Figure 5.13 elaborate on the level of engagement of methods studied, with the three dimensions of sustainability.

Table 5.28: *Comparison: level of engagement of assessment methods studied with three aspects of sustainability*

Aspects of sustainability	Assessment methods (Iran)	Assessment methods (UK)
environmental, social, economic	UHT, EQTUE	SA, IMD, QoL, SDIs, SPeAR, BREEAM Communities
Environmental, social	UDI	EIA, SEA
Environmental, economic	-	SAP
Social, economic	-	-
Environmental only	SIES, AQCC, Tehran SoE, Iran SoE, EPA	-
Social only	SCITN	-
Economic only	-	-

Combining all of the 9 Iranian assessment methods studied, the result shows that there is an imbalance in addressing three dimensions of sustainability. The Iranian methods could be considered as environmentally-oriented with little interest in economic aspects, while for the 9 British methods combined, addressing social, environmental and economic dimensions is relatively proportionate (see Figure 5.13).

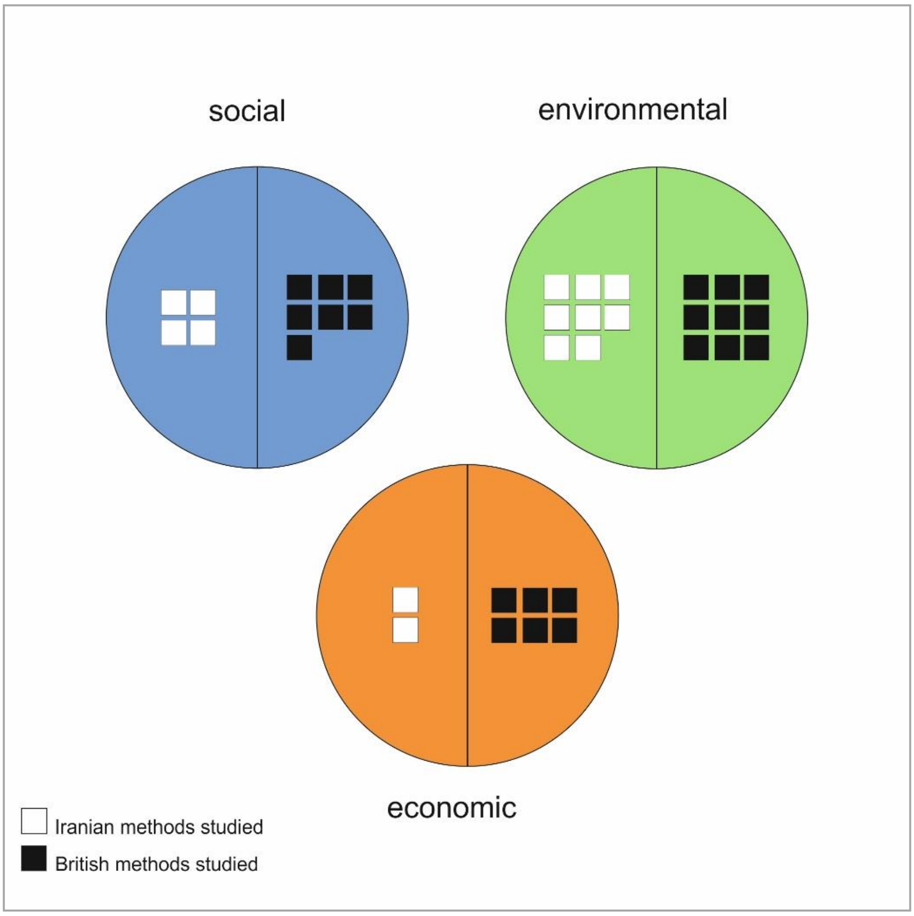


Figure 5.13: Number of methods addressing three aspects of sustainability

In the UK, sustainability assessment methods like SAP, EIA, and the conventional BREEAM have been criticised for not being inclusive enough to address sociocultural and / or economic issues. This also applies to the six Iranian assessment methods investigated in this study, for their one-dimensional characteristics. However, as mentioned above, two of the Iranian methods (UHT and EQTUE) address all the three aspects and one may ask why these two methods could not be applicable to today's situation and that this study seeks to suggest a new one? As discussed earlier, Urban HEART Tehran (UHT) has been derived from a WHO's set of indicators which predominantly concentrates on the health issues as it originally aimed at measuring the level of health inequalities of the world cities. Despite the fact that the EQTUE offers a slightly more comprehensive indicator set in comparison to UHT, they both are yet far from representing a robust comprehensive indicator set. As previously discussed in section 5.2.7 of this chapter, there exist some fundamental issues with EQTUE which are as follows:

- application of now outdated international guidelines as the set was developed in the late 1990s;
- the problems of categorisation, wording processes and literature of the set;
- lack of comprehensiveness and inclusiveness (missing essential indicators);
- sole quantitative nature of the set; and
- suggesting a reductionist single-metric outcome.

As shown in Table 5.25, the nature of Iranian assessment methods is predominantly quantitative, and only two methods among them (UDI and UHT) apply to both qualitative and quantitative approaches. For the UK, except for the SAP method which is purely quantitative, all other assessment methods investigated, are a conglomeration of qualitative and quantitative characteristics (see Table 5.26). As discussed earlier in Chapter 4, sustainability research as a whole and sustainability assessment in particular, could benefit much more from a mixed-methods approach, in which the qualitative (interpretivist) method relates to social constructs and human interactions, while the quantitative (positivist) ontologies concentrates on the quantifiable and statistical behaviours. The comparison reveals that Iran definitely needs to pursue policies that will help to develop more inclusive and comprehensive sustainability assessment methods considering both qualitative and quantitative approaches.

It is also imperative to consider the geographical boundaries these assessment methods are being referred to. As explained in Chapter 2, the best urban sustainability assessment methods are those which have an ability to perform down to local communities at the neighbourhood level. This will help to enhance the precision and authenticity of the urban sustainability evaluation. In this respect, among the nine Iranian assessment methods discussed, only one have been implemented at the local level. This clearly shows that the sustainability assessment methods defined by local authorities and the public sector, should be reconsidered in terms of the geographical boundaries they tend to address. It is suggested that the urban sustainability assessment methods are designed in a way that be flexible to be implemented at the local scale.

On the basis of the above, it can be concluded that Iran definitely needs to seek a kind of urban sustainability assessment method that would be able to address not only the environmental issues, but also sociocultural and economic dimensions more broadly. There should be a mechanism to redefine the way indicator sets are developed to enhance their quality toward a more comprehensive and more inclusive characteristics. In particular, social indicators need to be carefully selected so as to be applied to all segments of society. It is also essential to develop a method that considers both quantitative and qualitative approaches for analysing urban sustainability. As mentioned earlier, the method should be designed in a way that it can be implemented at the local level. These are issues that need to be addressed which in fact, none of the Iranian assessment methods studied have been able to respond to comprehensively. This, obviously, does not mean that the British methods studied are not involved with any sort of imperfectionism, as their deficiencies were discussed previously.

5.5 Summary

This chapter started with the investigation of the existing assessment methods and frameworks developed, implemented, practised or being under development in Iran (section 5.2). This process, coupled with the review of the UK sustainability assessment methods discussed in Chapter 2, led to introducing two comprehensive sets of indicators for the two countries, drawn from aforementioned assessment frameworks (section 5.3). Subsequently, section 5.4 drew a comparison between the indicators, data sources and assessment methods of the two comprehensive sets to recognise and discuss their probable similarities and differentiations, and also to uncover that how and to what extent the UK system could be consistent with Iran's. This has led the researcher to conclude with a finalised urban sustainability assessment indicator set for Iran which will be explained in Chapter 7. It is worth mentioning that the proposed framework was scrutinised by relevant experts which its process and procedure will be discussed in the next chapter (Chapter 6).

Chapter 6: The questionnaire and the interviews: findings and analysis

6.1 Introduction

This chapter sets out the results of the study through conducting a questionnaire survey as well as semi-structured interviews. The key aim of the questionnaire survey is to discover experts' opinions about the indicator set suggested, while interviews tend to delve into narratives of the high-ranking officials who are deeply involved with the urban management structure of Iran's capital. To this end, descriptive analytical approaches, including Excel and SPSS were applied to assess the questionnaire results, while the oral communications were analysed by employing the qualitative content analysis methodology. This will be followed by explaining the meaning of the results in section 6.4; the 'discussion' part of this chapter.

6.2 The questionnaire

As described earlier in Chapter 4, the questionnaire survey developed by using Bristol Online Survey (BOS) software, has included 19 questions in three parts. The following paragraphs will depict the findings of the survey which, as mentioned above, will be discussed subsequently in section 6.4 of this chapter. For the full questionnaire, see Appendix 4.1.

6.2.1 Demography

The profile of the respondents in terms of their age lies between twenty-three and fifty-four (see Table 6.1). There are fifteen respondents, 37.5%, who are in the age range of twenty to twenty-nine years old. Another twenty respondents, 50%, are within thirty to thirty-nine years old. There are two respondents, 5%, who are between forty and forty-nine while another two are over fifty. One respondent did not clarify his/her age. As Table 6.1 reveals a sizeable majority of respondents (87.5%) fall into the age ranges under forty. However, this is not a surprise for a country whose almost 72% of its total population are under forty years old and its over-sixty-year-olds hardly reach the 8% (SCI, 2012b). There is relatively a fair distribution of gender among respondents whose twenty-one (52%) are male and eighteen (45%) are female. One of the respondents did not specify his or her gender.

Considering respondents' educational levels, as shown in the table below (see Table 6.2), eighty-two percent of them hold a post-graduate degree. Hence, twenty-one respondents (52%) hold a Masters' degree while another twelve (30%) are entitled as either PhD or Postdoctoral.

***Table 6.1**: Age distribution*

Age	Frequency	Percent
20-29	15	37.5
30-39	20	50.0
40-49	2	5.0
50-59	2	5.0
Total	39	97.5
No answer	1	2.5
Total	40	100.0

There are six respondents (15%) who are holding a Bachelor degree. One respondent preferred not to mention their level of education.

***Table 6.2**: Educational levels of respondents*

Education	Frequency	Percentage
Bachelor	6	15%
Master	21	52%
PhD	9	22%
Postdoc	3	8%
No answer	1	3%
Totals	40	100%

The majority of the respondents are active in the private sector as it reads 65% (26 respondents) of the survey population. Another 20% (8 respondents) do work in public sector including municipalities, local authorities and governmental organisations while two respondents (5%) mentioned they work in both public and private sectors. Four respondents (10%) did not respond to the question regarding their employment status. Among participants there are twenty-six architects, seven urban planners and/or urban designers, two civil engineers, one environmental manager, one landscape architect, one geomatics engineer, and one industrial designer (see Table 6.3). One respondent did not clarify on their field of study.

***Table 6.3**: Respondents' fields of study*

Fields of study	Frequency	Percentage
Architecture	26	65%
Urban planning/designing	7	17.5%
Civil engineer	2	5%
Environmental management	1	2.5%
Industrial design	1	2.5%
Landscape architecture	1	2.5%
Geomatics (GIS)	1	2.5%
No answer	1	2.5%
Totals	40	100%

6.2.2 The state of data

The following paragraphs will focus on the situation of data including data availability, data accessibility and data quality in the processes of urban sustainability assessment in Iran.

Data availability

The respondents were asked to rate the situation of availability/existence of data sources in the processes of urban sustainability assessment in Iran. It can be said that by and large the respondents ranked the availability of data in Iran as 'poor' (Figure 6.1). Twenty-two out of forty respondents (55%) said that the state of data availability is either poor or very poor. sixteen (40%) reckoned that it is 'satisfactory' while another two (5%) considered the availability of data as 'good'.

A cross-tabulation analysis drawn between employment status and data availability, revealed that sixty-four percent of respondents who work in private sector believed that the data availability is either 'poor' or 'very poor'. Thirty-two percent (of private sector actors) said that it is 'satisfactory' while only four percent thought data availability is in a 'good' situation. Forty percent of those who work in public sector saw the situation as 'poor' or 'very poor' while fifty percent assumed it is 'satisfactory' and another ten percent believed that the condition is 'good'.

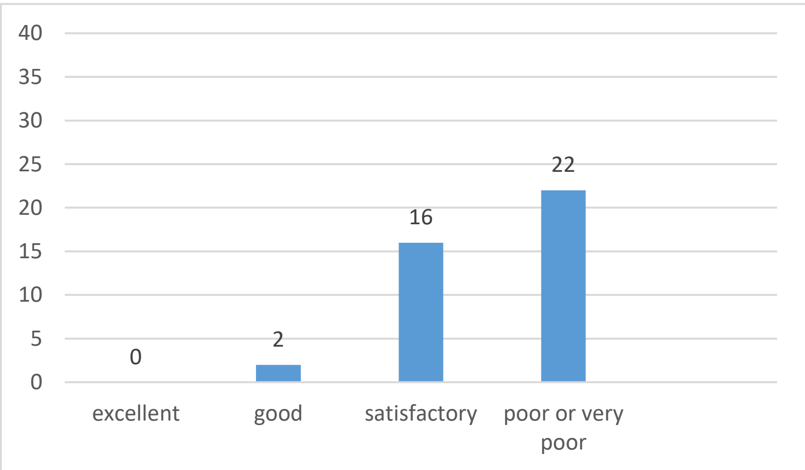


Figure 6.1: Data availability

In conclusion sixty-four percent of private sector actors considered data availability as either 'poor' or 'very poor' whereas sixty percent of respondents who work in public sector saw it as either 'satisfactory' or 'good'.

Table 6.4: Cross-tabulation analysis for data availability and employment status

Data availability	Private sector	Public sector	No answer	Totals
Very poor	19.05%	2.38%	0.00%	21.43%
Poor	23.81%	7.14%	4.76%	35.71%
Satisfactory	21.43%	11.90%	4.76%	38.10%
Good	2.38%	2.38%	0.00%	4.76%
Excellent	0.00%	0.00%	0.00%	0.00%
No answer	0.00%	0.00%	0.00%	0.00%
Totals	**66.67%**	**23.81%**	**9.52%**	**100%**

Data accessibility (accessibility to the existing data)

The respondents were asked to rate the possibilities of access to existing/ available data in the processes of urban sustainability assessment in Iran. As a result, twenty-four respondents (60%) said that the state of data accessibility is either 'poor' or 'very poor' while twelve (30%) believed that it is 'satisfactory'. Four respondents (10%) considered the state of data accessibility as 'good' (Figure 6.2).

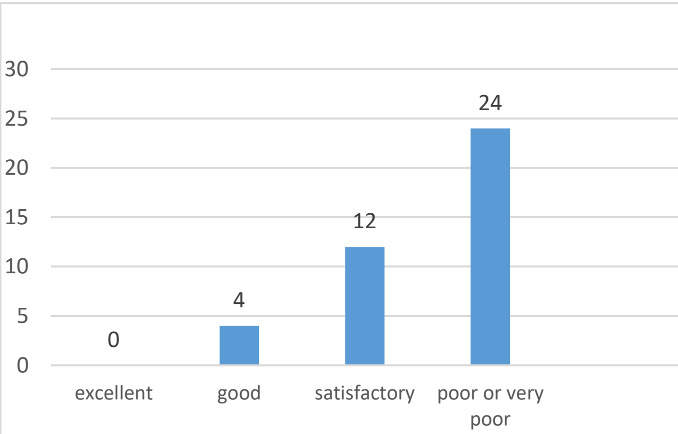


Figure 6.2: Data accessibility

As Table 6.5 represents a cross tabulation analysis for 'data accessibility' and 'employment status', sixty-eight percent of those who work in private sector believed that the state of data accessibility is either 'poor' or 'very poor'. Twenty-eight percent saw it as 'satisfactory' while four percent considered it as 'good'. These figures for public sector actors are sixty, forty and ten respectively. The results show, despite being satisfied with the situation on the existence of data, the public sector seemingly has a hard time getting access to those available data. Hence

Table 6.5: Cross-tabulation analysis for data accessibility and employment status

Data accessibility	Private sector	Public sector	No answer	Totals
Very poor	16.67%	4.76%	0.00%	21.43%
Poor	28.57%	9.52%	2.38%	40.48%
Satisfactory	19.05%	7.14%	2.38%	40.48%
Good	2.38%	2.38%	4.76%	9.52%
Excellent	0.00%	0.00%	0.00%	0.00%
No answer	0.00%	0.00%	0.00%	0.00%
Totals	**66.67%**	**23.81%**	**9.52%**	**100%**

public and private sectors within the survey population relatively share a common attitude towards the condition of data accessibility in Iranian urban sustainability assessment procedures.

Data quality

Since 1990s many scholars proposed different definitions of data quality (Cai and Zhu, 2015). Data quality can be defined as a "perception or an assessment of data's fitness to serve its purpose in a given context" (Wang and Strong, 1996; Cai and Zhu, 2015). The respondents were asked to express their views on the quality of data within the sphere of Iranian urban sustainability assessment. Nineteen respondents (47.5%) said the quality of data is 'satisfactory' while eighteen (45%) assumed that it is either 'poor' or 'very poor'. Another five (7.5%) considered the state of data quality as 'good'. Therefore fifty-five percent of the respondents are satisfied with the data quality.

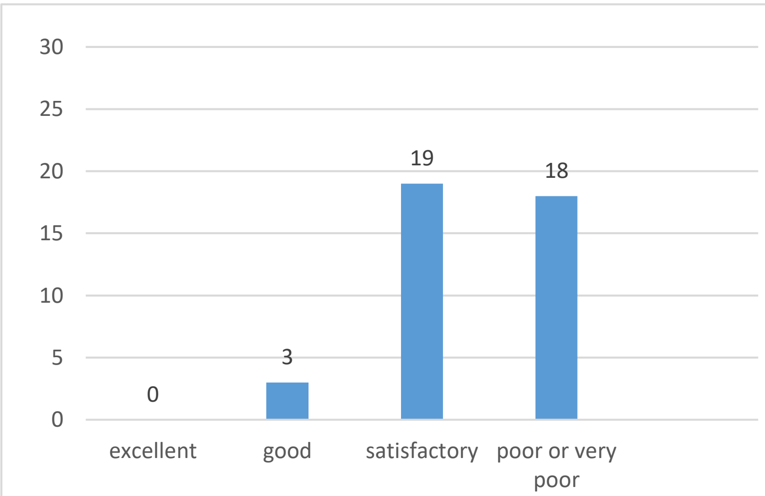


Figure 6.3: Data quality

However considering public and private sectors' division, as results demonstrate (see Table 6.6), the private sector still weighs against the notion that sees data quality as either 'good' or 'satisfactory'. Fifty-four percent of private sector's participants voted for the lack of data quality considering it as either 'poor' or 'very poor'. The public sector is satisfied with the condition of data quality with an overall majority of sixty percent while another forty percent share a negative attitude towards the situation.

Table 6.6: Cross-tabulation analysis for 'data quality' and 'employment status'

Data quality	Private sector	Public sector	No answer	Totals
Very poor	11.90%	0.00%	0.00%	11.90%
Poor	23.81%	9.52%	0.00%	33.33%
Satisfactory	30.95%	9.52%	7.14%	47.62%
Good	0.00%	4.76%	2.38%	7.14%
Excellent	0.00%	0.00%	0.00%	0.00%
No answer	0.00%	0.00%	0.00%	0.00%
Totals	**66.67%**	**23.81%**	**9.52%**	**100%**

6.2.3 Sustainable urban development

To seek experts' general opinions on the performance of sustainability in Iranian cities, two queries were included in the questionnaire. These are explained in the following paragraphs.

State of sustainable urban development

The overwhelming majority of the respondents (85%) observed the overall state of sustainable urban development in Iran as either 'poor' or 'very poor'. Five respondents (12.5%) assumed that it is 'satisfactory' while one (2.5%) ranked it as 'good'. The results, repeatedly, draw a clear distinction between public and private sectors' opinions (see Table 6.7).

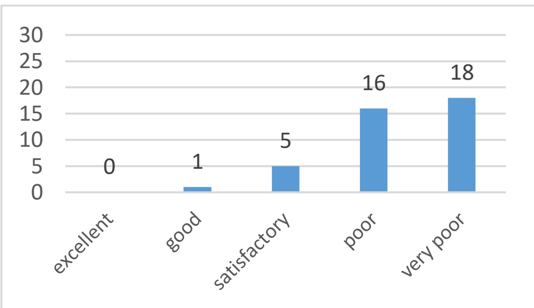


Figure 6.4: State of sustainable urban development

Table 6.7: Cross-tabulation analysis for 'SUD' and 'employment status'

State of sustainable urban development	% of private sector	% of public sector
Very poor	57	20
Poor	32	50
Satisfactory	7	30
Good	4	0.00
Excellent	0.00	0.00
Totals	**100**	**100**

State of urban sustainability assessment

Thirty respondents (75%) thought that the state of urban sustainability assessment in Iran is either 'poor' or 'very poor'. Nine respondents (22.5%) assumed that it is 'satisfactory' while one (2.5%) ranked it as 'good' (see Figure 6.5). The cross-tabulation analysis (see Table 6.8) reveals that the private sector comparatively gave a considerably lower rank to the situation. Eighty-six percent of private sector workers considered the situation as either 'poor' or 'very poor' while a large number of public sector (40%) ranked it as 'satisfactory'. This was fourteen percent for the private sector.

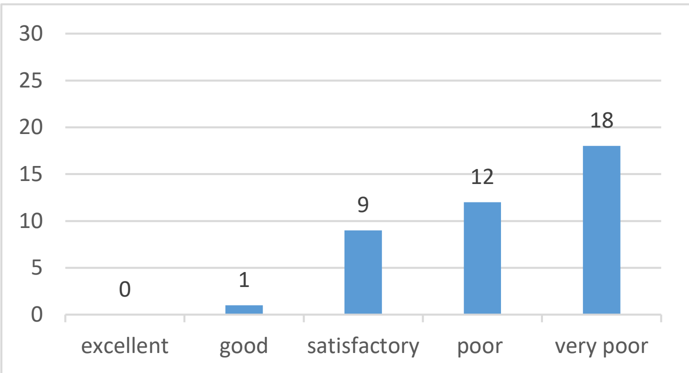


Figure 6.5: State of urban sustainability assessment

6.2.4 The significance of the role of GIS in current Iran's urban planning procedures

The question aimed to investigate that to what extent Geographic Information System (GIS) has influenced decision making processes in the Iran's planning agenda.

Table 6.8: cross-tabulation analysis for 'urban sustainability assessment' and 'employment status'

State of urban sustainability assessment	Private sector	Public sector	No answer	Totals
Very poor	35.71%	4.76%	4.76%	45.24%
Poor	21.43%	9.52%	0.00%	30.95%
Satisfactory	7.14%	9.52%	4.76%	21.43%
Good	2.38%	0.00%	2.38%	2.38%
Excellent	0.00%	0.00%	0.00%	0.00%
No answer	0.00%	0.00%	0.00%	0.00%
Totals	**66.67%**	**23.81%**	**9.52%**	**100%**

Nine respondents (23%) thought the GIS has played either 'significant' or 'highly significant' role in current planning procedures. Eleven (28%) considered the role of GIS in urban planning procedures as 'insignificant' or 'highly insignificant' while another nineteen respondents (49%) had 'no idea' about the issue.

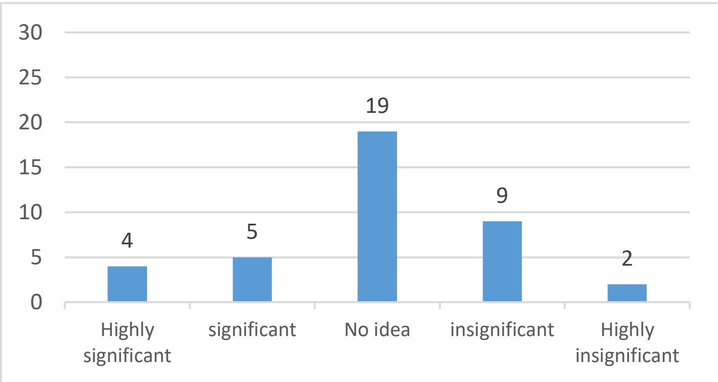


Figure 6.6: Role of GIS in current planning system

6.2.5 Key-challenges of urban sustainability assessment

The question reads: what is the most important challenge in the process of evaluation of urban sustainability in Iran? The respondents could rate the given choices in importance from one to six amongst data, indicator, assessment techniques, public awareness, expertise and institutional management. The results (Figure 6.7) reveal 'data' as the most important challenge in the process of urban sustainability assessment in Iran. Expectedly, respondents recognised the 'institutional management' as the second most significant obstacle followed by assessment techniques, expertise, indicator, and public awareness respectively (see Table 6.9).

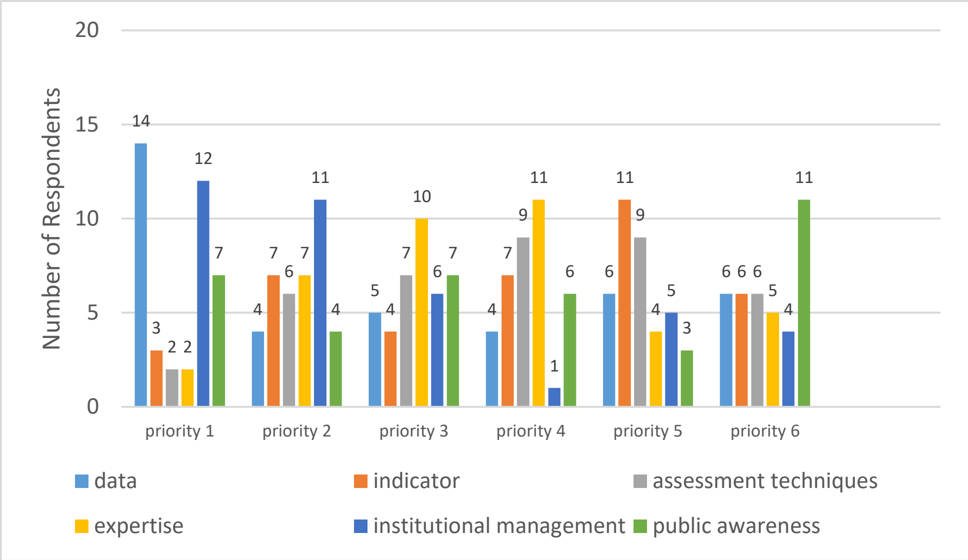


Figure 6.7: Prioritisation of 'challenges of urban sustainability assessment in Iran'

Table 6.9: Challenges of urban sustainability assessment in Iran

Priority 1	Data
Priority 2	Institutional management
Priority 3	Assessment techniques
Priority 4	Expertise
Priority 5	Indicator
Priority 6	Public awareness

6.2.6 Weighting the indicators

Thus the following paragraphs, derived from the results of four specific questions (see Appendix 4.1), aim to tackle the issue of weighting the indicators proposed in this research through a prioritisation system.

Category Indicators

The respondents were asked to priorities the three aspects of urban sustainability: social, environmental and economic. They were asked to rate their choices in importance from one to three. The results show that fifty-one percent of respondents considered the environmental indicators as first priority while forty-six measured the social indicators as second priority. In respondents' views economic category secures the third place on the list by sixty-three percent (see Table 6.10 & Figure 6.8).

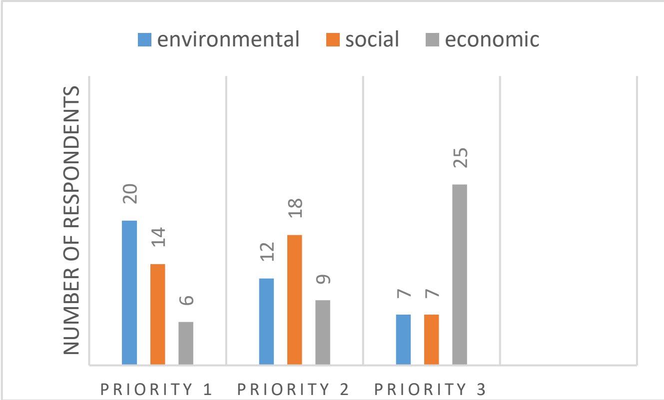


Figure 6.8: Prioritisation of Category Indicators

Table 6.10: The results of prioritisation of Category Indicators

Priority 1	Environmental
Priority 2	Social
Priority 3	Economic

Environmental Headline Indicators

The respondents were asked to rate the nine proposed Environmental Headline Indicators in importance from one to nine. The indicators include: air, water, land, noise, waste, access to nature, traffic volume, natural disaster, and biodiversity. The results reveal that the Headline Indicator: 'air', is the highest-concerned environmental indicator as forty percent of participants decided to choose it the first priority. The 'water' falls into the second level by forty-three percent agreed on considering it as second priority. It is followed by the headline indicators: land and soil, access to nature, traffic volume, waste, noise, natural disaster, and biodiversity as third, fourth, fifth, sixth, seventh, eighth, and ninth priorities respectively (see Figure 6.9 & Table 6.12).

Table 6.11: Prioritisation of Environmental Headline Indicators (number of respondents)

	Air	Water	Land	Noise	Waste	Access to nature	Traffic volume	Natural disaster	Biodiversity
Priority 1	16	13	3	0	1	2	2	3	0
Priority 2	13	17	3	0	1	0	4	2	0
Priority 3	5	5	10	0	5	2	7	4	1
Priority 4	4	1	4	4	8	8	6	3	1
Priority 5	0	3	3	6	9	4	4	1	9
Priority 6	0	0	6	4	13	2	6	3	5
Priority 7	0	0	5	15	1	5	3	6	4
Priority 8	1	1	3	6	1	8	4	10	4
Priority 9	1	0	2	4	0	8	3	6	15

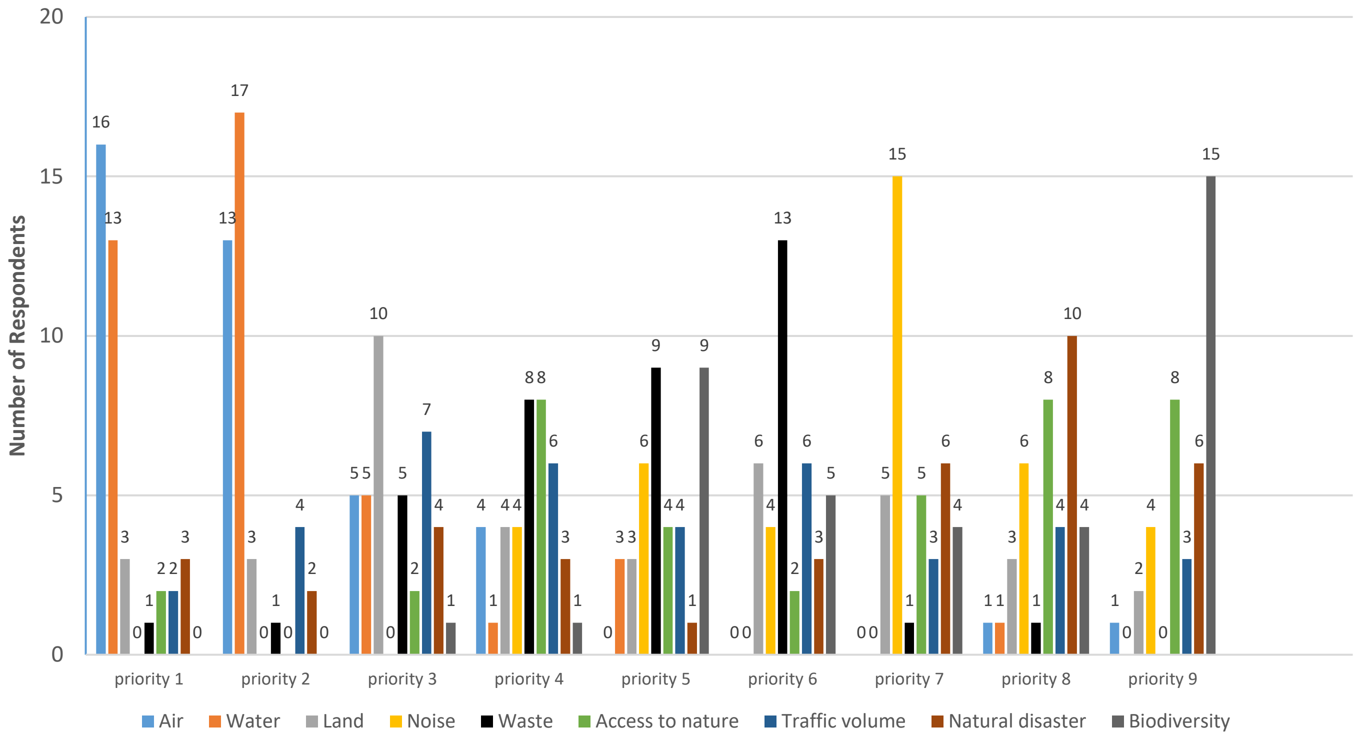


Figure 6.9: Excel analysis for prioritisation of Environmental Headline Indicators

Table 6.12: The results of prioritisation of Environmental Headline Indicators

Priority 1	Air
Priority 2	Water
Priority 3	Land and soil
Priority 4	Access to nature
Priority 5	Traffic volume
Priority 6	Waste
Priority 7	Noise
Priority 8	Natural disaster
Priority 9	Biodiversity

Social Headline Indicators

The respondents were asked to rate the eleven proposed Social Headline Indicators in importance from one to eleven. The outcome, as shown in Figure 6.10, reveal that the Headline Indicator: 'education' gains the heaviest weight amongst social indicators followed by, social security, healthcare, population, culture, transport, housing and services, social capital, image of the city, life expectancy, and satisfaction. Hence the respondents, respectively, ranked education, social security, and healthcare as three highest-concerned social indicators.

Table 6.13: Prioritisation of Social Headline Indicators (number of respondents)

	Population	Education	Healthcare	Housing & Services	Social security	culture	Life expectancy	Satisfaction	transport	Social capital	Image of the city
Priority 1	3	11	4	2	3	6	1	2	0	5	1
Priority 2	4	5	5	2	7	5	3	1	2	3	1
Priority 3	3	6	7	3	6	5	0	3	1	1	3
Priority 4	3	7	6	4	3	4	4	2	2	3	0
Priority 5	3	1	2	3	3	11	6	3	4	0	2
Priority 6	2	1	1	5	6	4	3	2	8	3	2
Priority 7	1	1	4	6	5	1	5	3	5	3	3
Priority 8	4	2	3	7	0	1	3	4	2	9	3
Priority 9	2	2	2	2	1	1	3	4	4	2	13
Priority 10	5	0	3	4	1	0	6	5	4	4	5
Priority 11	7	1	1	0	3	0	4	8	5	4	4

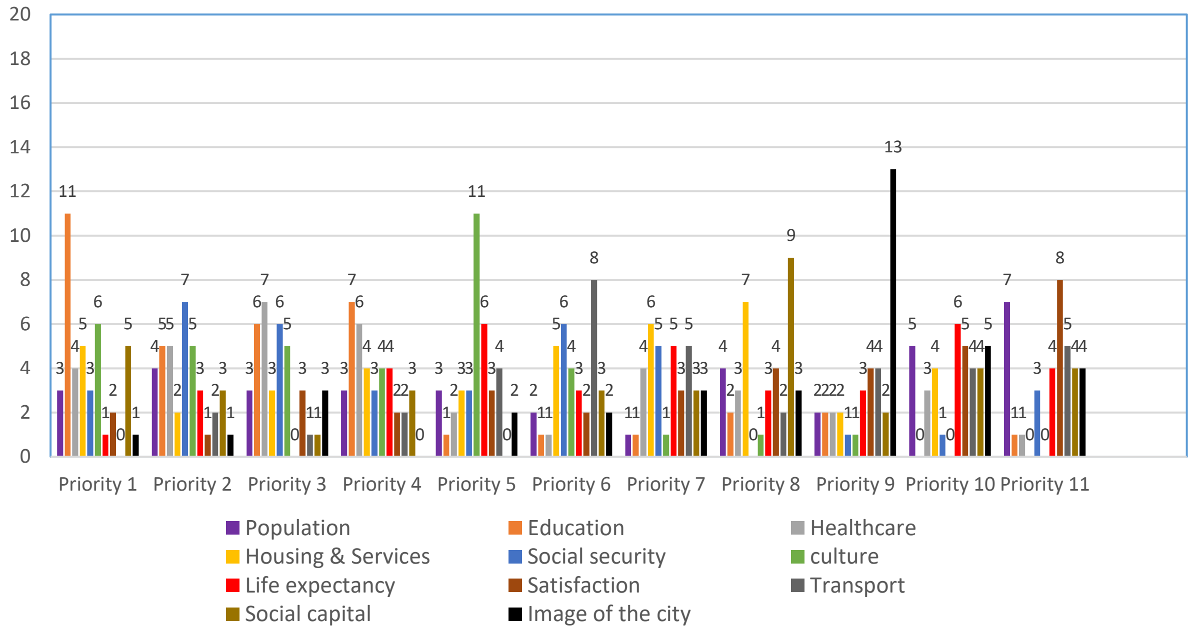


Figure 6.10: Excel analysis for prioritisation of Social Headline Indicators

Table 6.14: The results of prioritisation of Social Headline Indicators

Priority 1	Education
Priority 2	Social security
Priority 3	Healthcare
Priority 4	Population
Priority 5	Culture
Priority 6	Transport
Priority 7	Housing and services
Priority 8	Social capital
Priority 9	Image of the city
Priority 10	Life expectancy
Priority 11	Satisfaction

Economic Headline Indicators

The respondents rated the ten proposed Economic Headline Indicators in importance from one to ten. The outcome, as presented in the histogram below (see Figure 6.12 and Table 6.15), reveals that eighteen out of forty respondents put ‘employment’ in highest priority of social indicators. The indicators: business survival and poverty are rated as second and third highest priorities respectively. They are followed by the indicators: economic prosperity and income, research and development, inflation, energy, non-oil export, physical infrastructure, and environmental goods and services in order of preference.

Table 6.15: Prioritisation of Economic Headline Indicators (number of respondents)

	Employment	Business survival	Poverty	Economic prosperity & income	R&D	Environmental goods and services	Physical infrastructure	Non-oil export	Inflation	Energy
Priority 1	18	6	4	1	1	0	2	0	2	5
Priority 2	7	11	5	4	0	3	3	3	3	2
Priority 3	6	7	6	7	4	3	1	1	1	2
Priority 4	2	4	8	10	4	2	2	1	3	2
Priority 5	2	3	1	3	8	3	6	2	6	3
Priority 6	0	1	1	4	3	4	5	7	5	7
Priority 7	2	2	3	1	6	3	4	3	5	8
Priority 8	0	2	2	3	4	7	2	8	6	2
Priority 9	0	2	2	1	5	6	6	4	5	5
Priority 10	2	0	4	4	2	8	4	8	2	2

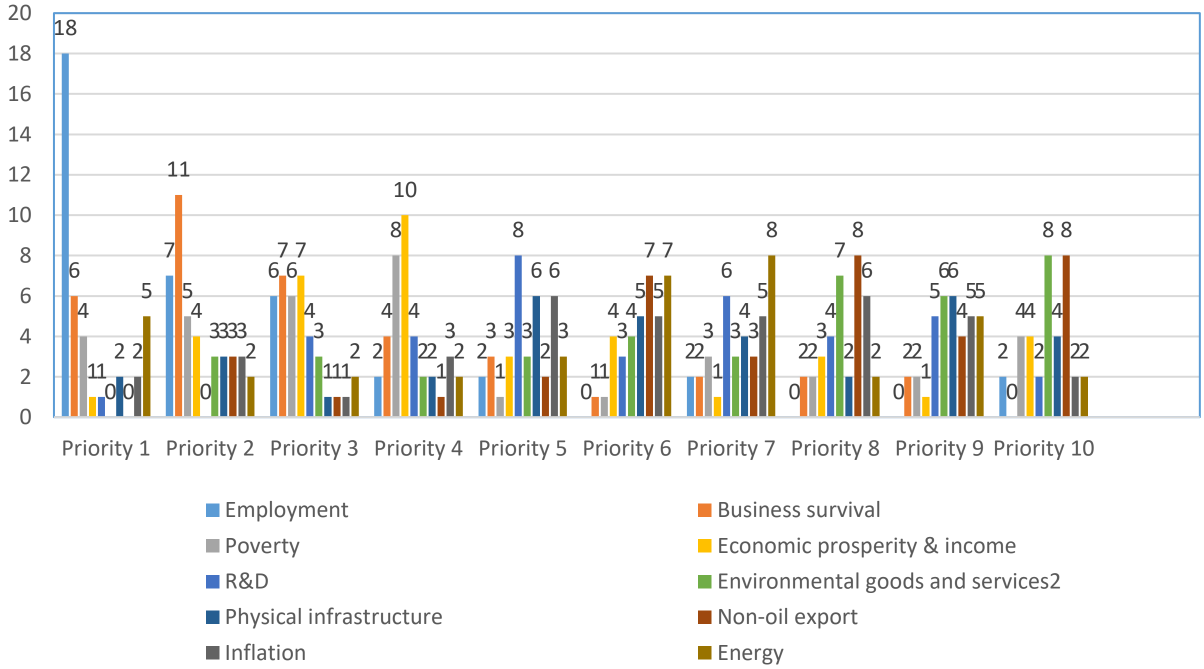


Figure 6.11: Excel analysis for prioritisation of EconomicHeadline Indicators

Table 6.16: The results of prioritisation of Economic Headline Indicators

Priority 1	Employment
Priority 2	Business survival
Priority 3	Poverty
Priority 4	Economic prosperity & income
Priority 5	R&D
Priority 6	Inflation
Priority 7	Energy
Priority 8	Non-oil export
Priority 9	Physical infrastructure
Priority 10	Environmental goods and services

6.2.7 Validity of Indicators

The respondents were questioned on validity of the proposed indicators using the Likert Scale analytical methodology. Each single indicator was, categorically, rated against the Liker Scale ranging from 'strongly agree' to 'strongly disagree' (see Table 6.17). The respondents were provided with the summarised definitions of indicators where there were a possibility of ambiguity.

***Table 6.17**: Sample of Liker Scale questionnaire*

Headline Indicator	Sub-Indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Soil and Land	soil quality	5	4	3	2	1
Soil and Land	Desertification	5	4	3	2	1

As described earlier in the *Chapter 5*, the level of validity of each indicator has been analysed through the coding system of *IBM SPSS Statistics* (Statistical Package for the Social Science) analytical method. As shown in the table above, the satisfaction score was defined in order of respondents' agreement from 'strongly agree' (5), 'agree' (4), 'neutral' (3), 'disagree' (2), to 'strongly disagree' (1).

***Table 6.18**: Sample of IBM SPSS Statistic analysis table: validity of Economic Indicators*

Respondent	Age	Gender	Degree	EC1	EC2	EC3	EC4	EC5	EC6	EC7	…	…	EC21
1													
2													
3													
….													
….													
40													

The questionnaire exposed a set of 164 measures (72 environmental, 71 social, and 21 economic) to the respondents' judgment. The analyses outcome demonstrated that the respondents overwhelmingly supported the proposed indicator set by a total mean satisfaction score of 4.28 (out of 5). Their approval stamp for environmental, social, and economic indicators can be read with mean scores of 4.23, 4.25, and 4.37 respectively (see Table 6.19).

***Table 6.19**: Mean Satisfaction Score of indicators*

Indicator	**Mean Satisfaction Score (1-5)**
Environmental Indicators	4.23
Social Indicators	4.25
Economic Indicators	4.37

Table 6.20 displays the results of *validity of economic indicators* presenting valid percent of the respondents' satisfaction as well as the mean satisfaction scores.

***Table 6.20**: Validity of economic indicators' results*

Indicator Code	N	Strongly agree (valid percent)	Agree (valid percent)	Neutral (valid percent)	Disagree (valid percent)	Strongly disagree (valid percent)	Total	Mean Satisfaction Score
EC1	37	62%	30%	8%	0%	0%	100%	4.5405
EC2	38	55%	34%	11%	0%	0%	100%	4.4474
EC3	39	46%	36%	18%	0%	0%	100%	4.2821
EC4	39	39%	46%	15%	0%	0%	100%	4.2308
EC5	39	54%	31%	13%	2%	0%	100%	4.3590
EC6	38	39%	32%	24%	5%	0%	100%	4.0526
EC7	38	55%	32	13%	0%	0%	100%	4.4211
EC8	38	58%	29%	10%	3%	0%	100%	4.4211
EC9	39	44%	46%	5%	2%	3%	100%	4.2564
EC10	39	67%	20%	8%	5%	0%	100%	4.4872
EC11	37	43%	38%	16%	3%	0%	100%	4.2162
EC12	39	38%	51%	8%	3%	0%	100%	4.2564
EC13	39	59%	36%	2%	3%	0%	100%	4.5128
EC14	38	53%	39%	8%	0%	0%	100%	4.4474
EC15	39	38%	49%	10%	3%	0%	100%	4.2308
EC16	39	51%	34%	10%	5%	0%	100%	4.3077
EC17	38	63%	27%	5%	5%	0%	100%	4.4737
EC18	39	59%	31	8%	2%	0%	100%	4.4615
EC19	37	70%	24%	6%	0%	0%	100%	4.6486
EC20	39	54%	26%	20%	0%	0%	100%	4.3333
EC21	39	59%	26%	15%	0%	0%	100%	4.4359

Only 12 individual indicators including eight 'environmental' and four 'social', gained a mean satisfaction score under 4.00 ranging from 3.38 to 3.97. Therefore they locate somewhere between neutrality (3.00) and agreement (4.00) of the respondents. However, it is worth noting that still a firm majority of respondents are either *strongly agreed* or *agreed* with 11 out of these 12 indicators (see Table 6.21). Seven (out of 12) indicators gained an approval by over 70 percent of the respondents. Three indicators were approved by 60 to 70 percent of the respondents while one indicator won the battle with a narrow majority of 56 percent. The most unpopular indicator with an approval rate of 3.38, as it reveals, is “state and number of mosques” (coded as S47) which falls into the headline indicator: culture within the social category. As the table below shows 49 percent of the respondents were in favour of this specific indicator.

***Table 6.21**: Indicators with Mean Satisfaction Score under 4.00*

Indicator Code	N	Strongly agree (valid percent)	Agree (valid percent)	Neutral (valid percent)	Disagree (valid percent)	Strongly disagree (valid percent)	Total	Mean Satisfaction Score
ENV15	39	23%	54%	15%	5%	3%	100%	3.8974
ENV16	39	28%	49%	18%	3%	2%	100%	3.9744
ENV17	38	24%	53%	18%	3%	2%	100%	3.9211
ENV30	37	35%	38%	11%	11%	5%	100%	3.8649
ENV37	38	29%	42%	26%	3%	0%	100%	3.9737
ENV42	39	31%	36%	31%	2%	0%	100%	3.9487
ENV66	38	21%	55%	18%	3%	3%	100%	3.8947
ENV67	38	26%	53%	16%	3%	2%	100%	3.9737
S25	38	29%	39%	26%	3%	3%	100%	3.8947
S32	39	25%	31%	31%	13%	0%	100%	3.6923
S47	39	18%	31%	33%	8%	10%	100%	3.3846
S48	38	21%	48%	21%	5%	5%	100%	3.7368

6520 answers were expected from 40 respondents regarding validity of 164 indicators. There existed 247 missing values which stands for 3.7 percent of total answers. The number of missing values for individual questions ranges from 1 to 4 (2.5% to 10% of individual questions). For 90 percent of the questions (147 out of 164), either 1 or 2 answers were missed. 14 questions had 3 missing answers each, while a mere 2 questions received no response from 4 respondents.

6.2.8 The comment box

As noted earlier, the questionnaire gave respondents an opportunity to pen their thoughts if they wish to do so. The respondents initially wrote in Farsi and subsequently the text was translated to English by the researcher. As the table below (Table 6.22) shows, responses were categorised according to the headline questions, for the purpose of content analysis.

Table 6.22: Comments derived from the questionnaire's Comment Box

Prioritisation of Category Indicators
Although the economy is too important, I think the environmental issues are the most concerned. The social issues have been neglected in our society and we have serious weaknesses in this regard and it should be seriously considered. Though I choose it as second priority.
I think social sustainability should be at highest priority. In general, the term environmental sustainability is more tangible and understandable whereas the social and economic sustainability still are issues with more ambiguity.
In the past decades, the focus has been on the environmental issues while human being and its needs are the main elements of concentration in the city. So if 'social sustainability' provides sufficient infrastructure to meet the needs of citizens and to protect social justice, consequently the economic and environmental factors will be improved.
Creating appropriate social and economic contexts could be a good start to create new debates.
Behavioural change can lead to change of patterns.
A city should provide spaces for social activities and create neighbourhoods in which people would feel a sense of belonging.
I think all these three aspects should be treated with same priority.
Tehran is in the condition of environmental crisis. Improper and incompetent managers who have no clue of urban issues, created this mess of pollution and congestion. It's not a city to live in anymore.
State of data availability
Very poor. There are lots of issues here: statistics contradictory, parallel public and private institutions, political manipulation of information, lack of transparency in assessment structures, lack of public awareness of the use of statistical data and so on.
In recent years, some public and private institutions in Iran have been considering the sustainability issues. Different agencies such as Iran Engineering Organization seeks to redefine and compile agendas. However, despite these theoretical efforts, sustainability remained a motto in the country.
There is no appropriate and reliable documentation in the form of research projects in this regard.
Here in Iran we struggle with needless paperwork to access resources which are generally backward and old.
City managers do not really care about research and systematic data collection. Unless students and anyone who is interested may have done something. Of course without any support.
State of data accessibility
Very poor. Because even getting access to the simplest data goes through a complex, pointless and time consuming bureaucratic system.
The situation in general is very poor. But it really depends on the way different organisations and departments gather and distribute data. There might be some institutions which are more transparent than the others.
Certain statutory criteria and protocols in various countries concerning defining and implementing sustainability have been defined. Since such systems have not been defined in Iran, the systematic access to data is nondescript.
There is a lack of collaboration between organisations who collect/generate data. Also making data exclusive is another issue.
State of data quality
By multiplying the existing data, accessible data and the data that can be used, what remains is perhaps just a small fraction.
The compiled, systematically-categorised and available data which have not been influenced by authoritarian power and have retained their impartiality and integrity are extremely rare.
Usually data are dated and need to be updated.
Due to lack of discipline, transparency and the inability of current structures, I cannot give it a high level of reliability.
In most cases, they are unrealistic.

Continued

Table 6.22: *Comments derived from the questionnaire's Comment Box*

State of sustainable urban development
Poor. Sustainable urban development before it reaches the state that can be tangible and understandable to the public, it requires infrastructural structures (which are usually hidden from the public eyes) that can provide an appropriate context for sustainable development. It is difficult to generalise this to the whole country. For there may be a city in Iran in which the local authorities have a fair understanding of sustainable development and aiming towards sustainability. But in general the situation is poor, I reckon.
In academic circles, conferences in Iran, sustainable urban development is becoming a necessity that needs to be developed.
Basically, in Iran the concepts of sustainability and development have been perceived differently. And in the course of implementation, these concepts are forgotten and remain a theoretical memory.
What we have is not called 'city'. It is actually a parody of a city. There are elements like parks, shops, banks, municipalities, etc. But they are not moving forward towards a sustainable urban development. In this situation, citizens cannot really grow and prosper in different dimensions.
Role of GIS and availability of geospatial data
I think in Iran, the infrastructure of GIS has been implemented so far.
As a tool, GIS is necessary but not sufficient.
This system makes it possible to modulate and integrate the information and in this sense, it is imperative.
If geospatial data are limited to using digital place finders and refers to urban and non-urban directions, I think the availability is good in general.
Organisations such as Iran National Cartographic Centre giving users access to these kinds of database, however under specific terms and conditions.
Prioritisation of environmental indicators
First, serious problems such as waste, and natural disasters such as earthquake, especially in large cities like Tehran should be taken into account. Then the long-term issues like water crisis should be considered. However, my input is based on the current situation of the country, which might be different in the future.
I think all of the proposed indicators are in a high priority, but it needs to be noted that 'water' and 'air' are in a more critical condition in Iran.
Prioritisation of social indicators
According to Maslow's pyramid, education, culture and social security are the main pillars that must be met so as to finally provide satisfaction and life expectancy
Prioritisation of economic indicators
I prioritised the indicators based on Iran's current situation which may be different in the future circumstances.
Keywords are highly interdependent, indivisible and have the same effects. Employment, business survival, and poverty are a non-biodegradable composition that in large scale are correlated with inflation, non-oil exports and economic prosperity. These indicators should not be prioritised. Namely it is difficult to choose between the eradication of 'poverty' and creating new jobs (employment). Meanwhile 'research and development' should be in a very high priority.
The most important challenge of urban sustainability assessment in Iran
An appropriate 'institutional management' can lead to increase 'public awareness' and by employing specialist human resources (experts) it will be able to design efficient 'assessment techniques' resulting in the achievement of the 'indicators' and the reliable 'data'.
Validity of indicators
All indicators proposed here are quite important. Some of them were new to me though.
Quite logically, one cannot disagree with the proposed indicators.
Number of sub-indicators could be less, because it may challenge the concept as well as functionality of the 'indicators. Although all indicators are imperative, many of them cannot be measured or at least cannot be measured with quantitative methods and many also requires qualitative and/or field research that will reduce the generalizability of a set of indicator.
It is a good and comprehensive classification. But it is the procedures of collection of these indicators that defines their importance in the decision-making processes.

6.3 Semi-structured interviews

The 24 semi-structured interviews conducted with the high-profile officials of municipalities and local authorities, ministerial bodies, as well as experts and scholars, were to obtain their first-hand opinions and insights over a variety of topics related to sustainable urban development and sustainability assessment procedures in Iran. Therefore, texts and manuscripts have been analysed by employing the qualitative content analysis methodology. The findings and interpretations of the interviews will be discussed within the following section. The main issues and topics discussed in the interviews can be found in Appendix 6.1.

6.4 Discussion

As the title says, the purpose of this section is to discuss and delve into the key issues raised from the results obtained from the questionnaire and the interviews. In this respect, the following paragraphs will try to draw a clear picture by offering the researcher's interpretation on the survey results. It should be noted that, in the following paragraphs, the word 'respondent/respondents' refers, specifically to the 'questionnaire respondent/respondents' not to those who were interviewed.

6.4.1 The state of data

The data is the cornerstone of any kind of assessment. The indicators defined to evaluate cities' level of sustainability cannot be assessed in the absence of relevant data. Delving into the questionnaire results as well as the written and oral words of commentators and interviewees, a kind of impugning tone of criticism can be observed over the state of data in the country. In terms of data availability and access to data, as mentioned earlier, a firm majority of the respondents observed the situation as either 'poor' or 'very poor'. Several respondents who penned their thoughts, were concerned about the process of data accessibility due to existence of a considerably-bureaucratic structure. The process of getting access to data was described as "complex", "time consuming" and "pointless":

"The state of data accessibility is very poor. Because even getting access to the simplest data goes through a complex, pointless and time consuming bureaucratic system."

One respondent who voiced concern about the difficulties in accessing data, wrote: "Here in Iran we struggle with needless paperwork to access resources which are generally backward and old". The other claimed that "systematic access to data is nondescript in Iran" and that, it is imperative to "define and implement sustainability statutory criteria and protocols" to be able to establish such system. Several interviewees emphasised how the obscurity that exists around the term ‘confidentiality’ imposed further restrictions on exchanging data, even among authorities and state organisations. Perhaps this is why an official at ‘Tehran Province Water and Wastewater Company’, called data a “political matter” in Iran. A respondent also, found the process of “making data exclusive” a fundamental issue. Sensitive social data such as “drug use and prostitution data are strictly confidential. They are hardly available to researchers and even to municipality departments”, said a senior official of ‘Office for Social Studies’ at Tehran Municipality’s Deputy of Sociocultural Affairs. The head of Environmental Assessment Committee at the TM’s Office for Environment and Sustainable Development, pointed out the restrictions to publishing the committee’s reports: “We cannot publish the reports of the committee. But we may send the reports to some of the government organisations on demands”. Several officials raised concerns about getting access to environmental data such as water quality. “Water data is a political matter and even exchanging data between government organosations is a frustrating process”, said a senior official. A chief executive officer of DoE’s Deputy of Human Environment, also commented on the matter:

“Water pollution data are strictly confidential. Ministry of Energy is very strict to exchange water pollution data even between governmental organisations such as DoE, due to social concerns.”

A high profile official at the ‘Office for Water Resources Quality’ under Tehran Regional Water Authority, shared the same thought:

“I can show you the confidential letter I received myself that bans authorities from releasing any sort of data about quality of Tehran’s water. This letter even points out the students and researchers, especially those who are either working or studying abroad. The water quality data is absolutely confidential.”

A principal ministerial advisor also mentioned the difficulties of sharing data with international researchers:

“From the government point of view, there is a sort of distrust of anyone coming from abroad to this country; they believe that most of secret intelligence agents have been sent to this country as either journalists or students. This is why they are very sensitive and they put strong restrictions on data distribution in government organisations”.

If one needs to approach a kind of data which are not available via the SCI domain — especially the sensitive social and environmental data such as crime, water quality, etc. — there is no way to put requests online presently. This appears as a physical exercise and all applications to obtain any sort of data from authorities should be submitted through the internal security offices called *herasat,* a representative of Ministry of Intelligence which is found within all public facilities and state institutions. This is despite the fact that— as discussed in Chapter 5— the Freedom of Information Law has been launched officially in Iran.

A high rank official of a Ministry of Energy department (Iran Power Generation and Transmission Company (TAVANIR)), was concerned about the availability of 'renewable energies' data at the urban level: "Renewable energies data are not available at the urban and local authority levels. However, there are data at a national level", adding "Overall, there is a lack of data in the country". A senior official of the 'Economic Modelling and Information Management Office' which operates under the Ministry of Economic Affairs and Finance, also shared the same view over the availability of 'economic data' at the urban level:

"Economic data are hardly available at the urban levels. It mostly exists at the provincial level. Basically data are not much produced at the urban level. Generally speaking, urban data are rare."

In the same vein, a high profile official of the NCSD expressed doubts over availability of biodiversity data at an urban level:

"DoE provides this data on national level, but I am not sure we have it at the urban scale. Tehran municipality, for instance, considers the height above 1700m as natural resources that shouldn't be intervened. But I don't think we have that concept of biodiversity within the cities. It is limited to green spaces in the city. However I know the municipality appointed environmental advisors to look at these issues beyond just green spaces."

As described in section 5.5.2 of chapter 5, despite the fact that the Statistical Centre of Iran (SCI) collects the census data at the lowest urban level called 'block' (which consists of a group of buildings), evidently, the availability of such data remains in question.

In a report (Tehran SoE, 2012) produced by the Research and Planning Centre of Tehran; a policy-making arm of Tehran Municipality, it is stated that, providing data was the key obstacle that "caused the process' decline", within the process of preparing the State of Environment Report of Tehran (discussed in chapter 5). The report highlighted the challenges as follows: (a) part of the required information was not provided; (b) the authority for some part of information remained unknown and thus the information was not accessible; (c) part of required information couldn't be find in any organization, or the organization lacked data bank; (d) part of information was lacked periodically; (e) part of information were inaccessible because they were confidential, or sensitive information, or could cause problems for the authority.

Regarding the quality of data, two divergent narratives can be drawn from the survey outcome. On the one hand, there is an overall satisfaction with the state of data quality as a majority of the respondents (55%) presumed it as either 'satisfactory' or 'good' (47.5% ranked it as 'satisfactory' while 7.5% chose 'good'). On the other hand, the respondents' comments (derived from the questionnaire) and the interviewees' insights reveal a heavily critical attitude towards the matter. In this respect, several respondents questioned the reliability of data, referring to data as "generally backward and old" or "usually dated" that "need to be improved". In the same vein, one respondent went on to argue that "in most cases data are unrealistic". Another wrote: "due to lack of discipline, transparency and the inability of the current structures, I cannot give it a high level of reliability". A monitoring officer from the DoE's Office for Monitoring Environmental Pollution asserted that "generally speaking, data are not much reliable due to lack of planning". Several high-profile officials raised their concerns about the precision of the reports local authorities provide. A mayor advisor at Tehran Municipality expressed doubts about the accuracy of reports prepared by the TM: "There are huge differences between the reality of implementation and the reports we provide". An official from the Department of Environment's NCSD shared the same attitude regarding the reports Iran submitted to the international organisations:

"*We submitted reports to international agencies such as CSD or MDG almost in every two years period, not very regularly though …, The data Iran used for submitting reports to international bodies was not much precise, obviously."*

Several respondents mentioned the issues regarding the authorities influence over data, as one of them put it, "the political manipulation of information". One of the commentators said that there are "statistical contradictions" within data being released by the authorities. Another respondent, critically challenged the quality of data in Iran in terms of: lack of impartiality, integrity and independence:

"The compiled, systematically categorized and available data which have not been influenced by authoritarian power and have retained their impartiality and integrity are extremely rare."

It is worth noting that the issue raised by the survey respondents and interviewees, who wish to remain anonymous, were also announced publicly by the Iranian officials on rare occasions. For instance, Akbar Ranjbarzadeh, an Iranian MP who is the member of Board of Directors of *Majlis* (parliament) voiced concern about the 'number of the unemployed' given by the SCI (Statistical Centre of Iran) and the government's Ministry of Cooperatives, Labour, and Social Welfare. Referring to a report by the Islamic Parliament Research Centre (IPRC), he claimed that "the number of unemployed is twice as high as official statistics", adding, "The statistics system should be formed in a way that the SCI would not be under the influence of governments" (Ghadimi, 2017). Similarly, disputes were observed, for example, over statistics on drug addiction in the country (BBC Persian, 2017). The CEO of Tehran Air Quality Control Company, in an article on 'urban air pollution in Iran', expressed his concerns about the state of air quality data: "Air quality is being monitored and reported to the public, though data availability and validity remain a challenge" (Hosseini & Shahbazi, 2016).

Interestingly, despite ranking the data quality as 'satisfactory', the respondents, in response to a question targeting the key challenges in the process of urban sustainability assessment in Iran, recognised 'data' as the 'most important challenge'. Then 'institutional management' falls into second place while 'public awareness' seemed to be a 'no big deal' in the process of sustainability assessment according to the survey respondents. It is perhaps explicable that, due to scholarly processes of evaluation, the other issues such as indicators, assessment techniques, etc. weigh in. Nevertheless the vital importance and necessity of awareness of public cannot be compromised.

One of the issues mentioned by several interviewees was the lack of "comprehensive datasets" within different departments. For example, the then Head of Office for Water Resources based in DoE's Deputy of Human Environment, claimed that there has been "no comprehensive environmental databank in place". This was one of the fundamental issues raised by majority of interviewees. However, it is worth noting that in a significant move, the 'Economic Modelling and Information Management Office' of the 'Deputy of Economic Affairs and Finance' has recently launched a web-based bilingual economic databank titled: *Economic and Financial Databank of Iran* (MEAF, 2017). The data are available at the international, national and provincial levels through 10, 14, and 7 headline indicators respectively. Although there is still room for improvement, particularly in terms of defining indicators, providing data at urban and municipality levels, and visualising data, this development can be seen as a serious yet significant attempt towards establishing an open source database which will pave the way for other major government departments to establish appropriate environmental and social databanks.

A mayor advisor of Tehran Municipality expressed his/her concerns about the lack of cross-departmental communications in the process of data production: "There is a lack of collaboration between organisations which collect and generate data", adding that "comprehensive collaboration and appropriate management are needed between all stake holders, from academics to developers, to investors to local authorities and so on". A senior official of the 'Roads and Urban Development Research Centre' (a public body under the Ministry of Roads & Urban Development) shared the same thought in a broader perspective:

"Unfortunately all departments and organisations are performing individually. When we say that we need to create an integral incorporated assessment system, it means we need to connect all these disintegrated sections and departments and to avoid acting separately."

Other issues related to data, derived from the respondents' and interviewees' comments, are as follows:

- Lack of public awareness of the use of statistical data
- Lack of "appropriate and reliable documentation in the form of research projects"
- Lack of support from city managers
- Lack of transparency in assessment structures
- Lack of funds to produce and update data
- Parallel public and private institutions
- Reluctance by the local authorities in "research and systematic data collection"

6.4.2 The state of sustainability

The results revealed that there is a real attitude of negativism among the respondents about the state of 'sustainable urban development' as well as 'urban sustainability assessment' in the country. As mentioned earlier in this chapter, the respondents, overwhelmingly considered the overall performance of sustainability within Iranian cities as either poor or very poor. In this respect, the respondents and interviewees commented on a variety of issues that brought up such conclusion. The key issues raised by the survey participants – among them: lack or weakness of executive power, problems in the process of formation of cities, failure of authoritarian structures, lack of legislations, lack of consideration for social development and community-led planning – were incorporated into two categories of 'management, planning and implementation' and 'public engagement and participation'. Therefore, the following paragraphs will look at these issues through coding, labelling and categorisation of the words of respondents and interviewees to build a strategic narrative.

Management, planning and implementation

As one respondent pointed out, despite the "efforts of some public and private institutions", sustainability remained a "motto" in Iran. The statement and the meaning it carries leads to further inquiries addressing the reason that may convey such impression. One commentator emphasised that the concepts of 'sustainability' and 'development' have been misread by the local authorities, adding, "in the course of implementation, these concepts are forgotten and remain a theoretical memory". The other shared his/her strong opinions about the idea of the 'city' in Iran:

"What we have here is not 'city'. It is actually a 'parody of the city'. There are elements like parks, shops, banks, municipalities, etc. But they are not moving forward towards a sustainable urban development. In this situation, citizens cannot really grow and prosper in different dimensions."

Giving real-time examples, the respondents and interviewees shared their experiences and observations over the subject matter. The survey found that 'mismanagement', 'misleading planning' and 'barriers to implementation' are the key challenges in transforming sustainability from a 'motto' to 'practical reality'.

Taking on the state of urban sustainability, the mayor of a Tehran regional municipality asserted that Iran "is in the very beginning stage of this process":

"In terms of using renewable energies in construction industries and in the built environment, we have not really moved forward [...] Overall, in urban development plans and municipality agendas, I would say urban sustainability has not been really considered much."

On 17. April 2017, the municipal public body: Tehran's Air Quality Control Company (AQCC) published a report titled: *Tehran's air [quality] management is still in the hand of the wind*, on its official website (AQCC, 2017). The study of Tehran air quality trend during the period from April 11 to April 17 showed that, as a spokesperson for the AQCC asserted: "it is only the wind and hours of consecutive rainfall that can save Tehran from atmospheric pollutants" (AQCC, 2017). The statement no doubt raises the issues over the air quality management in Iran's capital. One of the respondents heavily criticised the urban management structure and considered the 'improper management' as the cause of Tehran's problematic conditions:

"Tehran is in the condition of environmental crisis. Improper management and incompetent managers who have no clue of urban issues, created this mess of pollution and congestion. It's not a city to live in anymore."

A high-ranking official of the Road, Housing and Development Research Centre – which is a high profile subsidiary organisation under the Ministry of Roads and Urban Development – voiced his/her criticisms at the authenticity of Tehran Municipality assessment procedures: “In my opinion they are just trying to hide the reality behind these assessments’ reports and to justify their performance”. S/he went on to argue that the assessments carried out by Tehran Municipality “are not reliable at all”, as s/he similarly decried the TM as “the main cause of this disorganised and chaotic situation” the Iran’s capital faces today:

“I would say ‘planning’ has lost its point here. In a situation where municipalities need to maintain their incomes by selling city so they will do anything to raise their income without considering authorised plans, the assessment is totally out of context here.”

In fact, cutting off the government funds resulting in shortage of financial resources, has eventually turned the Tehran Municipality into a real state, selling density and making deals with landowners over the urban land use planning. In a 2014 report on Tehran Urban Development Index (TM, 2014a), it is stated that the capital’s urban management has failed to comply with urban policies and planning agendas such as Tehran Detailed Plan.

Several interviewees raised concerns over the anti-environmental planning policies carried out by authorities in Tehran peripheries. A senior official of ‘Office for Natural Environment’ at the Tehran Province Environmental Protection Organisation impugned the authorities’ plan for building a ‘new town’ within the boundaries of a national park:

“Unfortunately, I am not optimistic. I don’t see a good prospect at all. Just have a look at the 8th phase of Pardis New Town near the capital, the so called ‘Paradise Valley’. They built the city in the heart of a national park which should have been protected against any sort of interventions.”

An official of the ‘Deputy of Architecture and Urban Planning’ at the Andisheh New Town Municipality was concerned about the lack of infrastructures such as public transport and drainage networks in the ‘new towns’: “Decision makers do believe that there is no economic interest to invest in public transport (metro) before people pouring into the city”. As s/he stated, the recently-built ‘new town’ located 30 kilometres southwest of Tehran, “is not supplied by urban sewerage networks, so the wastewaters are absorbed into the soil through waste wells and pollute groundwater”. S/he also argued that the authorities should had been concerned about the process of site selection which led to socioeconomic dispute as well as environmental pollution:

"The city has been built over the sand mines. You can see many mining industries are active around the city. I think they should not have built the town in a location where there is a huge mining potentiality."

Seemingly, this led the municipality to regulate limitations for the companies involved, due to their juxtaposition with the town, as a chief executive of Andisheh New Town Development Company, commented on the issue: "The (mining) companies are not allowed to exceed five-metres-depth of excavation, but they do. There are legal voids as well as many other issues". It is worth mentioning that, as an official of the new town municipality expressed: "in strategic plans, there is a ban on construction of polluting industries within a radius of 120 kilometres from the capital". "But this has not really happened", s/he added.

In the same vein, a high-ranking official of the 'Fundamental Studies Group' which is a subset of the 'Road, Housing and Urban Development Research Centre', explained how a collaborative pilot project never came to reality:

"In 2010, a pilot project called 'Shahr-e Javan' Community [Farsi for 'Young City' Community] *has been defined as a collaborative research project between Iran's Ministry of Roads and Urban Development and Technische Universität Berlin. This project aimed to find solution through urban design and planning for sustainable urban development in Iran which could be environmentally responsive, energy efficient, as well as being respectful to Iranian culture and identity. A series of instructions and guidelines have been compiled and the detailed master plans and architectural solutions have been suggested. Unfortunately it has never got a chance to be implemented."*

An independent researcher and practitioner who had been involved in the project stated that: "Shahr-e Javan in Hashtgerd New Town was planned to be a strategic model for sustainable urban development in Iran, but sadly never happened". It should be mentioned that in November 2015, Iran media reported that a memorandum of understanding (MoU) was signed between Iran and Germany to construct the project (IRNA, 2015b), however, at the time of writing, there is no report available regarding the project progress.

An official of 'Tehran Region 22 Municipality' also commented that the sustainable development strategies– derived from CDS (City Development Strategy) agenda of *Cities Alliance* which is a "global partnership for poverty reduction and the promotion of cities in sustainable development" – developed for the region, were ignored and never found its way into the implementation: "Unfortunately it is too hard to implement these strategies due to complexities exist within the organisational structures".

A senior official of the Department of Environment stated that sources of funding is one of the key challenges that hinders the implementation process:

"We discussed here at the DoE a sustainable development plan for Lake Urmia and, if only, god willing, financial resources are sorted out, there will be a chance to revitalise a major part of the lake."

"... But regarding domestic air pollution, for issues like old vehicles and so on, DoE and municipality work together. There are plans for tackling these issues but the implementation of those plans depends on availability of financial resources and budgets."

The abovementioned comments, apparently, convey the impression that there are considerable difficulties in implementation processes. It should be noted that the convoluted matter of implementation in Iran's planning structure does not only relate to the small or large-scale urban projects, but also to the national legislative frameworks. An official of the Tehran Province Environmental Protection Organisation commented that:

"The [preparation of] Iran's Spatial Planning Scheme [Tarh-e Amayesh-e Sarzamin] dates back to 1975. The country has been divided to eight ecological areas according to this plan. But the plan has not yet been passed by the parliament. It needs to be legislated. The situation of the plan is unclear at the provincial level and beyond."

It is worth mentioning that on 29 April 1992, the government passed a resolution to oblige the then Planning and Budget Organisation (presently known as IMPO) and the then Ministry of Housing and Urban Development, acting as the governmental bodies to pave the ways towards finalising the Iran's Spatial Planning Scheme (IPRC, 2017c). However, it "has never been implemented in any of the five Development Plans" so far, according to Iran's chairman of parliament, Ali Larijani, speaking at a conference in Tehran (IRCP, 2014).

Although "there is a lack of legislations and legal acts", negligence in implementation of the existing regulations remains a challenge. "According to *Article 184* of the Fifth Development Plan Act (2011/12 – 2015/16), Department of Environment was obligated to produce sustainable development indicators for Iran", said an official of the Department of Environment's NCSD. While the *Article 184* touches on more holistic issues such as providing and implementation of SEA, the *Article 185*, explicitly, emphasises the development of sustainability assessment mechanisms, citing "producing a national indicator set for sustainable development", "determining and quantifying the sustainability indicators", and "establishment of data banks for sustainability indicators" (IPRC, 2011). It should be noted that the parliament passed the fifth Five-Year Development Plan Act (2011-2015) on 5 January 2011 (IPRC, 2011) and, accordingly, the DoE's High Council for Environmental Protection (HCEP) was assigned to coordinate and implement the act of parliament. However, a study (Naderi-Mahdei et al., 2015) has identified that Iran's Five-Year Development Plans (IDPs) have not been compatible enough with the sustainable development aims:

"At a glance, it is obvious that while the fifth IDP is significantly different from the other IDPs on paper, practically, not enough attention has been paid to the idea of sustainable development. Thus, it appears that, sustainable development still does not have an acceptable place in the planning structure of the country."

In a broader perspective, a high-profile official of the National Committee for Sustainable Development emphasised that there are formidable obstacles to the implementation of project sustainability in many developing countries including Iran, adding that, 'poverty' is the most fundamental issue among them:

"The manifestos and slogans of sustainable development are not a priority in developing countries. This is being argued in all of the world summits and conferences. For developed countries, the issue is development of renewable energies, but for developing countries the priority is to tackle poverty."

To this end, s/he went on to argue that "the way the term sustainable development is being promoted in the world, cannot be inclusive and comprehensive", and that, the lack of infrastructures due to the high costs of sustainable technologies can hinder the implementation of sustainable development in developing countries.

"For instance, reducing CO_2 emission and the use of fossil fuels or applying renewable energies, all these things are technology-oriented targets. They (developing countries) say this style will lead to a higher cost of managing and running the world. Although it would not be a problem for wealthy developed countries, it would be yet an extra cost for developing countries that already struggling with poverty and it could not be practical."

"In Iran, poverty is one of the main problematic issues of the society", said a senior official of the Deputy of Socio-Cultural Affairs of Tehran Municipality. According to a report titled: 'Measurement and Economic Analysis of Urban Poverty' authored by three senior government researchers, about 40% of Iran's urban population live under the relative poverty line (Kiani et al., 2011). In a newspaper interview, referring to an unpublished report by the 'Deputy of Social Welfare' under the 'Ministry of Cooperatives, Labour, and Social Welfare', the prominent Iranian economist Behrooz Hadi-Zenooz revealed that about 17% of Iran's urban population and 40% of rural settlers live in 'multidimensional poverty' (Gholizadeh, 2016) while other reports show that between 12 to 18 percent of Iran's total population live under the absolute poverty line. A study carried out by Hadi-Zenooz (2005) shows that the rent-seeking nature of Iranian economy fuelled by the government, is a major obstacle to poverty alleviation. As he stated, economic growth – which relies heavily on good governance – is antidote to poverty. Adding that poverty remains a challenge since there are "fundamental weaknesses in governance processes in Iran" (Hadi-Zenooz, 2005).

Giving an example, an official of Andisheh New Town Municipality discussed the socially unsustainable situation of new towns as a result of the social inequality:

"Most new towns are initially filled by the poor. Initially, the towns do not attract middle and upper class due to the lack of urban facilities and infrastructures. By the time while the towns start to maintain themselves and receive some facilities and urban services, middle class who cannot survive in metropolis, pour into new towns. When the town is being shaped, ghettos are born in its suburbs."

Implementing sustainability agenda for reducing carbon emissions remains a challenge in an oil-based economy like Iran: "There exists a conflict of interests here".

"In these countries [developing countries], *policy-makers, politicians and MPs believe that there are much more important priorities than just reduction of CO_2. They say 'why we should act towards a low-carbon agenda while we produce carbon (fossil fuels) which is a major source of income?' So, in their view, 'if we reduce carbon we lose that money'. There exists a conflict of interests here."*

Although the argument above attracts the governments of the countries such as Iran, the point is that, at the end of the day, a sustainable economy cannot rely much on unsustainable finite resources (e.g. fossil fuels) in a long-term period. Therefore, there is a serious need for development of non-oil economy plans.

Several interviewees voiced concerns over the managerial issues such as: the lack of coordination, the lack of authority in the decision making processes within the local councils and regional municipalities, and government waste. For instance, a mayor advisor of Tehran Municipality was concerned about the importance of feasibility studies in early stages of the major urban projects:

"For instance, the artificial Lake Chitgar in Tehran's Region 22 which became an iconic project for the capital, and the municipality is too proud of it, is located on the seismic faults which threatens its surrounding residential neighbourhood in the course of an earthquake, according to reports of Japan International Cooperation Agency (JICA) which collaborated with Tehran Municipality to evaluate Tehran vulnerability against the potential earthquake. So we built the lake before we do the risk assessment. Now it's too late."

Several officials stated that the sustainable solutions have been ignored so far in the decision-making processes. An expert commented that "we need to take waste recycling seriously, especially, industrial waste should be considered. Waste recycling shouldn't be a luxury". Another official suggested that sustainable solutions such as using grey water system for irrigation purposes, could be applied to preserve urban green spaces, given the fact that "lack of water resources is serious in the country". Also, a senior official of the 'Office for Green Space' at the Tehran Region Municipality expressed the importance of plants environmental adoptability:

"Non-native plants are being used in urban parks and gardens which mostly are not responsive to the local climate condition. This has led to the uprising costs of preservation and maintenance."

The CEO of the 'Roads and Urban Development Research Centre' mentioned that there is a lack of an initiative department to lead:

"For instance, in the Ministry of Road, Housing and Urban Development there is not such organization as "deputy of sustainable urban development". We need an official governmental initiative under the ministry of urban development regarding sustainable development. At the moment we don't have it."

In contrary, there are a myriad of unnecessarily budget wasting departments and organisations operating within different sectors of the government.

"In the last 6-7 years, we also established the Strategic Committee for Sustainable Development (SCSD) under the directorship of Iran Department of Environment. However members of this committee are ministers' deputies and it has a more political will in comparison with NCSD. The National Committee resolutions need to go through the government, high council, etc. whereas the Strategic Committee has more legislative power."

It is intriguing to note that the SCSD which is to play yet a more critical role than that of NCSD, does not even have a website after "6-7 years" of activity. And it is the same for the now 24-year-old NCSD. One may argue that, instead of establishing a brand new committee, the existing NCSD could be much more improved in terms of its functionality and empowered regarding its legislative authority.

As mentioned earlier, regional municipalities suffer from a lack of authority in the decision making processes:

"The Ministry of Roads and Urban Development produces Detailed and Master Plans of our cities and municipalities are mostly doing the task of implementation"

"The regional municipalities are not involved in the decision making processes and even in design processes. They just play the role of executive arms of a top-down system"

"We try to reflect our views on projects defined for the Region 12. But it is out of consideration. I think there should be a scrutiny process in regional municipalities for new development plans. The decisions are made somewhere else and regional municipalities do not have a say on them."

"For instance, they (deputy of architecture and urbanism of Tehran municipality) defined a new development plan in Region 12. It included pedestrianisation of 17 Shahrivar Street and the Imam Hossein Square. You may think that in a car-dominated city like Tehran, this would be a great idea. But the social impact was negative. Because there wasn't substantial social studies in the planning process. They didn't look at the sociocultural situation of the neighbourhood and the activities happening in the area. So the project failed."

Public engagement and participation

Despite controversies over the issue in the last three decades, public participation has been identified "as an important decision making procedure" within the sustainability science as well as urban planning literature (Brabham, 2009; Davies et al., 2012; Cohen et al., 2015). And it is yet another critical issue raised by the respondents and interviewees of this survey. "There is no public participation or public engagement in place in the decision making processes", expressed an advisor of Deputy of Architecture and Urbanism at the Tehran's Region 12

Municipality. S/he pointed out the reasons behind a paucity of public participation: "It is the lack of public awareness and lack of trust between the public and the authorities that led to a lack of public participation". One interviewee based in Tehran Municipality asserted that "social capital" – which, according to Putnam (1995), translates into 'civic engagement' and 'interpersonal trust'– "is a critical issue in Iran", adding that "there is a lack of consideration towards local communities and social development and that, "social policies need to be reconsidered". S/he went on to argue that there is a negligence in carrying out community planning procedures and considered it as one of the "main problems in the urban development processes in Iran".

A mayor advisor of Tehran's Region 22 Municipality explained how appropriate planning and strategies could lead to encourage the general public to be more engaged:

"Good strategies and plans could help. It even could change the behavioural patterns. For instance a national park in North Iran, did set up a 50,000 Rials entry fee (almost 1 GBP). The amount will only be refunded if park-goers bring all their rubbish back."

Another issue raised relating to the public engagement matter, was about the difficulties due to a lack of support for non-governmental organisations, as a senior official of TM put it: "NGOs and specifically environmental NGOs are not supported by the government", emphasising that "they need to be empowered". This can be referred to debates over the crucial role of civil society in urban planning and development and the fact that the NGOs, specially 'neighbourhood-based' ones, can bridge the gap between citizens on one hand and companies and the governmental agencies on the other (Beatley, 2000; Carley et al., 2001; Portney and Berry, 2011).

Giving an example of a national environmental crisis such as Lake Urmia, a high profile official of DoE pointed out that there is a firm connection between the public awareness (or public concern) and the authorities' actions: "The hot topics like Urmia gets more public attentions. And because there is a public concern, it will be more welcome from the authorities". Again, this would prove the vital role of NGOs in drawing the public attention to the problematic environmental and socioeconomic issues cities face today.

Several officials raised concerns about the relationship between the academia and society: "There are huge gaps and weaknesses", said a high profile official of the Road, Housing and

Urban Development Research Centre. A senior official of the NCSD sees the slow process of the engagement as a natural course of development in developing countries such as Iran:

"These conceptions and ideas of sustainable development may take 10 years, even more in some of these developing countries to find its ways through academia and it may take some more years to be transferred from academia to the society."

6.4.3 Weighting and validity of indicators

As explained in Chapter 3, it is imperative to value indicators through weighting methodologies so as to fulfil a comprehensive function. The results were to tackle the issue of weighting the indicators proposed in this research through a prioritisation system. This will help weighting indicators through rating procedures. Thus, the respondents were asked to priorities the indicators within two levels of 'category indicators' and 'headline indicators'. Regarding the former, the results revealed the environmental category as first priority, followed by social and economic, respectively. In contrary, several respondents went on to argue that the 'social sustainability' should be put in highest priority, as one mentioned, if there be "sufficient social infrastructures" in place "to meet the needs of citizens and provide social justice", it will consequently lead to improvement of economic and environmental factors. One also thought that all the three aspects "should be treated with the same priority". However, the result critically elaborates on the broader issues Iranian cities presently face. The previously mentioned environmental crisis across the plateau and the societal complexities and contradictions of a fast-changing society well convinced the respondents to consider the economic aspects as third priority despite a complicated and baffling economic structure being in place.

Considering headline indicators, the results show that the respondents marked the headlines: air, education, and employment as top priorities for environmental, social and economic categories respectively.

As several respondents stated, the prioritising or weighting the indicators should be reviewed constantly as the social, economic and environmental conditions might be subject to change, as one respondent stressed: "I prioritised the indicators based on Iran's current situation which may be different in future circumstances". For instance if the 'air' factor, now is in highest priority, it may change due to possible improvement of air pollution within the course of assessment and that, there might be another headline indicator which be in a more critical condition at the time. So it is imperative to review the priority of indicators based upon the outcome of the latest assessment.

As noted earlier, some of the respondents were concerned about the whole idea of rating system within sustainability assessment, as one wrote:

"*Keywords are highly interdependent, indivisible and have the same effects. For instance within economic headline, employment, business survival, and poverty are an inseparable composition that in large scale can be correlated with other indicators such as inflation, non-oil exports and economic prosperity. These indicators should not be prioritised. Namely it's difficult to choose between the eradication of 'poverty' and creating new jobs (employment).*"

Another respondent expressed doubts about the generalisability of prioritising indicators, as different regions or cities might have different priorities. For instance, as one stated, an indicator such as natural disaster (earthquake) might be a very high priority for a city like Tehran while it can be an out of context issue for another city.

As Wong (2006) stated, the purpose of 'weighing' the indicators according to their relative importance usually is to "combine or aggregate individual indicators into a single composite index". However she argued that the single-score-solution might be also problematic as it is "less responsive to pinpoint issues at the lower rungs of the spatial hierarchy", for instance at local and regional levels (Sawicki and Flynn, 1996; Wong, 2006). There are also other concerns relating to use of composite indices. For instance, simplifying the phenomenon into a single figure can raise concerns over ignoring detailed information on different aspects of the phenomenon studied. It can also cause "misrepresentation" and be subject to "distorted interpretation" (Wong, 2006). Wong (2006) suggested that the graphical presentation of the indicators analysed, can be an alternative to an approach that reduces indicator values into a simple index or a summary score. This has been applied nearly three decades ago when Herman et al. (1988) used multi-dimensional diagrams presenting the indicator values to analyse the dynamic characteristics of US cities (Wong, 2006). The SPeAR's dartboard-shaped diagram, as discussed in Chapter 5, is also a more recent example of this methodology which this study were inspired by (see section 5.6 of Chapter 5).

The respondents, also specified their level of agreement or disagreement on the 164 measures proposed, which were a subset of 30 headline indicators within 3 categories. As explained earlier in this chapter, only five measures have favourability rating of less than 70%. This shows that the proposed indicator set received a considerably high approval ratings. "All indicators proposed here are quite important", wrote one of respondents. One respondent commented that "it is a good and comprehensive classification, but it is the procedures of collection of data for these indicators that define their importance in the decision-making processes". The comment recalls the expression Wong (2006) wrote in her book *Indicates for Urban and Regional Planning*: "Indicators alone are idle information, which hardly convey any meaningful message for policy-making". Another stated that "Quite logically, one cannot disagree with the proposed indicators".

6.4.4 Public and private sector

In Part A of the questionnaire, the respondents were asked to clarify on their 'working statuses'. Although, due to the nature of the investigation, the survey population is relatively small, a series of cross-tabulation analyses uncover a sharp contrast in the way the respondents who work in public and private sectors perceived the situation. For instance, 64% of private sector actors considered 'data availability' as either 'poor' or 'very poor' whereas 60% of respondents who work in public sector saw it as either 'satisfactory' or 'good'. In the same vein, while 54% of those who work in private sector considered 'data quality' as either poor or very poor, the public sector employees gave it an approval rating of 60%. The optimistically positive attitude of the public sector towards data availability may refer to the institutional position it holds. In other words, the considerable level of negativity among private sector observed, could translate into the complicated processes of accessing the data archives which presumably raise concerns about the existence of data in the first place. Although public and private sectors within the survey population relatively share a common attitude towards the condition of data accessibility, the state of sustainable urban development and the state of sustainability assessment, in all cases, the public sector considered the situation less 'poor'.

6.5 Summary

The purpose of this chapter was to draw an explanatory image of the results derived from the survey questionnaire and the interviews conducted. The chapter was formed of the opinions and insights of 64 participants including experts, practitioners, academics and authorities' officials. The questionnaire's outcome were analysed by applying analytical methods including SPSS and EXCEL, while written and oral commentaries were studied based on a content analysis methodology. Conclusively, the issues raised in the questionnaire and interviews were expanded on in the discussion section (section 6.4) within four sub-sections including: the state of data, the state of sustainability, weighting and validity of indicators, and public and private sector. To put it in a nutshell – according to the results of this survey– in Iran, there are relatively satisfactory quality data which are poorly available. Plus, data remain the most important challenge in the assessment processes. The sustainable urban development is non-functional and the sustainability assessment performance is poor. Evidently, the public sector (among the 40 respondents) expressed a sense of optimism while the private sector shunned. To tackle these issues, in the next chapter (conclusion), the study will offer suggestions derived from the content analysis of interviews' manuscripts as well as the respondents' written comments.

Chapter 7: Conclusion

7.1 Introduction

Why was it important to do this research? What does it add to the subject area of study? This very final chapter will, simply, try to provide answers to these questions. Beginning with an overview of the research process, the chapter highlights the research limitations, its contributions to knowledge and what it has to offer for potential future work. Drawing upon the research findings, these closing lines of the dissertation are aimed at suggesting relevant principles and policies through answering the initial questions of the study.

7.2 A review of the research process

Learning from the UK, this piece of work was aimed at delving into the existing methods and mechanisms of urban sustainability assessment in Iran. To this end, it was essential to have a firm grasp of the notion of urban sustainability assessment in general, digging up its main drivers: indicators, datasets and assessment methods and techniques (Chapter 2). Selecting UK as the guideline of the study, it was also required to carry out an in-depth review of the UK experience and achievement in the evaluation of urban sustainability through studying its most considerable assessment systems and mechanisms (Chapter 2). On the other hand, the research provided a broad overview of Iran – as the key focus area of the study – depicting its current situation related to the sustainable urban development by reviewing the urban management structure, sustainable technologies and assessment methods (Chapter 3). All these can be defined as secondary data which was obtained from texts and written documents including: scholarly journal articles, magazine articles, conference papers, reviews, textbooks, online sources such as digital libraries, websites, blogs and so on. On the other hand, the primary data collected for the purpose of this study, was derived from: official government documents and reports, unpublished manuscripts, a questionnaire survey and a series of semi-structured interviews. The government documents and reports as well as unpublished manuscripts were used to carry out an investigation into the mechanisms of urban sustainability assessment in Iran (Chapter 5). Reviewing Iran and the UK sustainability assessment systems led to suggesting two comprehensive sets of indicators (including data sources and assessment methods) for the two countries (Chapters 5) which resulted in proposing an urban sustainability assessment framework for Iran through a comparative-content-analysis approach (Chapters 5&7). The validity of the proposed framework was subsequently assessed by relevant experts and academics (Chapter 6). Finally, the results of the questionnaire survey and interviews were analysed and discussed (Chapter 6).

***Table 7.1**: The research aims and objectives revisited*

Aims and objectives	Addressed in …
To review in-depth the UK experience and achievement in urban sustainability assessment through indicator systems; data sources; and assessment methods and techniques.	Chapters 2
To investigate the existing situation of Iran in terms of sustainable built environment development	Chapter 3
To explore the urban sustainability assessment mechanisms in Iran	Chapter 5
To develop / propose a systematic sustainability assessment mechanism in an Iranian context with a comprehensive plan of an integrated indicator system, data sources and assessment techniques.	Chapter 5, 7
To re-assess the interim suggestions and draw final conclusion of the study	Chapters 6, 7

7.3 Research limitations

The study preliminary aimed at developing a system for urban sustainability evaluation in Iran and testing the scheme through a specific case study at the neighbourhood level. However through the investigations, the scope of research and the obstacles to data collection for the purpose of testing the proposed system were considered critical. Through data gathering procedures in Iran, it was recognised that identifying the gaps in literature and enhancing principles, theories and frameworks of the urban sustainability assessment mechanisms to tackle the existing issues from a theoretical perspective, is even more useful to the knowledge basis rather than developing a new tool which will not be testable due to scarcity of existing data, complicated process of data gathering and the large scale of the research boundaries. Therefore, experiencing the limitations and challenges of data gathering process in early stages of the research in Iran, made the researcher and supervisory team rethink of the research aims and objectives. It changed the empirical nature of the research to a more rhetoric and theoretical characteristics. To this end, the probe into existing assessment systems used / developed / underdeveloped / suggested in Iran became the subject of the study. These assessment methods were discovered through conducting a survey of 33 local authorities and government departments across Iran's capital. Consequently, this, as explained earlier in Chapter 5, led to suggesting an urban sustainability assessment framework for Iran.

Through the process of the research investigation, it was planned to hold a seminar in Iran during summer 2015 to represent the research questions, to discuss the research findings, and to collect initial feedback from the participants. The workshop was held in Tehran in September 2nd, 2015 through the efforts of the Tehran-based research advisor, in collaboration between University of West London and Andisheh New Town Development Company (under the Ministry of Road and Urban Development). The experience of holding a workshop in Iran revealed the fact that the research topic was completely new to the majority of participants. It matters not to underestimate the problems and challenges of holding seminars and workshops: the problems of organising meetings which all participants in a project can attend, of negotiating a research agenda, of reaching agreement on approaches and definitions and of ensuring that they are observed. This situation led the researcher to put effort into using the questionnaire survey method instead, regarding collecting feedback from specific audience.

7.4 Research contributions

This peculiar section tries to explain the suggestions this research may offer and provide the reader with its contributions to knowledge. This will be followed by recommendations for future works in the next section.

7.4.1 A suggestion for establishing a bottom-up organisational structure

In some developing countries including Iran, public awareness of the term urban sustainability is quite limited. Even among governmental bodies, developers and stakeholders there is a serious and often obvious lack of concern towards sustainable development. This is clearly a major challenge for sustainable development in Iran. The lack of a meaningful collaboration among academia, industries and local authorities in the process of research and development of sustainability assessment remains an issue. As a high-ranking official of the 'National Committee for Sustainable Development' – a government department which is involved in the policy making process – argued, academics have misinterpreted the situation, considering the fact that sustainability agendas are not a priority in Iran:

"On one side there are academics who see developed countries and think we need to implement all their agendas here. But we are in a situation in which those agendas are not a priority and a matter of importance. Therefore, in that sense, sustainable development could not really find its way in many developing countries."

Coming from one of the influential figures in policy making processes of sustainability agendas in Iran, as well as the other previously mentioned interviewees, the statement clearly reveals that the authorities and academics do provide quite different views on the necessity of implementation of sustainable development goals. Furthermore, as previously mentioned, "sustainable development still does not have an acceptable place in the planning structure of the country" (Naderi-Mahdei et al., 2015). It would be extremely laborious – if not impossible – to proceed with the sustainability agenda while those in charge do not consider it as a matter of great urgency. This research has identified that there is a serious need for a compelling bottom-up organisational structure to pursue the matter of urban sustainability with the aim of raising awareness among the general public and the authorities demanding palpable steps towards sustainable development goals.

Thus, it is suggested that the prominent higher education institutions (e.g. University of Tehran) in collaboration with researchers, scientists, practitioners, independent parties and NGOs, establish a scientifically robust and practically dynamic committee; which could be a kind of independent and non-governmental version of the stagnant NCSD, which is aimed at: (a) conducting research and development (R&D) in sustainable urban development, (b) raising public awareness about the notion of sustainable development and its necessity in this day and age, (c) suggesting sustainable solutions for the problematic environmental, social and economic issues of Iranian cities, (d) negotiating with the local authorities for possible collaborations, and most importantly (e) pressing the government for the appropriate actions.

It should be noted that such committee is inevitably required to engage with the general public through a well-established communicative approach including: launching a dedicated official website; employing popular social media platforms and multimedia instruments; conducting conferences, workshops, seminars and symposiums; producing leaflets, brochures, pamphlets; approaching digital and print media such as newspapers, magazines, blogs and so on. It is imperative to convey the message in a way that is precise and concise, simple and graphically presented, so it could reach out to a much wider audience. As previously mentioned, the authorities seems to find it difficult to completely ignore the situation, while issues become a matter of public concern (as happened in the case of Lake Urmia). Establishing such state of the art, non-governmental, research-led organisational structure comprising a wide range of disciplines from academics, to researchers and scientists, to practitioners, to activists and artists, could provide a platform to voice concerns about the fundamental urban sustainability issues that need to be considered a high priority.

7.4.2 A study on the current Iranian sustainability assessment systems

The primary aim of this study was to explore the existing urban sustainability assessment systems in Iran. So far most academic researches on urban sustainability assessment carried out in Iran have focused on analysing a phenomenon (neighbourhood / town / city) based on defined indicators drawn from several international guidelines. In this study the author has tried to shift the focus to examination of the existing national sustainability assessment methods developed by, or, in collaboration with the Iranian local authorities, so as to depict the situation of current urban sustainability assessment systems in Iran which has hitherto been non-existent in the body of Iranian literature. To this end, nine assessment methods have been identified through conducting a survey of 33 local authorities and the government departments and this has led to the conclusion that the present systems need to be substantially improved. Moreover, it has been observed that there is a lack of an integrated, comprehensive and systematic urban sustainability assessment method which would consider all three environmental, social and economic aspects of sustainable development. Also, through interviews conducted in Iran for the purpose of this study, it has been identified that the role of urban sustainability assessment in current planning processes is considerably insignificant. In a nutshell, the investigation of the current assessment systems developed and/or implemented, has tried to answer the where-does-Iran-stand question on dealing with the matter of urban sustainability assessment at official levels.

7.4.3 Developing an urban sustainability assessment model for Iran

Through a series of interviews and a questionnaire survey (with 64 participants including 40 respondents and 24 interviewees), this research has tried to approach scholars, academics and practitioners in the built environment discipline, as well as the local authorities and government officials, from advisors, to mayors, to heads of departments, to those who are involved in policy- and decision-making processes. The participants shared their experience and offered insights on the across-the-board issues that restrained the possibilities of achieving sustainability in Iran. Referring to Trudgill's *Barriers to a better environment* (Trudgill, 1990), Glasson (2007) mentions the acronym 'AKSTEP' as the potential constraints on the achievement of sustainability, which it reads: lack of Awareness, Knowledge, Social concern, appropriate Technology, Economic resources and Political will, all of which that have been also pointed out by the interviewees of this study. Therefore, identifying major obstacles (as discussed in Chapter 6), driven by the quintessential ingredients of the participants' insights and experience, could be a prerequisite for improvement, as Alberti (1996) rightly wrote: "… sustainability indicators will not affect policymaking unless there is consensus on how sustainability problems are defined and prioritized". The most noticeable issues raised, are as follows:

Urban mismanagement
Misleading planning
Anti-environmental planning
Incompetent managers
Lack of coordination
Mismanagement in planning and assessment process
Institutional problem
Lack of transparency
Government waste (unnecessary/extra organisations)
Failure of authoritarian structures
Cross-departmental communication
Implementation constraints
Excessive bureaucracy
Negligence of rules and regulations
Lack or weakness of executive powers
Lack of power and authority in decision making processes within the local councils and Regional Municipalities
Data problem
Unreliable data
Data unavailability (especially at the urban level)
Lack of data integrity
Issue of data impartiality
Lack of comprehensive and integrated databases
Lack of data transparency
Ambiguity of data confidentiality
The issue of 'freedom of information'
Authoritarian power influencing data
Obstacles for sustainable urban development
Conflict of interests due to existing oil-based economic structure
Lack of Research and Development
Ignoring sustainable solutions
Lack of robust NGOs / lack of support for NGOs
Lack of funding resources
Sustainability is not a priority for the authorities
Lack of plans and policies towards economic sustainability
Lack of constructive international communications
Poverty
High costs of sustainable technologies

Lack of infrastructures
Lack of consideration towards local communities and community-led planning
Lack of statutory regulations and protocols /policy/legislation
Negligence towards social issues / lack of appropriate social policies / lack of consideration for social development
Lack of public engagement and participation
Lack of trust between the public and authorities
Public awareness
Negligence of risk assessments
Lack of appropriate interrelationship between academia and the outside world: society / industry / authorities
Waste recycling issues

The diagram below (see Figure 7.1) schematically demonstrates the fundamental factors involved in the process of achieving sustainability. There should be a political will for a bold and dramatic change in the obsolete and inefficient urban managerial structure in Iran. This is an absolute prerequisite for any further development. Referring to the results of this study, 'data' and 'institutional management' are the most critical challenges in the process of the implementation of urban sustainability assessment in Iran (see Table 6.9). Therefore, it is vital that the authorities and their policy- and decision-making arms seek to move towards:

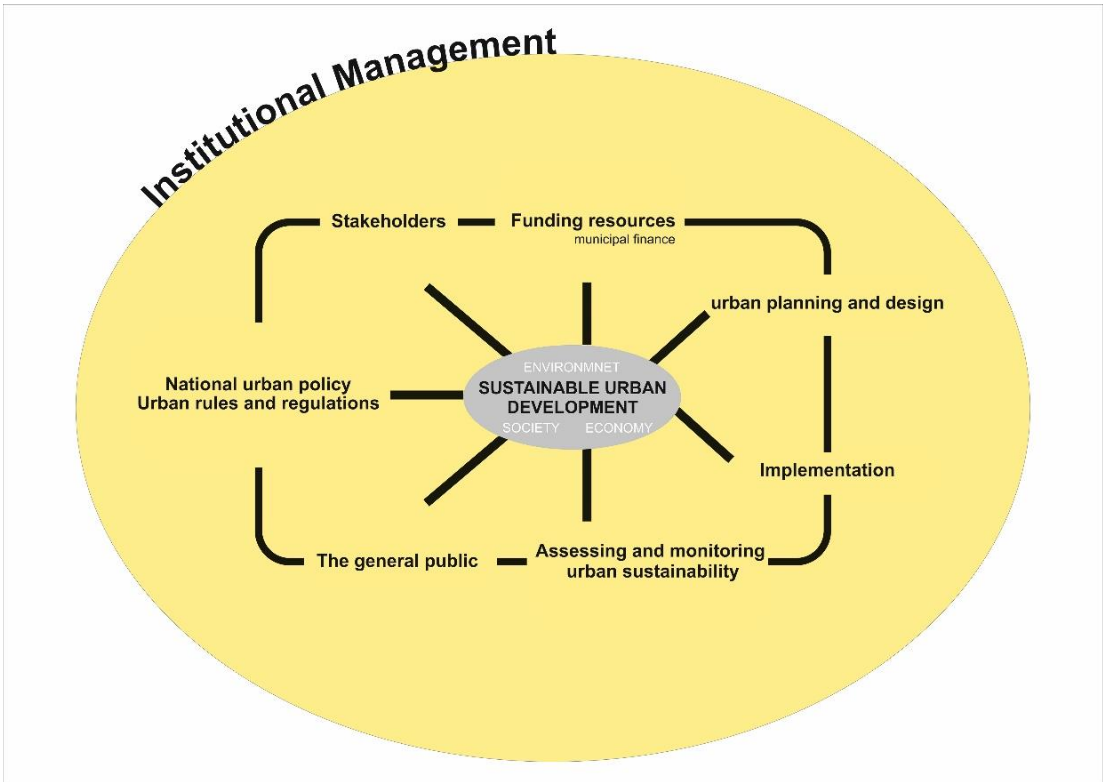


Figure 7.1: A schematic diagram of the fundamental factors involved in the process of achieving sustainability aims

- Improving the institutional context;
- Reforming the urban managerial structures so as to enhance the quality of urban management (e.g. by employing competent and knowledgeable managers;
- Defining appropriate urban policies, rules and regulations considering the sustainability aims;
- Refining municipal fiscal systems by developing more sustainable income approaches;
- Establishing integrated and comprehensive data banks within local authorities and different sectors of the government organisations;
- Enhancing cross-departmental communications;
- Improving data quality and availability;
- Providing suitable and reliable baseline data for all the dimensions of sustainability;
- Providing appropriate environmental, social and economic indicators for a sustainability strategy;
- Overcoming the methodological constraints involved in socio-economic and bio-physical issues/policies/integration.

Defining an urban sustainability indicator framework for Iran

As noted throughout this dissertation, indicators are the key instruments of sustainability assessment strategy. Without them there is nothing to be measured and monitored. Also, as mentioned earlier, the indicators should be S.M.A.R.T which means they should to be Specific, Measurable, Achievable/Acceptable, Reliable/Realistic and Time-bound (Olivier et al., 2013). Given the Iranian assessment systems, as explained above, it has been realised that there is an urgent need for development of a comprehensive indicator framework. Therefore, learning from the UK assessment systems coupled with exploring the existing Iranian ones, led the researcher to suggest a conclusive urban sustainability indicator set to be implemented in Iran. The framework introduces a hierarchical model comprising four levels of hierarchy: category

(C), headline indicator (HI), sub-indicator (SI), and measure (M) (see Figure 7.3). Measures are actual evaluators that are assessed by data either derived from existing data sources such as Census data, and governmental departments and organisations databases, or constructed from different sources. The evaluator may be assessed by applying a rating system based on experts' opinions. The set suggests 30 headlines comprising 164 measures that encompasses 9 environmental, 11 social, and 10 economic headline indicators with 72, 71, and 21 measures respectively (see Table 7.2).

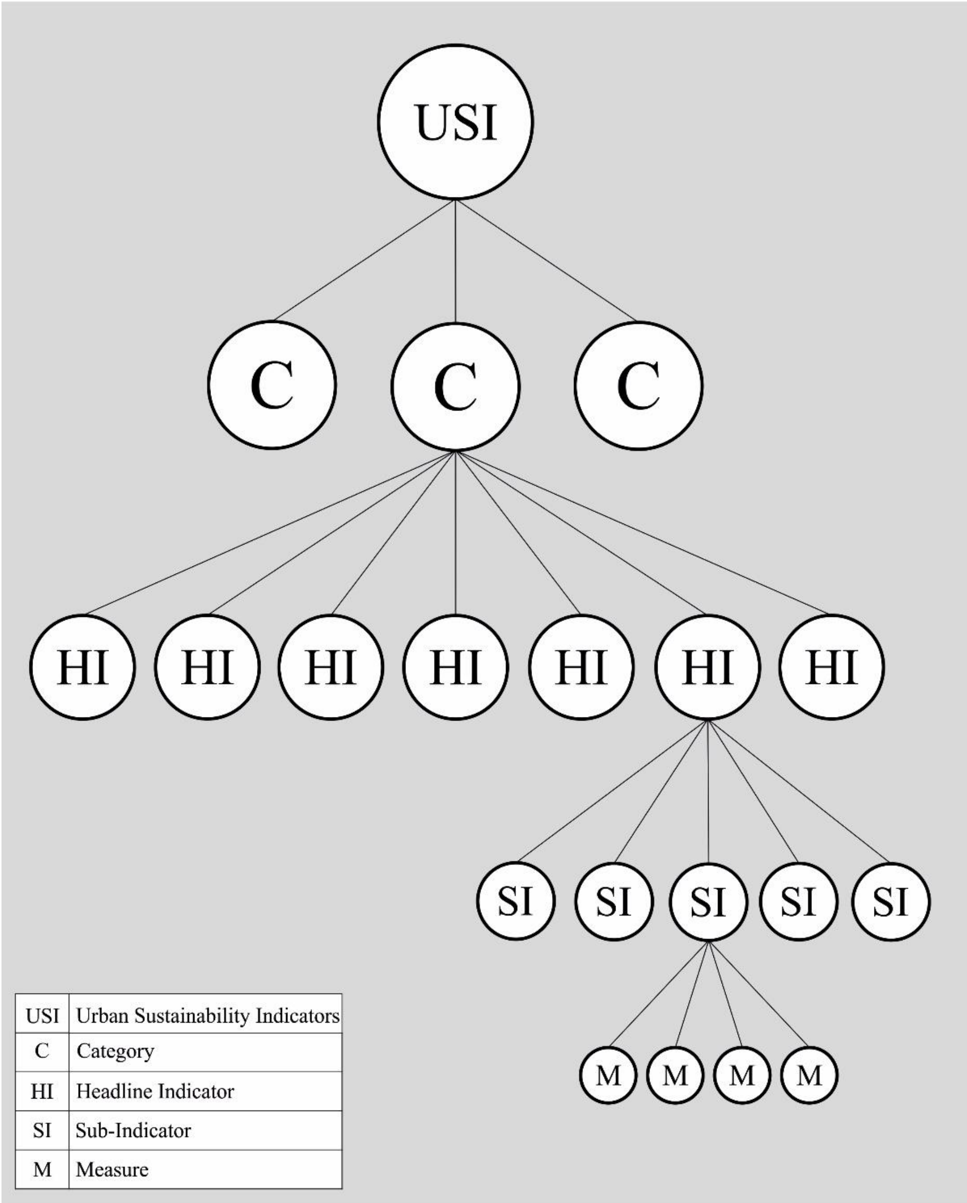


Figure 7.2: Hierarchical structure of the proposed Urban Sustainability Indicator Set

Table 7.2 The number of headline and sub-indicators for the proposed urban sustainability assessment indicator set

Urban Sustainability Indicator Set for Iran		
Category	**Headline Indicator (n)**	**Sub-Indicator (n)**
Environmental	9	72
Social	11	71
Economic	10	21
Total	**30**	**164**

As Figure 7.5 demonstrates, the environmental headline indicators include: air, water, soil and land, noise, waste, access to nature, traffic volume, natural disaster, and biodiversity. The headlines such as population, education, healthcare, housing and services, social safety and security, culture, life expectancy, satisfaction, transport, social capital, and ‘image of the city’ are incorporated within the ‘social’ category. Giving an example, the social headline: ‘social safety and security’ comprising four sub-indicators: crime, childcare, disability, and ‘form and space’, is evaluated based on the 12 defined measures. Figure 7.4 will give the reader an idea of how this hierarchical structure could work. It should be mentioned that the full set including 30 headlines and 164 measures, can be obtained from the appendices section (see Appendix 7.1).

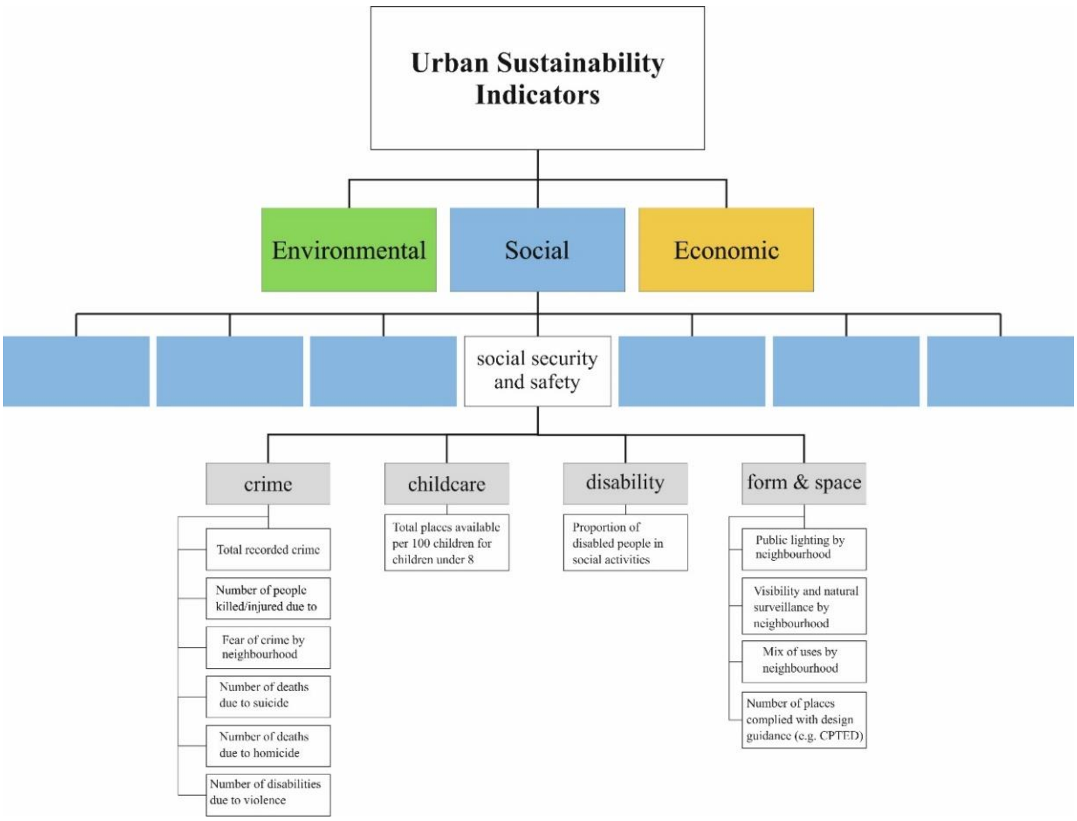


Figure 7.3: Hierarchical structure of the proposed Urban Sustainability Indicator Set: an example

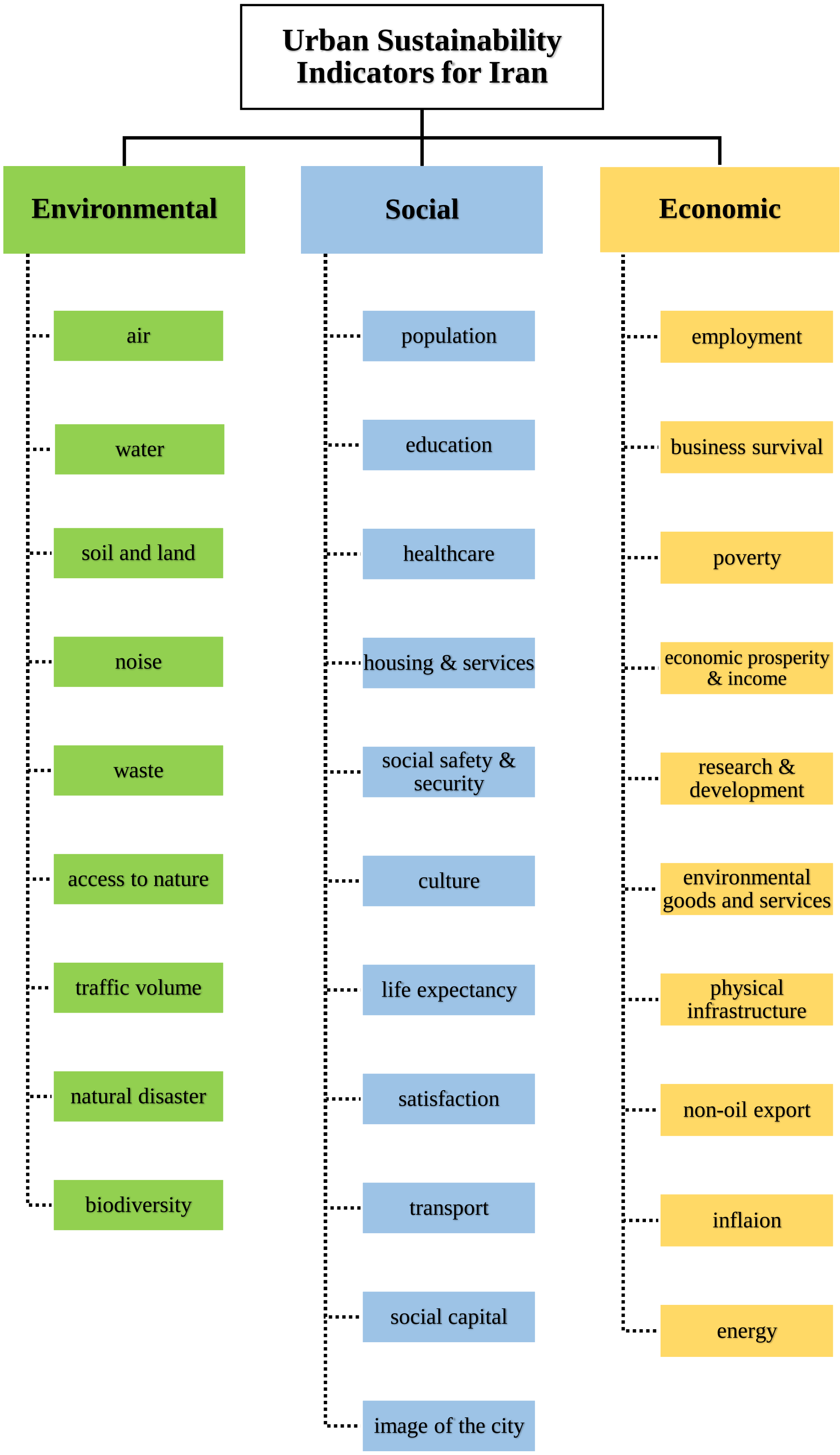


Figure 7.4. *Environmental, Social and Economic Headline Indicators for the proposed urban sustainability assessment indicator set*

The results of the assessment can be produced in form of a report, say, *The Urban Sustainability Assessment Report* which can be published every five years to point out the direction of change through time. The assessment can be carried out within different urban levels: neighbourhood, district (equivalent to 'borough' in England), as well as the city. The report needs to depict the outcomes of assessing individual indicators through descriptive tables, charts, histograms and so on. However for presenting the final outcome, a holistic circular SPeAR look-alike model diagram is suggested (see Figure 7.6). The model applies the same colour coding as the SPeAR, but with a different assessment rating vocabulary which is, in fact, inspired by the BREEAM. As shown in Table 7.3 the assessment results can be translated into a rating score in which the performance of urban sustainability is categorised into five levels of: excellent, good, fair, poor, and 'very poor'. The tool aggregates the scores for all the 'measures' within a 'headline indicator' and calculates the average of these scores to produce an overall rating of that specific headline. The ratings are displayed within wedges in a circle as different colors; from dark green (+2) as 'excellent' (best practice), to red (-2) as 'very poor' (worst case scenario) (see Table 7.3). Minimum standard (Fair) is set at a score of zero which represents a minimum regulatory compliance. It should be noted that the diagram does not offer a single figure solution. It is a graphical visualization of the sustainability of a phenomenon. It will explicitly demonstrate the strengths and weaknesses of the phenomenon and thus can be used to help decision- and policy-makers to focus on areas that need improvement. The diagram is conveniently readable as its user-friendliness and comprehensibility could make the outcome reach a much broader audience, so it can pave the way for raising public awareness about the sustainability performance of their neighbourhoods, towns and cities.

Table 7.3. Rating benchmarks for the proposed urban sustainability assessment Indicator Set

Colour code	Assessment rating	Score
(dark green)	Excellent	+2
(light green)	Good	+1
(yellow)	Fair	0
(orange)	Poor	-1
(red)	Very Poor	-2

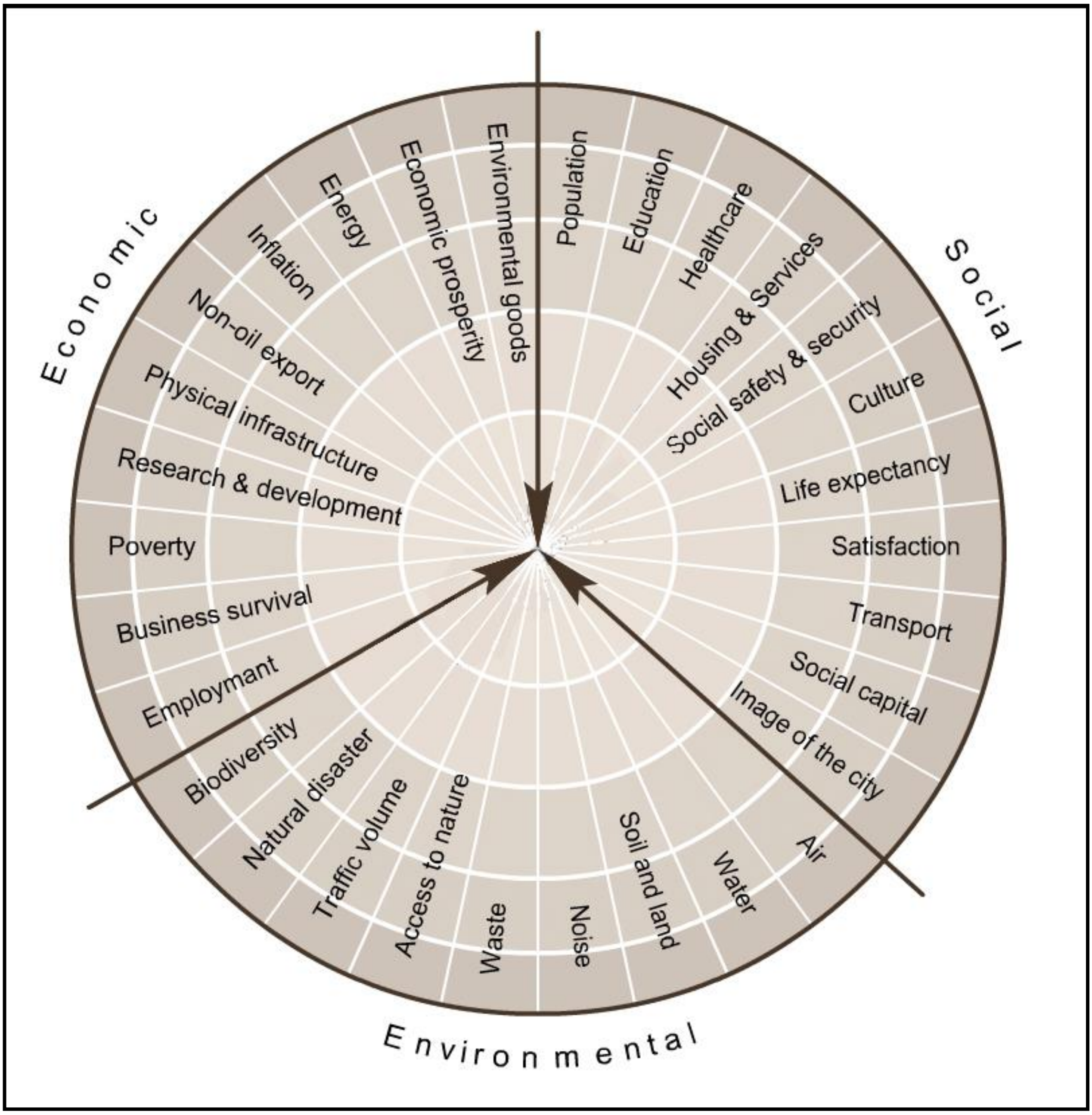


Figure 7.5. SPeAR look-alike diagram for presenting the assessment final results, illustrating the proposed 30 headline indicators

The figure below (Figure 7.7) demonstrates how the graphical presentation of an assessment final results may look like. The results are visualised through a single diagram that draws a holistic picture of the situation based on the abovementioned colour-coded rating system. The results also can be converted into the three circular diagrams to exhibit the environmental, social and economic states of sustainability separately. Figure 7.8 suggests the overall structural model of the proposed indicator set.

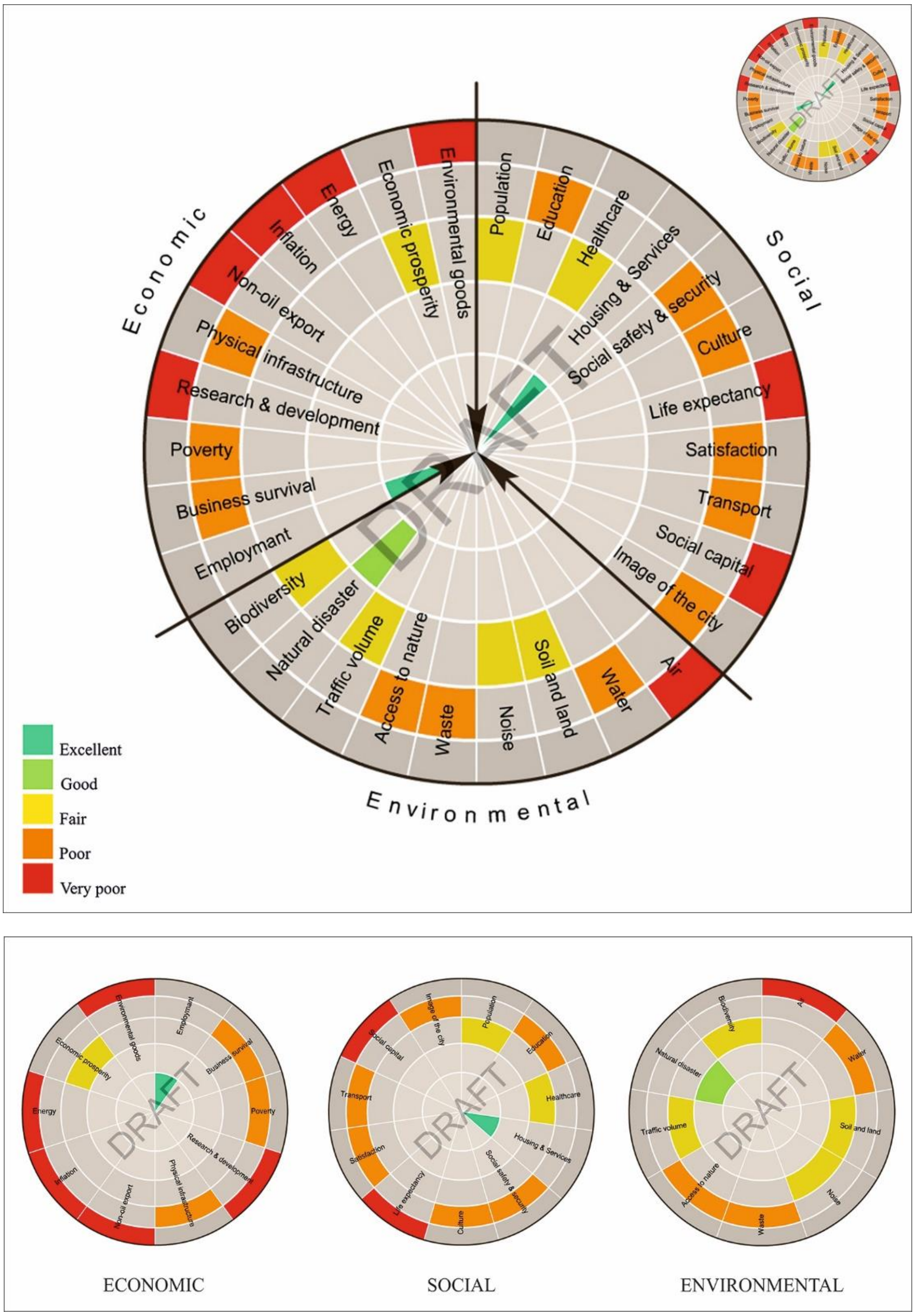
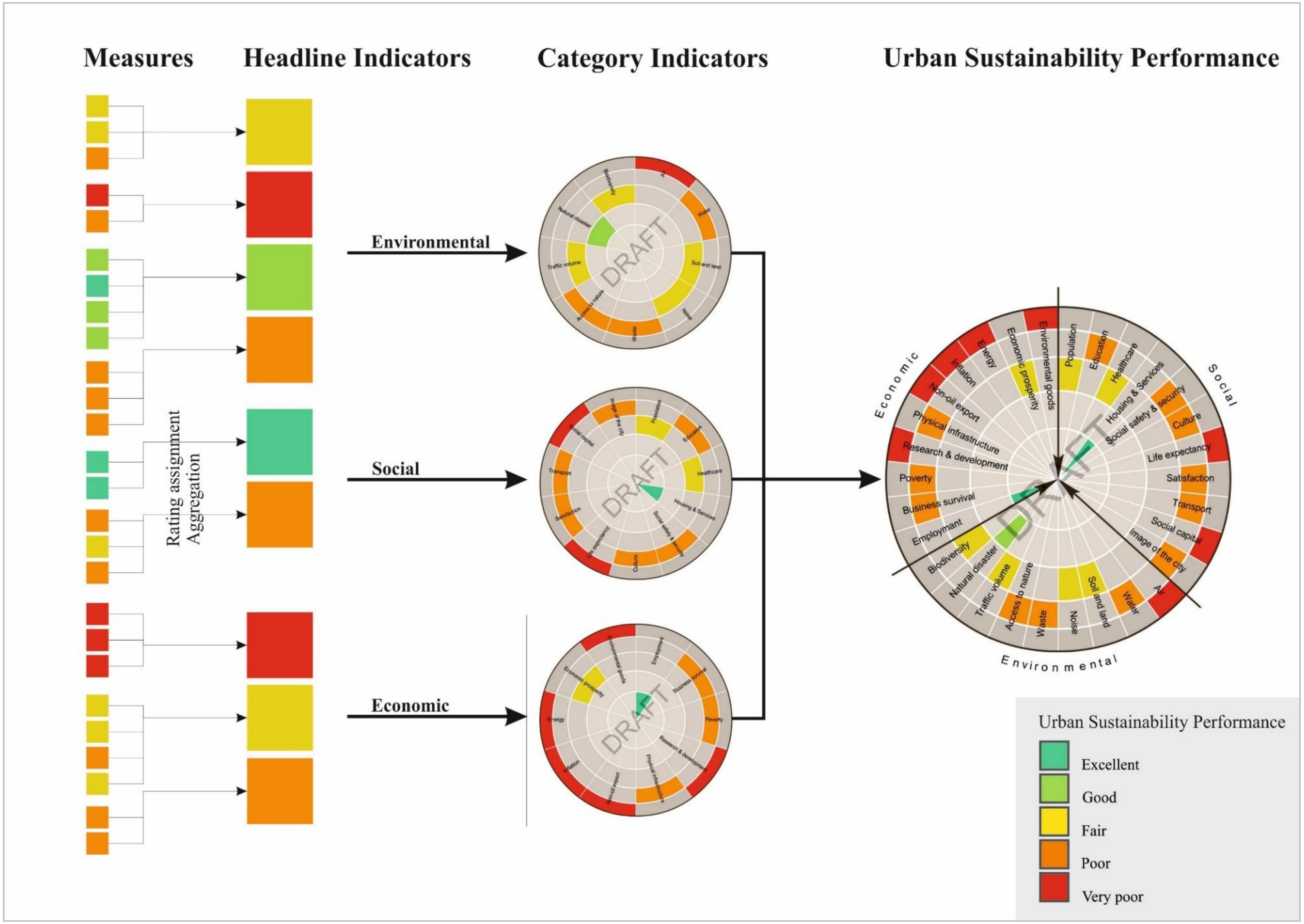


Figure 7.6. Example of merging the assessment final results into the SPeAR diagram

Figure 7.7: *The structural model of the proposed Urban Sustainability Indicator Set*



Although the current data infrastructure in Iran may fail to fully comply with the indicator set suggested, it has been imperative to introduce prospective indicators so as to, as Forward (2003) puts it, "act as a system of early warning", and also provide a platform for possible future developments. The assessment system this research has offered, aimed to theoretically enhance the quality of Iranian sustainability assessment methods by suggesting indicators that could address the notion of 'quality of life' especially from a sociocultural and economic points of view which noticeably lack in current assessment methods implemented or developed in Iran. In this vein, the framework could perform as a new set of guideline for stakeholders who are involved in the process of urban sustainability evaluation in Iran.

7.5 Recommendations for future work

Since this research has introduced a comprehensive urban sustainability framework for Iran, it is imperative to further this framework by testing it using case studies at different urban levels from neighbourhoods, to municipal districts, to regions, to cities. As noted above, such implementation is beyond the scope of a one-person research project and stimulates a high demand for human resources and funding facilities. To this end, the researcher tends to offer the urban sustainability assessment set proposed in this study to Iran's local authorities (e.g. Tehran Region 12 Municipality) to find out if there would be a possibility to implement the set using a specific case study. Therefore, a project needs to be defined by the local authority, titled, say, '*how sustainable is your neighbourhood/ district/ region/ city?*' It can be initially implemented at the lower levels such as neighbourhoods considering the obstacles such as budget and human resources. Based on the indicator set, the research team needs to establish a comprehensive and integrated database to clarify what kinds of data are already available and what is not. So, a '*no data available'* option can be added to the assessment report. In a broader perspective, the Ministry of Roads and Urban Development could initiate an *Urban Sustainability Assessment Act* to oblige local authorities and municipalities to carry out the evaluation across cities and report the outcome periodically.

It is said that any research may lead to findings that was not anticipated from the beginning. In this respect, analysing the questionnaire results, it was revealed that there can be a clear distinction between public and private sector actors on how they perceived the phenomenon. This can be pursued further by turning it into a potential research project to examine the role of public and private sector in the process of sustainable urban development or urban sustainability assessment in Iran, and to provide rationale to find out how and why the two rivals see things differently? This can lead to establish the diagnosis of their interrelationship and bridge the gap between the two, which can, conceivably, enhance the policy and decision-making processes and improve the implementation procedures.

Throughout the formation of the thesis, it was understood that one of the research questions – which is: 'How urban sustainability assessment can improve urban planning in Iran?' – can be also the subject for future study. Although the question has been addressed in chapters 3 and 5, it appeared that it could be a moving spirit behind development of a novel research proposal for Iran: '*Assessment-led planning: the role of sustainability measures in urban planning and design in Iran'*. Hence, the research will focus on the idea of how to transform the evaluation outcome into the solutions for improving cities.

7.6 Lessons learnt

The big lesson of this study for its researcher was the fact that facing challenges and meeting hindrances could be a natural part of a research process. As previously discussed in section 7.3: 'research limitations', the researcher faced challenges that shifted the research direction and encountered unexpected obstacles that, to some extent, effected the methods of data collection. These appeared to be nothing uncommon in a research process.

Learning from the experience, what the author of these lines may suggest to researchers and scholars who tend to select Iran as the major case study of their research, is that they need to consider and be prepared for the challenges in, and complexities of the processes of data collection in this country, especially when the sources of data are in the hands of local authorities and governmental bodies.

7.7 A final word

Warning bells have already rung and the necessity for 'urban sustainability' has permeated all-over the globe. Developing countries – more specifically, cities in developing countries – are in an even more critical condition. In 2013, eight of the top ten most populated cities in the world were located in developing countries (UN, 2014). Rapid urbanisation and its consequential effects – such as population explosion, irresponsible consumerism, environmental pollution, market-based urban development and the focus of cities on cars and concrete rather than their citizens and environment – in many developing countries, has put pressure on the cities and the supporting ecological systems (Von Haaren and Albert, 2011). There is surely a big question mark hanging over the future of cities of the global south.

Cities are ‘living organisms’. They work like a human body. They could become critically ill and afflicted. No doubt, giving a clear and accurate diagnosis will increase the chance of treatment. Sustainability assessment is not remedy as such, but it is definitely a means of diagnosis. Urban sustainability measurement is all about understanding the quality of cities’ performance. It is a means of raising awareness about cities’ environmental and socioeconomic conditions in which all segments of society, however, on different scales, are involved. The sustainability assessment outcomes could uncover the situation of the phenomenon defined. In a nutshell, sustainability evaluation results demonstrate that to what extent urban policies and legislations introduced, have been able to function effectively. They tend to explain the condition of the city by simply asking questions such as: how clean is the air we breathe and the water we drink? How much energy does the city swallow to keep running? How responsibly is the city protecting its flora and fauna, its land, its culture and history? How prepared is it for the events of natural disasters? How safe its streets are? How prosper, healthy and educated its citizens live? And many questions alike. Systematically and accurately responding to such queries by employing assessment mechanisms, could possibly lead to establishing a SWOT kind of analysis of the phenomenon and provide decision makers with solutions to the convoluted socioeconomic and environmental dilemmas cities face today.

To this end, developing the rightly and reliable indicators to be measured according to appropriate and precise data, is indispensable. This study aimed to play a part in this complex and multifaceted process, paving the way for further actions required to fully implement the urban sustainability assessment agenda in Iran. It is necessary for the Iranian authorities in charge, to realise that urban sustainability assessment is not a mere ‘check and tick box’ kind of process. It would be utterly idle if the assessment outcome could not find its way into the predominantly closed-door convocations in which decisions are made and policies are developed. The complexity of the bureaucratic structure of urban management in Iran creates a vast gap between regulations and implementation. Despite efforts in both public and private sectors, some respected establishment figures and high-profile officials now warn of the devastating effects of current levels of market-based and politically-charged urban development. Since high profits do not necessarily imply efficiency, policymakers should strengthen the contribution of social and environmental matters to the planning process and decision-making procedures. Implementation of such policies and regulations is even more fundamental concerning the local conditions in Iran. Refining implementation methods and procedures and assessing and monitoring projects within all stages of design, construction and performance could significantly influence the current situation. It is perhaps safe to say that what is comprehensively missing in Iranian urban management today is an independent powerful leadership.

References

Abbaspour, M., Karbassi, A., Khalaji Asadi, M., Moharamnejad, N., Khadivi, S., and Ali Moradi, M. (2013) Energy demand model of the household sector and its application in developing metropolitan cities (case study: Tehran). *Polish Journal of Environmental Studies* 22(2), p. 319–329.

Adinyira, E., Oteng-Seifah, S. and Adjei-Kumi, T. (2007) A review of urban sustainability assessment methodologies, In: Horner, M., Hardcastle, C., Price, A., and Bebbington, J. (eds). *First International Conference on Whole Life Urban Sustainability and its Assessment held at Glasgow Caledonian University*, Glasgow, Scotland, 27-29 June 2007.

AECB: Association for Environment Conscious Building (2006) Minimising CO_2 emissions from new homes; a review of building regulations methodology: How much energy will actually be saved? AECB Report, February 2006.

Afary, J., Avery, P., and Mostofi, K. (2017) Iran, *Encyclopedia Britannica* [Online]. Available at: https://www.britannica.com/place/Iran.

Ahmadkhani Maleki, B. (2011) Traditional sustainable solutions in Iranian desert architecture to solve the energy problem. *International Journal on Technical and Physical Problems of Engineering* 3(6), p. 84–91.

AJ: The Architects' Journal (2000) *Arup takes aim at appraisals with SPeAR of sustainability*. The Architects' Journal. 3 August 2000. [Online]. Available at: www.architectsjournal.co.uk.

Alberti, M (1996) Measuring Urban Sustainability. *Environmental Impact Assessment Review.* 16, p.381–424.

Alizadeh, A., and Keshavarz, A. (2005) Status of agricultural water use in Iran. Water Conservation, Reuse, and Recycling: Proceedings of an Iranian-American Workshop. National Academies Press, Washington DC, USA, p. 94–105.

Almonitor (2014), *Iran-Iraq battlefield tours spark controversy in Iran*, Almonitor. 1 April 2014. [Online]. Available at: www.al-monitor.com/pulse/ar/originals/2014/04/iran-iraq-war-battlefield-tours-indoctrination-fatalities.html

Amatriain, X., Lathia, N., Pujol, J., Kwak, H., and Oliver, N. (2009) The Wisdom of the Few: A Collaborative Filtering Approach Based on Expert Opinions from the Web. *Proceedings of the 32nd Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, SIGIR 2009.* Boston, MA, United States, p. 532–539.

Andalib, A., Daneshpour, A., Kazemian, G., Zaker Haghighi, K. and Matavaf, S. (2010) Tehran New Detailed Plan (Approval 2007), Tehran Urban Development and Planning Department Reports (Report 2) (in Farsi). [Online]. Available at: http://www.trudo.ir/.

Anjaneyulu, Y., and Manickam, V. (2007) Environmental Impact Assessment Methodologies (2nd edn.). Heyderabad, India: B.S. Publications.

AoTM: Atlas of Tehran Metropolis (2014) Population Increase in Tehran Districts. [Online]. Available at: http://atlas.tehran.ir/Default.aspx? tabid=264.

AQCC: Air Quality Control Company (2014). *Tehran Annual Air Quality Report, Period of March 2013 – Feb 2014* (in Farsi). Tehran, Iran. Tehran Municipality Publication. [Online]. Available at: http://air.tehran.ir/portals/0/ReportFiles/AirPollution/New/24.pdf

AQCC: Air Quality Control Company (2015). *Air and Noise Pollution Reports of Tehran's Municipal Regions: Region 4* (in Farsi). [Online]. Available at: http://air.tehran.ir/portals/0/ReportFiles/Manategh/02.pdf.

AQCC: Air Quality Control Company (2016). *Tehran Annual Air Quality Report, Period of March 2015 – March 2016* (in Farsi). Tehran, Nashr-e Shahr Publication. [Online]. Available at: http://air.tehran.ir/portals/0/ReportFiles/AirPollution/New/39.pdf.

AQCC: Air Quality Control Company (2017) *Tehran's air [quality] management is still in the hand of the wind (*in Farsi). AQCC website, 17 April. [Online]. Available at: http://air.tehran.ir

Arjomand Kermani, A., and Luiten, E. (2009) Sustainable urban planning in Iran. Proceedings of SUE-MoT Conference, 2nd International Conference on Whole Life Urban Sustainability and its Assessment, Loughborough, UK, p. 322–335.

Arminio, J., and Hultgren, F. (2002) Breaking out of the shadow: The question of criteria in qualitive research. *The Journal Of College Student Development* (Special Edition on Critical Issues in Qualitive Research), *43* (4): 446-460.

Arnove, R. F., Kelly, G. P., and Altbach, P. G. (1982) Approaches and perspectives. In: Altbach, Philip G., Arnove, Robert F. & Kelly, Gail P. (Eds.) *Comparative education*. New York: Macmillan; London: Collier Macmillan: 3-11.

Arup (2012) *SPeAR Handbook 2012.* [Online]. Available at: https://www.oasys-software.com/media/Manuals/Latest_Manuals/SPeAR_Manual.pdf.

Asadi Asad Abad, M., Baghban Taraghdari, M., Shirali, M., Mohagheghzadeh, F., and Abdollahian, H. (2012) Development of biomass energy in Iran. *International Journal of Advanced Scientific and Technical Research* 1(2), p. 235–241.

Asadi-Lari, M., Vaez-Mahdavi, M., Faghihzadeh, S., Montazeri, A., Farshad, A., Kalantari, N., Maher, A., Golmakani, M., Salehi, G., Motevallian, A., and Malek-Afzali, H. (2010) The application of urban health equity assessment and response tool (Urban HEART) in Tehran; concepts and framework. *Medical Journal of the Islamic Republic of Iran*. 24(3). pp. 175-185.

Aspinall, S., Sertyesilisik, B., Sourani, A., and Tunstall, A. (2012) How Accurately Does Breeam Measure Sustainability? *Creative Education,* l.3, p. 1–8. [Online]. Available at: www.SciRP.org/journal/ce.

Atkinson P, Coffey A, Delamont S (2001) A debate about our canon. Qualitative Research, 1 (1): 5-21.

Bâc, D. P. (2008) A history of the concept of sustainable development: literature review. *Annals of the University of Oradea, Economic Science Series*, 17(2), p.581-585. [Online]. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.532.7232&rep=rep1&type=pdf

Badri, S., and Eftekhari, A. (2003) Sustainability assessment: thoughts and methods (in Farsi). *Geographic Research*, 18(2), p. 9–34.

Badri, S., and Eftekhari, A. (2003) Sustainability assessment: thoughts and methods (in Farsi). *Geographic Research* 18(2), p 9–34.

Baktash, P. (2003) National and Regional Spatial Data Infrastructure (NSDI & RSDI) and National Cartographic Center of Iran's Activities about it. In: *The 2nd FIG Regional Conference*, Marrakech, Morocco, December 2-5, 2003. [Online]. Available at: www.fig.net/resources/proceedings/fig_proceedings/morocco/proceedings/TS2/TS2_6_baktash.pdf

Banihashemi Namini, S., Shakouri, M., Tahmasebi, M., and Preece, C. (2013) Managerial sustainability assessment tool for Iran's buildings. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability*, 167(1), p. 12–23, [Online]. Available at: http://dx.doi.org/10.1680/ensu.12.00041.

Banihashemi-Namini S, Shakouri M, Tahmasebi M and Preece C (2013) Managerial sustainability assessment tool for Iran's buildings. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* 167(1), p.12–23.

BBC Persian (2017) ''Nearly three million people' are addicted in Iran' (in Farsi). BBC Persian, 25 June. [Online]. Available at: http://www.bbc.com/persian/iran-40400293

Beatley, T. (2000) *Green Urbanism: Learning from European Cities*. Washington, D.C.: Island Press.

Bhabha, H.K. (1994) *The Location of Culture*. London and Ney York: Routledge.

Bird, D.K. (2009) The use of questionnaires for acquiring information on public perception of natural hazards and risk mitigation – a review of current knowledge and practice. *Natural Hazards and Earth System Sciences*, 9, p.1307–1325. [Online]. Available at: www.nat-hazards-earth-syst-sci.net/9/1307/2009/

Booth, P., and Kidd, S. (2015) Greater London Archaeological Priority Area Guidelines. Greater London Archaeological Advisory Service, London: Historic England. [Online]. Available at: www.londonfirst.co.uk/wp-content/uploads/2015/06/Archaeological-Priority-Area-Guidelines-v2-15-June2015.pdf

BOS: Bristol Online Survey (2017) BOS: The online survey tool designed for academic research, education and public sector organizations. University of Bristol, [Online]. Available at: https://www.onlinesurveys.ac.uk/

Boulding, K. E. (1966) *Economic Analysis.* New York: Harper and Row.

Brabham, D. C. (2009) Crowdsourcing the public participation process for planning projects. *Planning Theory*, 8 (3), p. 242–262.

Brandon, P. S., and Lombardi, P. L. (2011) *Evaluating sustainable development in the built environment, 2nd edn.* Oxford, UK: Blackwell Publishing.

BRE: Building Research Establishment (2005) *Guide to the Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP)*. [Online]. Available at: http://projects.bre.co.uk/sap2005/pdf/SAP-Guidance-document.pdf.

BRE: Building Research Establishment (2012) *BREEAM Communities: Technical Manual.* BRE Global Ltd. [Online]. Available at: www.breeam.com.

BRE: Building Research Establishment (2014a) *BREEAM UK New Construction; Non-Domestic Buildings: Technical Manual.* BRE Global Ltd. [Online]. Available at: www.breeam.com.

BRE: Building Research Establishment (2014b) *The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 2012 version 9.92.* [Online]. Available at: https://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf.

BRE: Building Research Establishment (2015) *Home Quality Mark Technical Manual*. BRE Global Ltd. [Online]. Available at: www.homequalitymark.com/filelibrary/HQM--December-2015-.pdf.

BRE: Building Research Establishment (2016) *BREEAM In-Use International: Technical Manual.* BRE Global Ltd. [Online]. Available at: www.breeam.com.

BRE: Building Research Establishment (2017a) *1921-2011: ninety years of building research*. [Online]. Available at: www.bregroup.com/about-us/our-history.

BRE: Building Research Establishment (2017b) *BREEAM in numbers*. [Online]. Available at: www.breeam.com/uk.

BRE: Building Research Establishment (2017c) *Housing Standards Review*. [Online]. Available at: www.breeam.com/uk.

BRE: Building Research Establishment (2017d) *Approved software for SAP 2012*. [Online]. Available at: https://www.bre.co.uk/filelibrary/SAP/2012/SAP2012_9-92_software.pdf.

Breen, J.M. (2008) John Paul II, the Structures of Sin and the Limits of Law**.** *St. Louis University Law Journal,* Vol. 52, p. 317–374.

Briassoulis, H. (2001). Sustainable Development and its Indicators: Through a (Planner's) Glass Darkly. *Journal of Environmental Planning and Management,* 44(3), p. 409-427.

Bryman, A. (2008) *Social research methods*. Oxford: Oxford University Press.

Bulmer, M. (2004) Questionnaires. In: Bulmer, M. (ed.), *Social Science Research Methods,* London: Sage Publications.

Burnard, P. (1991) A method of analysing interview transcripts in qualitative research. *Nurse Education Today,* 11, p.461–466.

Cabinet Office and Maude, F. (2010) Government removes barrier to public data use. Crown copyright. [Online]. Available at: https://www.gov.uk/government/news/government-removes-barrier-to-public-data-use

Cai, L., and Zhu, Y. (2015). The Challenges of Data Quality and Data Quality Assessment in the Big Data Era. *Data Science Journal*. 14 (2), p. 1–10. [Online]. Available at: http://datascience.codata.org/article/10.5334/dsj-2015-002/

Carley, M., Jenkins, P., and Smith, H., (eds) (2001) *Urban development and civil society: the role of communities in sustainable cities*. London and Sterling: Earthscan.

CCSD: Cambridge Centre for Sustainable Development (2014) Energy Efficiency in the Built Environment Research Programme. [Online]. Available at: http://www-csd.eng.cam.ac.uk/themes0/ energy-demand/energy.

CEC: Commission of the European Communities (1985). On the assessment of the effects of certain public and private projects on the environment. *Official Journal*. Commission for the European Communities, Brussels, 5 June 1985.

CEC: Commission of the European Communities (1993). Report from the Commission of Implementation of the Directive 85/3373/EEC on the assessment of the effects of certain public and private projects on the environment. COM (93). 28 Final. Commission for the European Communities, Brussels.

CEC: Commission of the European Communities (2001). Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment. [Online]. Available at: ttp://europa.eu.int/comm/environment/eia.

CH: Computer Hope (2017) Excel. [Online]. Available at: https://www.computerhope.com/jargon/e/excel.htm

Clough, D. J. (1984) *Decisions in public and private sectors: theories, practices and processes*, New Jersey: Prentice-Hall Inc.

Cohen, M., Wiek, A., Kay, B., and Harlow, J. (2015) Aligning Public Participation to Stakeholders' Sustainability Literacy—A Case Study on Sustainable Urban Development in Phoenix, Arizona. *Sustainability*, 7, p. 8709–8728. [Online]. Available at: www.mdpi.com/journal/sustainability

Cole, F. L. (1988) Content analysis: process and application. *Clinical Nurse Specialist*. 2(1), p. 53–57.

Comito, J., and Wolseth, J. (2012) *Watershed-based Community Assessments Key Components to Successful Watershed Improvement Projects*. Iowa State University. [Online]. Available at: https://www.iowalearningfarms.org/content/watershed-based-community-assessments

Creswell, JW. (2003) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (2nd ed.).* Thousand Oaks, CA: SAGE Publications.

Croasmun, J. T., and Ostrom, L. (2011) Using Likert-Type Scales in the Social Sciences. *Journal of Adult Education*. Mountain Plains Adult Education Association. 40(1), p.19–22.

Crown copyright (2000) Freedom of Information Act 2000. [Online]. Available at: http://www.legislation.gov.uk/ukpga/2000/36/pdfs/ukpga_20000036_en.pdf

Curtiss, R. (1996) Iran's 5,000 Years of Recorded History. *Washington Report on Middle East Affairs*, April 1996, p.83-85. [Online]. Available at: https://www.washingtonreport.me

Dam, S. (2006), Legal Systems as Cultural Rights: A Rights' Based Approach to Traditional Legal Systems Under the Indian Constitution**.** *Indiana International & Comparative Law Review*, 16 (2), p. 295-335.

Davies, S., Selin, C., Gano, G., and Guimarães Pereira, Â. (2012) Citizen engagement and urban change: Three case studies of material deliberation. *Cities*, 29 (6), p.351-357. [Online]. Available at: http://www.sciencedirect.com/science/article/pii/S0264275111001417?via%3Dihub

Davison, F. (1996) Planning for performance: requirements for sustainable development. *Habitat International*, 20(3), p.445-462.

DBEIS: Department for Business, Energy & Industrial Strategy (2014) *Guidance; Standard Assessment Procedure*. [Online]. Available at: https://www.gov.uk.

DCLG (2010a) *Code for Sustainable Homes; Technical Guide.* Department for Communities and Local Government. [Online]. Available at: www.gov.uk.

DCLG (2010b) *The English Indices of Deprivation 2010.* Department for Communities and Local Government. [Online]. Available at: www.gov.uk.

DCLG (2014) *Tree Preservation Orders and trees in conservation areas.* Department for Communities and Local Government. [Online]. Available at: www.gov.uk/guidance/tree-preservation-orders-and-trees-in-conservation-areas

DCLG (2015) *The English Indices of Deprivation 2015.* Department for Communities and Local Government. [Online]. Available at: www.gov.uk.

DCLG: Department for Communities and Local Government (2014) Guidance: Environmental Impact Assessment (EIA Regulations 2011). [Online]. Available at: https://www.gov.uk/guidance/environmental-impact-assessment.

Deakin M, Michell G, Peter N and Vreeker R (eds). (2007). *The Sustainable Urban Development Volume2, The Environmental Assessment Method.* London and New York: Routledge.

Deakin, M., Mitchell, G., Nijkamp, P., and Vreeker, R. (2007) *Sustainable Urban Development Volume 2: The Environmental Assessment Methods,* New York: Routledge.

Dempsey, N., Bramley, G., Power, S., and Brown, C. (2011) The social dimension of sustainable development: Defining urban social sustainability. *Sustainable Development*, 19(5), p. 289–300.

Denzin N.K & Lincoln Y.S (2005) *THE SAGE Handbook of Qualitative Research* (3rd edn). CA, USA: Sage Publication.

DETR: Department of the Environment, Transport and the Regions (2000) *The English Indices of Deprivation 2000.* Department of the Environment, Transport and the Regions [Online]. Available at: http://webarchive.nationalarchives.gov.uk

Devuyst, D. (1998) *Duurzaamheidsbeoordeling.* (Sustainability Assessment) Report of the Environmental Impact Assessment Center. Brussels: Human Ecology Department, Vrije Universiteit Brussel.

Devuyst, D. (2000) Linking impact assessment and sustainable development at the local level: the introduction of sustainability assessment systems. *Sustainable Development 8*(2), p. 67–78.

Devuyst, D. (2001) Sustainability Assessment at the Local Level. In: Devuyst, D., Hens, L., and De Lannoy, W. (eds.). *How Green Is the City? Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press, p. 175–206.

Devuyst, D., Hens, L., and De Lannoy, W. (eds.) (2001) *How Green Is the City? Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press.

Dijck, J.V. and Poell, T. (2015) Social Media and the Transformation of Public Space. *Social Media + Society,* 1(2), p.1–5. [Online]. Available at: http://journals.sagepub.com/doi/10.1177/2056305115622482

DoE, Department of Environment (2004), Iran State of Environment Report (in Farsi), Limited publication for official use only.

DoE: Department of Environment (1992) *Development plans and regional planning guidance.* PPG12. Department of the Environment. London: HMSO.

DoE: Department of Environment (1993) *Environmental appraisal of development plans: a good practice guide.* London: Department of the Environment.

Defra: Department for Environment, Food and Rural Affairs (2013) Sustainable Development Indicators. [Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/223992/0_SDIs_final__2_.pdf

DoE: Department of Environment (2013) The History of EIA Bureau (in Farsi). [Online]. Available at: http://www.doe.ir.

DoE: Department of Environment (2014). Set of Indicators for Environmental Sustainability. [Unpublished manuscript].

Dovers, S. (2002) Too deep a SEA? Strategic environmental assessment in the era of sustainability. In: Marsden, S. and Dovers, S. (eds.). *Strategic Environmental Assessment in Australasia*, Leichhardt, NSW: The Federation Press.

Edwards, R. and Holland, J. (2013) *What is qualitative interviewing*. London and NYC: Bloomsbury Publishing.

EEA (European Environment Agency) (2014) *Digest of EEA indicators 2014*. EEA Technical Report, No 8/2014. Luxembourg: Publications Office of the European Union. [Online]. Available at: www.eea.europa.eu/publications/digest-of-eea-indicators-2014.

EFILWC: European Foundation for the Improvement of Living and Working Conditions (2004) *Quality of life in Europe: First European Quality of Life Survey 2003*. Luxembourg: Office for Official Publications of the European Communities.

Eiraji, J., and Akbari, Namdar. S (2011) Sustainable systems in Iranian traditional architecture. International Conference on Green Buildings and Sustainable Cities, Bologna, Italy, Procedia Engineering, 21, p. 553–559.

Elo, S., and Kyngas, H. (2008) The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), p.107–115. [Online]. Available at: 10.1111/j.1365-2648.2007.04569.x

Espinosa J, Friedman J, Yevenes C. (2014). Adverse Shocks and Economic Insecurity: Evidence from Chile and Mexico. *Rev. Income Wealth*, 60 (Suppl. S1), S141–S158.

Evans, N. (2011) Lost in Translation? – The Bristol Accord and the Sustainable Communities Agenda. *The European Journal of Spatial Development*, Nordregio, Nordic Centre for Spatial Development and OTB Research Institute, Delft University of Technology. [Online]. Available at: http://www.nordregio.se/Global/EJSD/Refereed%20articles/refereed44.pdf

Evered R & Louis M.R (1981). Alternative Perspectives in the Organizational Sciences: 'Inquiry from the Inside' and 'Inquiry from the Outside'. *Academy of Management Review,* 6 (3): 385-395.

Farahmandpour, B., Nasseri, I., and Jafari, H. (2008) Analysis of ultimate energy consumption by sector in Islamic Republic of Iran. Proceedings of 3rd IASME/WSEAS International Conference on Energy & Environment, Cambridge, UK, p. 151–157.

Fayaz, R., and Kari, B.M. (2009) Comparison of energy conservation building codes of Iran, Turkey, Germany, China, ISO 9164 and EN 832. *Applied Energy* 86(10), p. 1949–1955.

Ferrans, C. E. & Powers, M. J. (1985) Quality of life index: development and psychometric properties, *Advances in Nursing Science*, 8, p. 15–24.

Firouz, C. (2010) Iran Revives Planning Agency to Enact Economic Reforms. *Almonitor*, [Online]. Available at: http://www.al-monitor.com/pulse/fr/originals/ 2013/08/iran-planning-agency-revived-rouhani.html#

FNA (FARS News Agency) (2017) 'Launching FOI Pilot Website; Seven Ministries Are Yet To Be Joined' (in Farsi). FARS NEWS AGENCY, 9 June. [Online]. Available at: http://www.farsnews.com/newstext.php?nn=13960317001047

Forrest, A. (2017) We need to talk about urban regeneration. *The Guardian*, 10 June 2017. [Online]. Available at: https://www.theguardian.com/sustainable-business/2017/apr/10/urban-regeneration-affordability-communities-neighbourhoods

Forward, S. (2003) *State of the art report on Life Quality assessment in the field of transport and mobility.* Linkoeping, Sweden: Swedish National Road and Transport Research Institute. [Online]. Available at: http://www.factum.at/asi/download/ASI_D21_final.pdf

Forward, S. (2003) State of the art report on Life Quality assessment in the field of transport and mobility. Swedish National Road and Transport Research Institute. Linkoeping, Sweden. [Online]. Available at: www.factum.at/asi/download/ASI_D21_final.pdf.

Fotouhi, M. (1995) Geothermal development in Sabalan, Iran. Proceedings of World Geothermal Congress, Florence, Italy, p. 191–196.

Fotouhi, M., and Noorollahi, Y. (2000) Updated geothermal activities in Iran. Proceedings of World Geothermal Congress, Kyushu-Tohoku, Japan, p. 183–185.

Foy, C. (2001) The Iran Project: About Iran. [Online]. Available at: http://www.iranproject.org/iran/iran.html.

Fu, C. and Aouad, G. (2009) Data integration for quantitative analysis of sustainability, *Proceedings of the Institution of Civil Engineers: Urban Design and Planning*, 162(3), p.131–140.

Ganah, A., and John, G. (2014) Achieving level 2 BIM by 2016 in the UK. In: *Computing in Civil and Building Engineering* (Issa, R. and Flood, I. (eds.). Orlando, FL: ASCE, p.143–150.

Ghadimi, A. (2017) 'A question with multiple answers: how many unemployed does Iran have?' (in Farsi). BBC Persian, 23 April. [Online]. Available at: http://www.bbc.com/persian/iran-39684486

Gholizadeh, M. (2016) 'Multidimensional Poverty Under Iran's Skin: In Conversation With Behrooz Hadi Zenooz'. *Shargh Daily*, 17 October 2016, p.4. [Online]. Available at: http://www.magiran.com/ppdf/nppdf/2387/p0238727050041.pdf

Gibson, R. B., Hassan, S., Holtz, S., Tansey, J., and Whitelaw, G. (2005) *Sustainability Assessment: Criteria and Process*. London: Earthscan.

Gibson, R.B. (2006) Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic and ecological considerations in significant decision-making. *Journal of Environmental Assessment Policy and Management.* 8(3), p. 259–280.

Gil, J. and Duarte, J. P. (2013) Tools for evaluating the sustainability of urban design: a review. *Proceedings of the ICE - Urban Design and Planning*, 166(6), p. 311–325.

Girardet, H. (2010) *Regenerative Cities*. World Future Council, Hamburg: HafenCity University. [Online]. Available at: http://www.worldfuturecouncil.org/wp-content/uploads/2016/01/WFC_2010_Regenerative_Cities.pdf

Girardet, H. (2015). *Creating Regenerative Cities*. Oxon and New York: Routledge.

Glasson, J. (2007) Regional Planning and Sustainability Assessment. In: Dimitriou, H, and Thompson, R. (eds.) *Strategic Planning for Regional Development in the UK*. New York: Routledge, p.220–247.

Glasson, J., Therivel, R., and Chadwick, A. (2012) *Introduction to Environmental Impact Assessment (The Natural and Built Environment Series)*. 4th ed., Abingdon, UK: Routledge.

GOV.UK (2017) Ordnance Survey. Crown copyright. [Online]. Available at: https://www.gov.uk/government/organisations/ordnance-survey

Grober, U. (2007) *Deep roots – A conceptual history of 'sustainable development' (Nachhaltigkeit)*. Berlin: Wissenschaftszentrum Berlin für Sozialforschung.

Haapio, A. (2012) Towards sustainable urban communities. *Environmental Impact Assessment Review*, 32(1), p. 165–169.

Hadi-Zenooz, B. (2005) Poverty and Inequality of Income in Iran (in Farsi). *Social Welfare Quarterly*, 5(17), p. 165–206. [Online]. Available at: http://refahj.uswr.ac.ir/article-1-2118-en.pdf

Hafeznia, M., and Veicy, H. (2009) Consideration of local sub-councils in optimum urban governance, case study: local sub-councils of Tehran. Proceedings of 4th International Conference of the International Forum on Urbanism (IFoU), The New Urban Question – Urbanism beyond Neo-Liberalism, Amsterdam, the Netherlands, p. 1225–1228.

Hantrais L (2009) *International comparative research: theory, methods and practice*. Basingstoke (England): Palgrave Macmillan.

Hantrais, L. (1995) Comparative Research Method. *Social Research Update*, Issue13: University of Surrey. See http://sru.soc.surrey.ac.uk/SRU13.html

Hanusch, M. and Glasson, J. (2008) Much ado about SEA/SA monitoring: The performance of English Regional Spatial Strategies, and some German comparisons. *Environmental Impact Assessment Review*, 28. p.601–617.

Harris, L.R., and Brown, G.T.T (2010) Mixing interview and questionnaire methods: Practical problems in aligning data, *Practical Assessment, Research and Evaluation*, 15(1), p.1—19. [Online]. Available at: http://pareonline.net/pdf/v15n1.pdf

Hashemi, M. Mirgholami, M. and Rafieian, M. (2014) Women's satisfaction evaluation of women-only parks; the case of Tabriz, Iran (in Farsi). *Hoviat-e Shahr Journal*, 19, p. 49–62.

Herman, R., Ardekani, S.A., Govind, S. and Dona, E. (1988) 'The dynamic characterisation of cities', in J.H. Ausubel and R. Herman (eds) *Cities and Their Vital Systems: Infrastructure – Past, Present, and Future*, Washington D.C.: National Academy Press.

Hobbs, J. (2013) *Fundamentals of World Regional Geography, 3rd edn.* Belmont, CA: Brooks/Cole.

Holland, J., and Ramazanoglu, C. (1994) 'Coming to conclusions: power and interpretation in researching young women's sexuality', In: Maynard, M. and Purvis, J. (eds.) *Researching Women's Lives from a Feminist Perspective*, London: Taylor & Francis.

Hosseini, V. & Shahbazi, H. (2016) Urban Air Pollution in Iran. *Journal of the International Society for Iranian Studies*. 49 (6), p. 1029-1046. [Online]. Available at: http://dx.doi.org/10.1080/00210862.2016.1241587

Hsieh, H. F., and Shannon, S. (2005) Three approaches to qualitative content analysis. *Qualitative Health Research*, 15, p.1277–1288.

IEEO: Iran Energy Efficiency Organisation (SABA) (2010) Iran Energy Balances Report (in Farsi). [Online]. Available at: http://www.saba.org.ir.

IEEO: Iran Energy Efficiency Organisation (SABA) (2013) FAHAM. [Online]. Available at: http://www.iransg.com/en/home

IEMA: The Institute of Environmental Management and Assessment (2011) *Special Report: The State of Environmental Impact Assessment Practice in the UK.* Lincoln, England: Ruddocks. [Online]. Available at: www.iema.net.

IFCO: Iranian Fuel Conservation Company (2014) Energy Conservation is an International Responsibility. [Online]. Available at: http://www.ifco.ir

IPRC: Islamic Parliament Research Centre (2011) The 5th Five-Year Development Plan Act of the Islamic Republic of Iran (2011-2015) (in Farsi). [Online]. Available at: http://rc.majlis.ir/fa/law/show/790196

IPRC: Islamic Parliament Research Centre (2014) Spatial Planning Scheme Not Implemented in the Development Plans (in Farsi). Spatial Planning in the Resistance Economy Conference. Tehran, Iran, 31 May 2014. [Online]. Available at: http://rc.majlis.ir/fa/news/show/888166

IPRC: Islamic Parliament Research Centre (2017a) 'Freedom of Information Law' (in Farsi). [Online]. Available at: http://rc.majlis.ir/fa/law/show/780303.

IPRC: Islamic Parliament Research Centre (2017b) Geospatial data of economic variables (in Farsi). [Online]. Available at: http://rc.majlis.ir/fa/gis

IPRC: Islamic Parliament Research Centre (2017c) Spatial Planning Scheme (in Farsi). [Online]. Available at: http://rc.majlis.ir/fa/law/show/129543

IRNA (Islamic Republic News Agency) (2015a) 'Freedom of Information Law Came into Effect' (in Farsi). [Online]. Available at: http://www.irna.ir/fa/News/81665715/

IRNA (Islamic Republic News Agency) (2015b) 'Iran and Germany signed a memorandum of understanding on the implementation of the Hashtgerd New Town project' (in Farsi). [Online]. Available at: http://www.irna.ir/fa/News/81828757/

ISNA: Iranian Students News Agency (2012) Implementation of the Urban HEART in Tehran's 374 neighborhoods (in Farsi). [Online]. Available at: http://www.isna.ir/news/91031910597/%D8%A7%D8%AC%D8%B1%D8%A7%DB%8C-%D8%B7%D8%B1%D8%AD-%D8%B3%D9%86%D8%AC%D8%B4-%D8%B9%D8%AF%D8%A7%D9%84%D8%AA-%D8%AF%D8%B1-374-%D9%85%D8%AD%D9%84%D9%87-%D8%B4%D9%87%D8%B1-%D8%AA%D9%87%D8%B1%D8%A7%D9%86

IUCNIAT: International Union for Conservation of Nature International Assessment Team (1995) Assessing progress toward sustainability: A new approach. In: Trzyna, T. C. (ed.). *A Sustainable World. Defining and Measuring Sustainable Development*. IUCN—The World Conservation Union and the International Center for the Environment and Public Policy, California Institute of Public Affairs. London: Earthscan.

James, P. (2015) *Urban Sustainability in Theory and Practice; Circles of Sustainability*. London and New York: Routledge.

Jones, C. (1985) *Patterns of social policy: an introduction to comparative analysis*. London; New York: Tavistock Publications.

Jones, S.R, Torres V, and Arminio J (2006) *Negotiating the Complexities of Qualitative Research.* New York and London: Routledge.

Kazemi Karegar, H., Zahedi, A., Ohis, V., Taleghani, G., and Khalaji, M. (2005) Wind and Solar Energy Developments in Iran. Tehran: University of Tehran Publication.

Kelly, G. P., Altbach, P. G., and Arnove, R. F. (1982) Trends in comparative education: a critical analysis. In Altbach, Philip G., Arnove, Robert F. & Kelly, Gail P. (Eds.) *Comparative education*. New York: Macmillan: 505-535.

Kennett, P. (2001) *Comparative social policy: theory and research*. Buckingham, England: Open University Press.

Khosravi, M. (1987) *Methodology for the Assessment of Environmental Factors in Project Development*. Department of Environment, Tehran, Iran.

Kiani, M., Attar, K., and Habibi, J. (2011) Measurement and Economic Analysis of Urban Poverty (in Farsi). In: *Proceedings of the 50 Years of Household Economics Conference held at Tarbiat Modares University, 15-16 February 2011* Tehran, Iran..

Kline, E. (2001) Indicators for Sustainable Development in Urban Areas. In: Devuyst, D., Hens, L., and De Lannoy, W. (eds.). *How Green Is the City? Sustainability Assessment and the Management of Urban Environments.* New York: Columbia University Press, p. 275-297.

Kozera A, Stanisławska J, Głowicka-Wołoszyn R (2016). FINANCIAL SECURITY OF POLISH HOUSEHOLDS. *Journal of Agribusiness and Rural Development.* 3(41), pp. 319–328. [Online]. DOI: 10.17306/JARD.2016.59.

Kristensen P (2004). The DPSIR Framework National Environmental Research Institute (Denmark), Department of Policy Analysis, European Topic Centre on Water, European Environment Agency. [Online]. Available at: http://wwz.ifremer.fr/dce_eng/content/download/69291/913220/file/DPSIR.pdf.

Landman, T. (2008) *Issues and methods in comparative politics: an introduction*; 3rd ed. London, New York: Routledge.

Lashkari, L., and Khalaj, M. (2011). *Urban sustainability principles in Iran's hot-dry climate zone, emphasizing the ancient cities* (in Farsi), Tehran, Iran: Ganj-e Honar.

Latifian, B., Jasemi, A., and Bandari, M. (2014) Environmental accounting and sustainability report. *International Research Journal of Applied and Basic Sciences* 8(3), p.325–328.

LBBD: London Borough of Barking & Dagenham (2008) *Planning Advice Note 6: Crime Prevention through Environmental Design*. London: London Borough of Barking & Dagenham. [Online]. Available at: www.lbbd.gov.uk

Leach, J.M., Boyko, C.T., Cooper, R., Woodeson, A., Eyre, J., and Rogers, C. D. F. (2015) Do sustainability measures constrain urban design creativity? *ICE Urban Design and Planning*, 168(1), p. 30–41.

Lee, I. (2001) Culturally-Based Copyright Systems?: The U.S. and Korea in Conflict**,** *Washington University Law Review*, 79(4), p.1103-1131.

Leedy**,** P. D., and Ormrod**,** J. E**.** (2005) *Practical Research, Planning and Design.* 8th ed. Boston: Pearson.

Leeser, R. (2016) *Briefing 2016-01*: *English Indices of Deprivation 2015*. London: Greater London Authority. [Online]. Available at: https://files.datapress.com/london/dataset/indices-of-deprivation-2015/2016-05-24T18:16:14/indices-deprivation-2015.pdf

Lijphart, A. (1971) Comparative Politics and the Comparative Method. *The American Political Science Review*, 65 (3): 682-693

Lijphart, A. (1975) The Comparable-Cases Strategy in Comparative Research. *Comparative Political Studies*, 8(2):158–77

Lofts, H., and Macrory, I. (2015) Sustainable Development Indicators, July 2015. Office for National. [Online]. Available at: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171766_407238.pdf

Lombardi, P. L. (1999) *Understanding sustainability in the built environment: a framework for evaluation in urban planning and design*, Unpublished PhD thesis, University of Salford.

London Borough of Camden (2014) Sustainability Appraisal of Camden's Local Plan: Scoping Report. [Online]. Available at: www.camden.gov.uk.

Lor, P. J. (2012) *International and Comparative Librarianship: A Thematic Approach.* Boston: De Gruyter Saur.

Lor, P. J. (2014) Revitalizing comparative library and information science: theory and metatheory, *Journal of Documentation*, 70(1), p.25-51.

Lowe, R., Wingfield, J. and Bell, J. (2007) Evidence for heat losses via party wall cavities in masonry construction, *Building Services Engineering Research and Technology*, 28 (2), p.161–181.

LSDC: London Sustainable Development Commission (2013) *London's quality of life indicators 2012 report.* London: Greater London Authority. [Online]. Available at: http://www.londonsdc.org/documents/research/LSDC_QoLindicators_2012_Evidence%20Report.pdf

M. Leach, J., Boyko, C., Cooper, R., Woodeson, A., Eyre, J., and Rogers, C. (2015) Do sustainability measures constrain urban design creativity? *Proceedings of the ICE – Urban Design and Planning*, 168 (1), p. 30-41. [Online]. Available at: www.icevirtuallibrary.com/doi/full/10.1680/udap.13.00034

Mabbett, D., and Bolderson, H. (1999) Theories and methods in comparative social policy. In: Clasen, J. (ed.) *Comparative social policy: concepts, theories and methods*. Oxford: Blackwell Publishers: 34-56.

MacLoughlin J. B. (1969) *Urban and Regional Planning: A Systems Approach*, London: Faber and Faber.

Madani, K. (2014) Water management in Iran: what is causing the looming crisis? *Journal of Environmental Studies and Sciences* 4(4), p.315–328. [Online]. Available at: http://dx.doi.org/10.1007/s13412-014-0182-z.

Madanipour, A. (2006) Urban planning and development in Tehran. *Cities* 23(6), p.433–438.

Madanipour, A. (2011) Sustainable development, urban form and megacity governance and planning in Tehran. In: Sorensen, A. and Okata, J. (eds.), *Megacities; Urban Form, Governance and Sustainability.* New York: Springer, p.67–91.

Mason, J. (2002) *Qualitative Researching,* London: Sage.

Massam, B. H. (2002). Quality of life: public planning and private living. *Progress in Planning*, Vol. 58 (3), p. 141–227. [Online]. Available at: https://doi.org/10.1016/S0305-9006(02)00023-5

May, T. (1997) *Social Research: Issues, Methods and Process,* 2nd edn. Buckingham, England: Open University Press.

McGregor, A., and Roberts, C. (2003) *Using the SPeAR Assessment Tool in Sustainable Master Planning*. US Green Building Council. [Online]. Available at: http://www.usgbc.org/Docs/Archive/MediaArchive/208_McGregor_PA426.pdf.

McNeill, P., and Chapman, S. (2005) *Research methods* (3rd ed.), New York: Routledge.

Meadows, D. H., Meadows, D. L., Randers, J., and Behrens III, W. (1972) *The Limits to Grow: A report for the Club of Rome's project on the predicament of mankind.* New York: Universe Books.

MEAF: Ministry of Economic Affairs and Finance (2017) Economic and Financial Databank of Iran. [Online]. Available at: http://databank.mefa.ir/default.aspx?Lang=En

Mega, V. and Pedersen, J. (1998). *Urban Sustainability Indicators*. Luxembourg: Office for Official Publications of the European Communities.

Moazedi, A., Taravat, M., Nazarboland Jahromi, H., Madani, K., Rashedi, A., and Rahimian, S. (2011) Energy-Water Meter: A Novel Solution for Groundwater Monitoring and Management. *Proceedings of the World Environmental and Water Resources Congress 2011: Bearing Knowledge for Sustainability*, p. 962–969, Palm Springs, California: ASCE. [Online]. Available at: www.ascelibrary.org/doi/10.1061/41173%28414%2999

MoE: Ministry of Energy (2015) Iran's Energy Balance Report 2013 (in Farsi). Deputy for Electricity and Energy, [Online]. Available at: http://www.saba.org.ir/saba_content/media/image/2015/09/7811_orig.pdf.

Mohammad, S., and Shea, A. (2013) Performance evaluation of modern building thermal envelope designs in the semi-arid continental climate of Tehran. *Buildings* 3(4), p.674–688.

Mohammed Ameen, R. F., Li, H., and Mourshed, M. (2014) Sustainability assessment methods of urban design: A review. In: Li, H., De Wilde, P., and Rafiq, Y. (ds.). *The 21st International Workshop on Intelligent Computing in Engineering 2014 held at* Cardiff University, *July 16th-18th, 2014*. Cardiff: Cardiff University.

MoI: Ministry of Interior (2010) The Municipality Establishment (in Farsi). [Online]. Available at: http://www.moi.ir/Portal/Home/Default.aspx?CategoryID=3046571a-7275-4160-81a1-3d66bbb3410c.

Mojtahed, R., Nunes, M. B., Martins, J. T., and Peng, A. (2014). Equipping the constructivist researcher: The combined use of semi-structured interviews and decision-making maps. *Electronic Journal of Business Research Methods*, *12*(2), 87-95. [Online]. Available at: http://ezproxy.uwl.ac.uk/login?url=https://search.proquest.com/docview/1627119511?accountid=14769

Morgan, R. (2012) Environmental impact assessment: the state of the art. *Impact Assess ProjApprais*, 30(1), P.5-14.

Morrison-Saunders, A., and Retief, F. (2012) Walking the sustainability assessment talk — Progressing the practice of environmental impact assessment (EIA). *Environmental Impact Assessment Review*, 36, p.34–41.

Morrison-Saunders, A., and Fischer, T. B. (2006) What is wrong with EIA and SEA anyway? A sceptic's perspective on sustainability assessment. *Journal of Environmental Assessment Policy and Management*, 8(1), p.19–39.

Morrison-Saunders, A., and Therivel, R. (2006) Sustainability Integration and Assessment. *Journal of Environmental Assessment Policy and Management.* 8(3), p. 281–298.

Moshiri, S. (2012) Energy price reform and energy efficiency in Iran. Proceedings of IAEE International Conference, Perth, Australia, p.33–37.

Mourshed, M., Kelliher, D. and Keane, M. (2005) Green Architecture- the Need for Climate Analysis and Thermal Simulation during Early Stages of Design. *Global Built Environment Review*, 5(2), p. 12–20.

Mulvaney, D. (2011) *Green Politics: An A-to-Z Guide.* Los Angeles: SAGE Publications.

Murphy, E., and Dingwall, R. (2003) Q*ualitative Methods and Health Policy Research.* New York: Walter du Gruyter, Inc.

Naderi-Mahdei, K., Pouya, M., Taheri, F., Azadi, H., and Van-Passel, S. (2015) Sustainability Indicators of Iran's Developmental Plans: Application of the Sustainability Compass Theory. *Sustainability*, 7, p.14647-14660. [Online]. Available at: www.mdpi.com/journal/sustainability

Nanbakhsh, H. (1993) Environmental Impact Assessment of Potable Water Supply and Sanitation in Rural Areas of Developing Countries. PhD thesis, University of Salford, Salford, UK.

Nasrollahi, F. (2009a) Climate and Energy Responsive Housing in Continental Climates: The Suitability of Passive Houses for Iran's Dry and Cold Climate. Universitätsverlag der TU Berlin, Berlin, Germany.

Nasrollahi, F. (2009b) Energy efficient architecture for Tehran. Proceedings of IFHP World Congress 2009, Urban Technology for Urban Sustainability: Climate Change and Energy Efficiency, Berlin, Germany.

Nasrollahi, F., Wehage, P., Effatolsadat Shahriari, E., and Tarkashvand, A. (2013) Energy Efficient Housing for Iran- Pilot Buildings in Hashtgerd New Town. Young Cities research paper series, vol. 04. Berlin: Universitätsverlag der TU Berlin.

NCC: National Cartographic Centre of Iran (2017a) History of the NCC. [Online]. Available at: www.ncc.org.ir/HomePage.aspx?TabID=4592&Site=NCCPortal&Lang=en-US

NCC: National Cartographic Centre of Iran (2017b) National Cartographic Centre Website (in Farsi). [Online]. Available at: www.ncc.org.ir

NematiMehr, M. (2008) Architecture, urban design and environmental sustainability, case study: Iranian arid old cities. *International Journal of Environmental, Cultural, Economic and Social Sustainability* 4(1), p.139–146.

Noble, B. F., and Harriman-Gunn, J. (2009) strategic environmental assessment. In: Hannah K (ed). *Environmental impact assessment practice and participation*. Don Mills: Oxford University Press, p. 103–130.

Noorollahi, Y., Yousefi, H., Itoi, R., and Ehara, S. (2009) Geothermal energy resources and development in Iran. *Renewable and Sustainable Energy Reviews* 13(5), p.1127–1132.

ODPM: Office of the Deputy Prime Minister (2003) *Sustainable Communities: Building for the Future*. ODPM, London, UK.

ODPM: Office of the Deputy Prime Minister (2005a) A practical guide to the Strategic Environmental Assessment Directive. [Online]. Available at: https://www.historicenvironment.scot/media/2384/practicalguidesea.pdf.

ODPM: Office of the Deputy Prime Minister (2005b) Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents: Guidance for Regional Planning Bodies and Local Planning Authorities. Yorkshire: ODPM Publication. [Online]. Available at: http://www.wyreforestdc.gov.uk/media/115280/NP27-Sustainability-Appraisal-of-Regional-Spatial-Strategies-and-Local-Development-Documents.pdf.

ODPM: Office of the Deputy Prime Minister (2006). *UK Presidency: EU Ministerial Informal on Sustainable Communities Policy Papers*. London: ODPM.

Odum, W. (1982) Environmental degradation and the tyranny of small decisions. *BioScience*. 32 (9): 728-729.

Oei, T. I., and Zwart, F. M. (1986) The assessment of life events: Self-administered questionnaire versus interview. *Journal of Affective Disorders*, 10(3), p.185–190.

Olivier, J., Leiter, T., and Linke, J. (2013). *Adaptation Made to Measure: A Guidebook to the Design and Results-Based Monitoring of Climate Change Adaptation Projects*. Berlin: GIZ.

ONS: Office for National Statistics (2014). Sustainable Development Indicators, July 2014. [Online]. Available at: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171766_368169.pdf

ONS: Office for National Statistics (2016). Sustainable Development Indicators Cancelled, July 2016. [Online]. Available at: www.ons.gov.uk/releases/sustainabledevelopmentindicatorsjuly2016

ONS: Office for National Statistics (2016a) Electoral wards / Electoral divisions. The National Archives. [Online]. Available at: www.webarchive.nationalarchives.gov.uk.

ONS: Office for National Statistics (2016b) Statistical Wards, CAS Wards and ST Wards. The National Archives. [Online]. Available at: www.webarchive.nationalarchives.gov.uk.

ONS: Office for National Statistics (2016c) Super Output Area (SOA). The National Archives. [Online]. Available at: www.webarchive.nationalarchives.gov.uk.

Ontheworldmap.com (2017) Iran Location on the World Map. [Online]. Available at: http://ontheworldmap.com/iran/iran-location-map.html

Oppenheim, A. N. (1992) *Questionnaire Design, Interviewing and Attitude Measurement,* London: Continuum.

OS: Ordnance Survey (2017) OS MasterMap. [Online]. Available at: www.ordnancesurvey.co.uk.

Osmani, M., and O'Reilly, A. (2009) Feasibility of zero carbon homes in England by 2016: a house builder's perspective. *Building and Environment* 44(9), p.1917–1924.

Owens, S. (1991) *Energy-conscious Planning: The Case for Action.* London: CPRE.

Oyen, E. (ed.) (1990) *Comparative Methodology: Theory and Practice in International Social Research*. London: Sage.

Panahi, M., Rezaei, F., and Meshkani, S. A. (2014) Seismic vulnerability assessment of school buildings in Tehran city based on AHP and GIS. *Natural Hazards and Earth System Sciences.* 14, p. 969-979. [Online]. Available at: www.nat-hazards-earth-syst-sci.net/14/969/2014/nhess-14-969-2014-discussion.html

Partidario, M. R. and Moura, F. (1997) Strategic sustainability assessment—or how to get strategic environmental assessment in the move towards sustainability. In: *Proceedings of 17th Annual Meeting of the International Association of Impact Assessment.* 28-31 May 1997. New Orleans: International Association for Impact Assessment.

Patassini, D. (1995) Paradigmi e strategie di valutazione di piani, programmi e Politiche (Paradigms and strategies for evaluating plans, programs and policies), *Urbanistica*, 105, p.50-59.

Pennings, P., Keman, H., and Kleinnijenhuis, J. (1999) *Doing research in political science*. London; Thousand Oaks (CA): Sage Publications.

Pesaran, M.H (1997), Economy in the Pahlavi period. *Encyclopedia Iranica*, 8(2), p.143-156.

Pickvance, C. G. (1986) Comparative Urban Analysis and Assumptions about Causality, *International Journal of Urban and Regional Research.* 10(2): 162-184.

Polit, D. F., and Beck, C. T. (2004) *Nursing Research. Principles and Methods*. Philadelphia, PA: Lippincott Williams & Wilkins.

Pope, J. and Grace, W. (2006) Sustainability Assessment in Context: Issues of Process, Policy and Governance. *Journal of Environmental Assessment Policy and Management,* 8(3), p. 373–398.

Pope, J., Annandale, D., and Morrison-Saunders, A. (2004) Conceptualising sustainability assessment. *Environ Impact Assess Rev*. 24(6), p.595–616.

Portney, K., and Berry, J. (2011) Civil Society and Sustainable Cities, In Princeton Conference on Environmental Politics: Research Frontiers in Comparative and International Environmental Politics, Niehaus Center for Globalization and Governance, Princeton University, December 2-3, 2011.

Pullinger, J. (1997) The Creation of the Office for National Statistics, *International Statistical Review*, 65 (3), p. 291–308.

Putnam, R. D. (1995) Bowling alone: America's declining social capital. *Journal of democracy*, 6 (1), p.65-79.

Rabionet, S. E. (2011) How I Learned to Design and Conduct Semi-structured Interviews: An Ongoing and Continuous Journey. *The Qualitative Report*, 16 (2), p. 563-566.

Ragin, C. C. (1987) *The comparative method: moving beyond qualitative and quantitative strategies*. Berkeley (CA): University of California Press.

Rahbar, D. (2005) Iran's effort for progressive of EIA in a transboundary context. Proceedings of 8th Meeting of the Working Group of EIA Convention, Geneva, Switzerland. April 25–27, 2005. [Online]. Available at: http://www.unece.org

Reig, P., Maddocks, A., and Gassert, F. (2013) World's 36 Most Water-Stressed Countries. World Resources Institutes. [Online]. Available at: www.wri.org/blog/2013/12/world%E2%80%99s-36-most-water-stressed-countries

Rezaei, M., Chaharsooghi, SK., and Abbaszadeh, P. (2013) The role of renewable energies in sustainable development: case study Iran. *Iranica Journal of Energy and Environment* 4(4), p.320–329.

Rezazadeh, R. (2011) Women empowerment and good urban governance in Iran. *Asian Social Science* 7(3), p. 260–268.

Rogers, R. (1997). *Cities for a small planet*. London: Faber and Faber Limited.

Rydin, Y. (2010) *Governing for Sustainable Urban Development.* London: Earthscan.

Saba Niroo (2008) Turbines designed and manufactured in Tehran, Iran. [Online]. Available at: http://www.sabaniroo.co.ir.

Sabetghadam, M. (2006) Energy and Sustainable Development in Iran. Helio International, Paris, France, Sustainable Energy Watch Report.

Sadler, B., and Verheem, R. (1996) *SEA: Status, Challenges and Future Directions*, Report 53, Ministry of Housing, Spatial Planning and the Environment, The Hague, Netherlands.

Salman, A., and Qureshi, S. (2009) Indicators of Sustainable Development: A Geographical Review of Urban Regeneration Projects in Karachi, Pakistan. In: Geographical Diversity: Proceedings of the HERODOT Conference, May 2009, Ayvalik, Turkey, p. 29-31, mbv: mensch und buch verlag, p. 183-187, Berlin.

Sartori, G. (1991) Comparing and Miscomparing. *Journal of theoretical politics* 3(3): 243-257.

SATBA: Iran Renewable Energy and Energy Efficiency Organization (2012a) History and Objectives of SATBA (in Farsi). See http://www.satba.gov.ir/

SATBA: Iran Renewable Energy and Energy Efficiency Organization (2012b) Biomass Energy (in Farsi). See http://www.satba.gov.ir/

Satterthwaite, D. (2006) *Barbara Ward and the Origins of Sustainable Development.* London: International Institute for Environment and Development (IIED).

Sawicki, D., and Flynn, P. (1996) ‘Neighbourhood indicators: a review of the literature and an assessment of conceptual and methodological issues’, *Journal of the American Planning Association,* 62(2), p.165–83.

Schmidt, M. (2003) La Escalera Karakola: Creating Urban Women's Space. *Off Our Backs: Feminism and Motherhood. 33(3/4), p. 53–54.*

SCI: Statistical Centre of Iran (2012a*) Iran Energy Statistics* (in Farsi). [Online]. Available at: www.amar.org.ir.

SCI: Statistical Centre of Iran (2012b) *Iran Statistical Yearbook 1392 [2013-2015]*. Tehran: Statistical Centre of Iran Publication.

SCI: Statistical Centre of Iran (2013) Atlas of Selected Results of the 2011 National Population and Housing Census (in Farsi). [Online]. Available at: www.amar.org.ir.

SCI: Statistical Centre of Iran (2016) Results of the 2016 Population and Housing Census (in Farsi). [Online]. Available at: www.amar.org.ir.

SCI: Statistical Centre of Iran (2017a) History of the Statistical Centre of Iran. Statistical Centre of Iran. [Online]. Available at: https://www.amar.org.ir/english/About-SCI/History.

SCI: Statistical Centre of Iran (2017b) An Introduction to Geographical Boundaries (in Farsi). Statistical Centre of Iran. [Online]. Available at: https://www.amar.org.ir

Scottish Government (2015). Cultural engagement in Scotland (attendance and participation). [Online]. Available at: http://www.gov.scot/Topics/ArtsCultureSport/Sport/MajorEvents/Glasgow-2014/Commonwealth-games/Indicators/C6

Seale, C. (2002). Quality Issues in Qualitative Inquiry. *Qualitative Social Work*, 1(1): 97-110.

Seifollahi, M., and Faryadi, S. (2011) Evaluating the Quality of Tehran’s Urban Environment Based on Sustainability Indicators, *Internationa. Journal of Environmental Res*earch, 5(2), p.545-554.

Shahidi Nejad, M. J., Alesheikh, A. A., and Kalantari Oskoei, A. (2016) Assessment of National Spatial Data Infrastructure Using BSC Model (in Farsi). *Journal of Geomatics Science and Technology*, 5 (3), p. 151–164. [Online]. Available at: www.jgst.issge.ir/article-1-357-en.html

Shahriari, K. (2017) Modernization Process in Iran: Historical Overview. *Journal of Social Science Studies*, 4(1), p.269–282. [Online]. Available at: http://www.macrothink.org/journal/index.php/jsss/article/view/10206

Sharifi, A. and Akito Murayama, A. (2013) A critical review of seven selected neighbourhood sustainability assessment tools. *Environmental Impact Assessment Review.* 38, p. 73–87.

Sharifi, M., and Shabanikia, A. (2012) Report of Renewable Energy Organization of Iran (in Farsi). Renewable Energy Research and Technology Bureau, Tehran: Pendar-e Nik Publishing.

Sharifian-Attar, T., Seyyed Mahdavi, S., Saebi, J., and JavidI, M.H. (2012) Implementation of smart transmission grid in Iran (case study: Khorasan Regional Electricity Company). Proceedings of 20th Iranian Conference on Electrical Engineering (ICEE), Tehran, Iran, p.422–426.

Sheate, W. R., Byron, H. J., and Smith, S. P. (2004) Implementing the SEA Directive: sectoral challenges and opportunities for the UK and EU. *European Environment*, 14, p.73–93.

Shen, L.Y., Ochoa, J., Shah, M. and Zhang, X. (2011) The application of urban sustainability indicators - A comparison between various practices. *Habitat International*, 35, p.17–29.

Shiraz University (2013) Shiraz Solar Power Plant. [Online]. Available at: http://www.shirazu.ac.ir/index.php?page_id=4098&search_words=no

Singh, R. K. (2014) Right to Information: The Basic Need of Democracy. *Journal of Education and Social Policy*, 1 (2), p. 86–96. [Online]. Available at: www.jespnet.com/journals/Vol_1_No_2_December_2014/13.pdf

Smeets, E., and Weterings, R. (1999) Environmental indicators: typology and overview. Copenhagen: European Environment Agency. [Online]. Available at: http://ilm.geogr.uni-jena.de/fileadmin/Geoinformatik/projekte/brahmatwinn/Workshops/FEEM/Indicators/EEA_tech_rep_25_Env_Ind.pdf.

Smith, A. E. (2000). Quality of life: a review. *Education and Ageing. Triangle Journals*, 15, p. 419-435.

Smith, J. K. (1990) Goodness Criteria: Alternative Research Paradigms and the Problem of Criteria: E.G. Guba (ed), *The Paradigm Dialogue* , London: Sage.

Soflaee, F., and Shokouhian, M. (2005) Natural cooling systems in sustainable traditional architecture of Iran. Proceedings of International Conference on Passive and Low Energy Cooling for the Built Environment, Santorini, Greece, p.715–719.

Soltis, J. F. (1990) The Ethics of Qualitative Research: E.W Eisner and A. Peshkin (eds), *Qualitative Inquiry in Education: The Continuing Debate*. New York: Techers College, Columbia University, pp. 247-257.

SPSS Inc. (2009) Corporate History, [Online]. Available at: http://www.spss.com.hk/corpinfo/history.htm

Stanghellini, S. (ed.) (2006) *Valutazione e processo di piano (Plan evaluation and process).* Florence: Allinea.

Sullivan, G. M., and Artino, A.R. (2013) Analyzing and Interpreting Data from Likert-Type Scales, *Journal of Graduate Medical Education*, 5 (4), p.541-542.

Tabari, H., Abghari, H., and Hosseinzadeh Talaee, P. (2012) Temporal trends and spatial characteristics of drought and rainfall in arid and semiarid regions of Iran. *Hydrological Processes* 26(22), p.3351–3361.

Tabatabaei, SJ., Eskandari, H., and Aghaei, Y. (2013) The effect of materials type and form of the roof on the thermal efficiency of buildings in hot and dry climates. *Gazi University Journal of Gazi Educational Faculty (GUJGEF),* 4(3), p.1–8.

Tabibian, M., Faryadi, S. (2002) Evaluating the quality of Tehran's urban environment. (in Farsi), *Mohitshenasi*, 27(28), p.1-12.

Taghavi Jeloudar, M., Han, M., Davoudi, M., and Kim, M. (2013) Review of ancient wisdom of Qanat, and suggestions for future water management. *Environmental Engineering Research,* 18(2), p.57–63.

Tajbakhsh, K. (2005) Planning culture in Iran: centralization and decentralization and local governance in the twentieth century (the case for urban management and planning). In: Sanyal, B. (ed.), *Comparative Planning Cultures*. New York: Routledge, p.67–90.

Tavassoli, M. (2011) *The Art of Renewing Urban Structure with Four Case Studies,* 2nd ed. (in Farsi). Tehran: Mahmoud Tavassoli Publication.

Tehran SoE (2012) The State of Environment (SoE) Report of Tehran. Research and Planning Centre of Tehran. [Online]. Available at: http://en.tehran.ir/Portals/0/Document/The%20State%20of%20Environment%20(SoE)%20Report%20of%20Tehran%20.pdf.

Therivel, R. (2004) *Strategic Environmental Assessment in Action*. London: Earthscan.

Therivel, R. (2013) Use of sustainability appraisal by English planning inspectors and judges. *Environmental Impact Assessment Review*, 38, p. 26–34. [Online]. Available at: https://doi.org/10.1016/j.eiar.2012.04.002.

Therivel, R., and Brown, L. (1999) Methods of strategic environmental assessment, In: Petts, J. (ed). *Handbook of Environmental Impact Assessment, Vol. 1*, Oxford: Blackwell Science, p.441–464.

Therivel, R., and Walsh, F. (2006) The strategic environmental assessment directive in the UK: 1year onwards. *Environmental Impact Assessment Review*, 26, p.663–675.

Tilbury, D., Janousek, S. and Denby, L. (2007) *Monitoring and Assessing Progress during the UNDESD in the Asia-Pacific Region: A Quick Guide to Developing National ESD Indicators.* Bangkok, Thailand: UNESCO Asia and Pacific Regional Bureau for Education.

TM: Tehran Municipality (2007) *Green Workbook. Environment and Sustainable Development Task Force* (in Farsi). Tehran, Iran.

TM: Tehran Municipality (2013) ATAF Executive Instructions: Departments, Organizations and 22 Municipal Districts of Tehran. Tehran: Office for Sociocultural Studies. [Online]. Available at: www.ataf.tehran.ir/Portals/0/guidelines1111.pdf.

TM: Tehran Municipality (2014) History of City Councils. [Online]. Available at: http://en.tehran.ir/Default.aspx?tabid=90.

TM: Tehran Municipality (2014a) Improvement Steps in the Urban Management: Urban Development Indices (in Farsi), Deputy of Coordination and Planning: Department for Performance Assessment and Management Improvement, [Online]. Available at: http://peim.tehran.ir/Portals/7/cdi.pdf

TM: Tehran Municipality (2014b). Socio-Cultural Indicators for Tehran Neighborhoods (in Farsi). Office for Sociocultural Studies. [Unpublished manuscript].

TM: Tehran Municipality (2014c). List of Environmental Performance Indicators for Urban Services Department (in Farsi). Office for Environment and Sustainable Development. [Unpublished manuscript].

TM: Tehran Municipality (2015) Tehran State of Environment 2014 (in Farsi). Office for Environment and Sustainable Development. [Online]. Available at: http://emc.tehran.ir/Portals/0/book/%D8%A7%D8%B5%D9%84%D8%A7%D8%AD%DB%8C94%20%D9%88%D8%B6%D8%B9%DB%8C%D8%AA%20%D9%85%D8%AD%DB%8C%D8%B7%20%D8%B2%DB%8C%D8%B3%D8%AA%20%D8%B4%D9%87%D8%B1%20%D8%AA%D9%87%D8%B1%D8%A7%D9%86.pdf?timestamp=1431930135107

TM: Tehran Municipality (2016) Urban HEART (in Farsi). [Online]. Available at: http://sheykh-hadi.mytehran.ir/Default.aspx?tabid=62562&language=en-US

TM: Tehran Municipality (2017) History of 'Environment and Sustainable Development Management Centre' (in Farsi). [Online]. Available at: http://emc.tehran.ir/%D8%AF%D8%B1%D8%A8%D8%A7%D8%B1%D9%87-%D9%85%D8%B1%DA%A9%D8%B2/%D8%AA%D8%A7%D8%B1%DB%8C%D8%AE%DA%86%D9%87

TNA: The National Archive (2017) UK Government Licensing Framework. The National Archive. [Online]. Available at: http://www.nationalarchives.gov.uk/information-management/re-using-public-sector-information/uk-government-licensing-framework/

Trudgill, S.T. (1990) *Barriers to a Better Environment: What Stops Us Solving Environmental Problems?* London: Belhaven.

Turcu, C. (2013) Re-thinking sustainability indicators: local perspectives of urban sustainability. *Journal of Environmental Planning and Management*, 56(5), p. 695–719.

UKDS: The UK Data Service (2017a) About The UK Data Service. University of Essex, University of Manchester and Jisc. [Online]. Available at: www.ukdataservice.ac.uk

UKDS: The UK Data Service (2017b) Census Boundary Data. University of Essex, University of Manchester and Jisc. [Online]. Available at: https://census.ukdataservice.ac.uk/use-data/guides/boundary-data

UKDS: The UK Data Service (2017c) 2011 Geographies. University of Essex, University of Manchester and Jisc. [Online]. Available at: http://infuse.ukdataservice.ac.uk/help/definitions/2011geographies/index.html#WARDLYR

UN: United Nations (2014) *World Urbanization Prospects, The 2014 Revision*. New- York: Department of Economic and Social Affairs, [Online]. Available at: https://esa.un.org/unpd/wup/publications/files/wup2014-highlights.Pdf

UN: United Nations (2017) Conferences and reports on the environment. [Online]. Available at: http://research.un.org/en/docs/environment/conferences

UNDP: United Nations Development Programme (2016) *Human Development Report 2016*. New York: UNDP. [Online]. Available at: www.hdr.undp.org/en/2016-report/download

UNEP, United Nations Environment Programme (2016), State of the Environment Report: Iran. [Online]. Available at: http://wedocs.unep.org/handle/20.500.11822/9352?show=full
Vahdat-Zad, V. (2011) Spatial discrimination in Tehran's modern urban planning 1906–1979. *Journal of Planning History* 12(1). p.49-62.

Verbruggen, H., and Kuik, O. (1991) Indicators of sustainable development: an overview. In: Kuik, O. and Verbruggen, H. (eds.). *In search of indicators of sustainable development.* Berlin: Springer Science+Business Media.

Vogler, J. (2007) *The international politics of sustainable development*, Cheltenham: Edward Elgar Publishing Limited.

Von Haaren, C., and Albert, C. (2011) Integrating ecosystem services and environmental planning: limitations and synergies. *International Journal of Biodiversity Science, Ecosystem Services & Management*. 7(3), p.150–67.

Wang, R., and Strong, D. (1996) Beyond Accuracy: What Data Quality Means to Data Consumers. *Journal of Management Information Systems.* 12 (4), p. 5-33.

Wathern, P. (ed) (1988) *Environmental Impact Assessment; theory and Practice*. London and New York: Routledge.

WBG: The World Bank Group (2011) Energy Use (kg of oil equivalent per capita). [Online]. Available at: http://data.worldbank.org/indicator/EG.USE.PCAP.KG. OE?page=6

WBG: The World Bank Group (2017) 'The World Bank In Islamic Republic of Iran'. [Online]. Available at: http://www.worldbank.org/en/country/iran/overview#1

WCED: The World Commission on Environment and Development (1987) *Our Common Future*, Oxford: Oxford University Press.

Weber, R. F (1990) *Basic Content Analysis (Quantitative Applications in the Social Sciences)*, California: SAGE Publications.

White, L., and Noble, B. F. (2013) Strategic environmental assessment for sustainability: A review of a decade of academic research. *Environmental Impact Assessment Review* 42, p.60–66.

WHO: World Health Organisation (1997) *WHOQOL: Measuring Quality Of Life.* [Online]. Available at: http://www.who.int/mental_health/media/68.pdf

WHO: World Health Organization (2007) *Urban HEART: Urban Health Equity Assessment and Response Tool.* Kobe, Japan: WHO Centre for Health Development.

WHO: World Health Organization (2013) Report on documentation and evaluation of Urban HEART pilot in Tehran, Islamic Republic of Iran. [Online]. Available at: http://www.who.int/kobe_centre/publications/urbanheart_evaluation_iran/en/.

Wong, C. (2006) *Indicators for Urban and Regional Planning: The Interplay of Policy and Methods*. London and New York: Routledge.

Wood, C., and Djeddour, M. (1991) Strategic environmental assessment: EA of policies, plans and programmes, *The Impact Assessment Bulletin* 10(1), p.3–22.

World Atlas (2017) World Facts: The Largest Countries in the World. [Online]. Available at: http://www.worldatlas.com

WWEA: World Wind Energy Association (2014) 2014 Half-Year Report. [Online]. Available at: http://www.wwindea.org/webimages/WWEA_half_ year_report_2014.pdf

Yigitcanlar, T., and Dur, F. (2010) Developing a Sustainability Assessment Model: The Sustainable Infrastructure, Land-Use, Environment and Transport Model. *Sustainability, 2,* p.321-340. [Online]. Available at: www.mdpi.com/journal/sustainability.

Yule, G. U. (1944) *The statistical study of literal vocabulary*. Cambridge: Cambridge University Press.

Zekri, S. (2009) Controlling groundwater pumping online. *Journal of Environmental Management,* 90 (11), p. 3581–3588. [Online]. Available at: www.sciencedirect.com/science/article/pii/S0301479709002291?via%3Dihub

Zhang, K., He, X., and Wen, Z. (2003) Study of indicators of urban environmentally sustainable development in China. *International Journal of Sustainable Development*, 6(2), p.170–182.

Zokaei, M. S. (2015) Youth Spaces and Everyday Life in Tehran. RC21 International Conference on "The Ideal City: between myth and reality. Representations, policies, contradictions and challenges for tomorrow's urban life", Urbino, Italy, 27-29 August. [Online]. Available at: http://www.rc21.org/en/conferences/urbino2015/

Appendices

Appendix 2.1: Sustainable Development Indicators' headline and supplementary measures (Defra, 2013)

Headline measures

			Long term	Short term
Economy				
1	Economic prosperity	GDP	✓	✗
		GDP per head	✓	✗
		Median income	✓	✗
2	Long term unemployment	Proportion of adults unemployed over 12 months	✓	✗
3	Poverty	Proportion of children in relative low income households (before housing costs)	✓	✓
		Proportion of children in absolute low income households (before housing costs)	✓	≈
4	Knowledge and skills	Human capital (£) stock	⋯	✓
		Human capital per head	⋯	≈
Society				
5	Healthy life expectancy	Healthy life expectancy at birth: males	✓	✓
		Healthy life expectancy at birth: females	✓	✓
6	Social capital	Proportion of people engaging in actions addressing issues of public concern	⋯	⋯
		Proportion of people who have a spouse, family member or friend to rely on if they have a serious problem	⋯	⋯
		Proportion of people engaging in any volunteering activity	⋯	≈
		Proportion of people agreeing that people in their neighbourhood can be trusted	⋯	≈
7	Social mobility in adulthood	Proportion of adults from less advantaged groups in managerial or professional positions	✓	✓
8	Housing provision	Net additional dwellings	≈	✗
Environment				
9	Greenhouse gas emissions	UK greenhouse gases emissions	✓	✓
		Greenhouse gas emissions associated with UK consumption	✗	✓
10	Natural resource use	Raw material consumption of non-construction materials	≈	≈
		Raw material consumption of construction materials	✓	✓
11	Wildlife: bird population indices	Farmland birds,	✗	✗
		Woodland birds	✗	≈
		Seabirds	≈	≈
		Water and wetland birds	≈	≈
12	Water use	Abstractions from non-tidal surface waters and ground waters	✓	✓

Appendix 2.1: Sustainable Development Indicators' headline and supplementary measures (Defra, 2013)

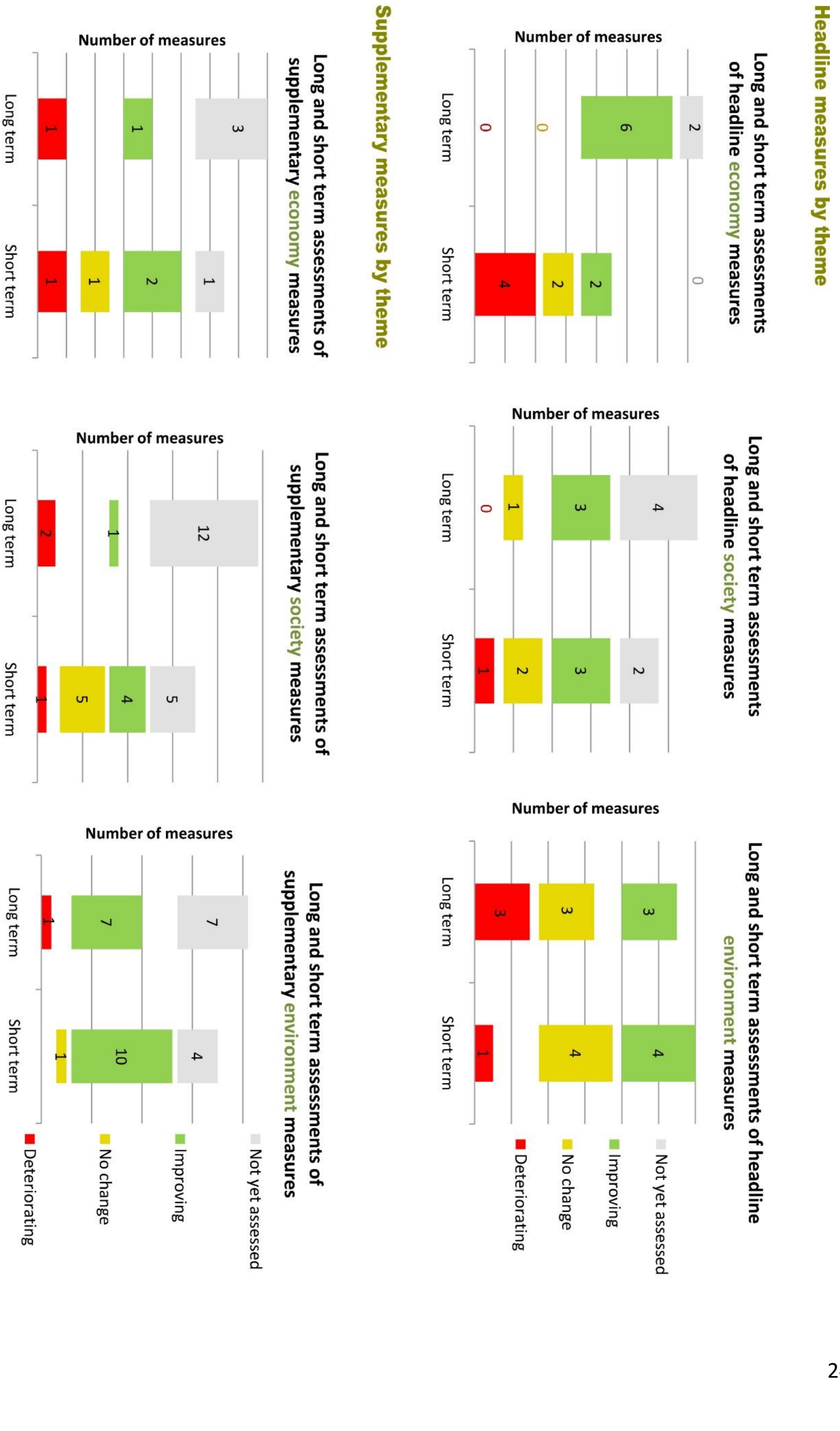
Supplementary measures

			Long term	Short term
Economy				
13	Population demographics	Population estimates and projections	n/a	n/a
		Household estimates and projections	n/a	n/a
14	Debt	Public sector net debt and public sector net borrowing as proportions of GDP to 2017/18	n/a	n/a
15	Pension provision	Percentage of eligible workers in a workplace pension	✗	✗
16	Physical infrastructure	Total non-financial assets net worth	⋯	✓
17	Research and development	Expenditure on R&D performed in UK business	✓	≈
		Expenditure on R&D related to environmental protection expenditure	⋯	✓
18	Environmental goods & services sector	Value of the environmental goods and services sector	⋯	⋯
Society				
19	Avoidable mortality	Mortality from deaths considered avoidable	⋯	✓
		Mortality from deaths considered amenable	⋯	✓
		Mortality from deaths considered preventable	⋯	✓
20	Obesity	Proportion of children overweight and obese (2-15 year olds)	✗	≈
		Proportion of adults overweight and obese	✗	≈
21	Lifestyles	Prevalence of smoking in adults	⋯	⋯
		Proportion of adults doing 150 minutes of exercise per week	⋯	⋯
		Proportion of urban trips under 5 miles taken by walking or cycling	⋯	≈
		Proportion of urban trips under 5 miles taken by public transport	⋯	≈
		Average daily consumption of fruit and vegetables	⋯	⋯
22	Infant health	Incidence of birth weight less than 2,500g in full term live births in England	⋯	✓
23	Air quality	Number of air pollution days classed as moderate or high - urban	⋯	⋯
		Number of air pollution days classed as moderate or high - rural	⋯	⋯
24	Noise	Proportion of the population affected by noise	⋯	≈
25	Fuel poverty	Number of households in fuel poverty	✓	✗

Appendix 2.1: Sustainable Development Indicators' headline and supplementary measures (Defra, 2013)

			Long term	Short term
Environment				
26	UK CO2 emissions by sector	Energy supply	✓	✓
		Transport	✗	✓
		Business	✓	✓
		Residential	✓	✓
		Other	✓	✓
27	Energy consumed in the UK from renewable sources	Proportion of gross energy consumption from renewable sources	⋯	✓
28	Housing energy efficiency	Mean SAP ratings of existing housing	✓	✓
		Mean SAP ratings of new housing	⋯	⋯
29	Waste	Proportion of household waste recycled	✓	≈
		Proportion of construction and demolition waste recovered	⋯	⋯
30	Land use & development	Land use by type	n/a	n/a
31	Origins of food consumed in the UK	The origins of food consumed in the UK by region.	n/a	n/a
32	River water quality	Proportion of rivers with biological quality classed as good or high	⋯	⋯
		Proportion of rivers which pass on chemical status	⋯	⋯
33	Fish stocks	Proportion of fish stocks harvested sustainably	✓	✓
34	Status of species & habitats	Number of priority species that are stable or increasing	⋯	✓
		Number of priority habitats that are stable or increasing	⋯	✓
35	UK Biodiversity impacts overseas	To be developed in line with biodiversity indicators	n/a	n/a

Appendix 2.2: Long and short term assessments for all measures by theme (Defra, 2013)



Appendix 2.3: Examples of SEA objectives and indicators (ODPM, 2005a)

SEA topics	**Possible SEA objectives** (to be adapted to regional/local circumstances by deletions, additions and refinements)	**Possible SEA indicators: ways of quantifying the baseline, prediction, monitoring** (to be adapted to regional/local circumstances by deletions, additions and refinements)
Biodiversity, fauna and flora	• avoid damage to designated wildlife and geological sites and protected species • maintain biodiversity, avoiding irreversible losses • restore the full range of characteristic habitats and species to viable levels • reverse the long term decline in farmland birds • ensure the sustainable management of key wildlife sites and the ecological processes on which they depend • provide opportunities for people to come into contact with and appreciate wildlife and wild places	• reported levels of damage to designated sites/species • achievement of Biodiversity Action Plan targets • reported condition of nationally important wildlife sites, Sites of Special Scientific Interest (SSSIs) etc. • achievement of 'Accessible Natural Greenspace Standards' • number/area of Local Nature Reserves
Population and human health	• create conditions to improve health and reduce health inequalities • promote healthy living • protect and enhance human health • reduce and prevent crime, reduce fear of crime • decrease noise and vibration • increase opportunities for indoor recreation and exercise	• size of population • changes in demography • years of healthy life expectancy / infant mortality rate • mortality by cause • recorded crimes per 1,000 population • fear of crime surveys • number of transport/pedestrian/cyclist road accidents • number of people affected by ambient noise levels • proportion of tranquil areas • percentage of population living in most deprived areas/reliant on key benefits/ income deprived • general resident perception surveys
Water and soil	• limit water pollution to levels that do not damage natural systems • maintain water abstraction, run-off and recharge within carrying capacity (including future capacity) • reduce contamination, and safeguard soil quality and quantity • minimize waste, then re-use or recover it through recycling, composting or energy recovery • maintain and restore key ecological processes (e.g. hydrology, water quality, coastal processes)	• quality (biology and chemistry) of rivers, canals and freshwater bodies • quality and quantity of groundwater • water use (by sector, including leakage), availability and proportions recycled • water availability for water-dependent habitats, especially designated wetlands • amount/loss of greenfield / brownfield land and proportion available for reuse • number of houses affected by subsidence, instability, etc. • housing density • waste disposed of in landfill • contaminated land • flood risk

continued

Appendix 2.3: Examples of SEA objectives and indicators (ODPM, 2005a)

SEA topics	**Possible SEA objectives** (to be adapted to regional/local circumstances by deletions, additions and refinements)	**Possible SEA indicators: ways of quantifying the baseline, prediction, monitoring** (to be adapted to regional/local circumstances by deletions, additions and refinements)
Air	• limit air pollution to levels that do not damage natural systems • reduce the need to travel • reduce respiratory illnesses	• number of days of air pollution • levels of key air pollutants / by sector and per capita • achievement of Emission Limit Values • population living in Air Quality Management Area • access to key services • distances travelled per person per year by mode of transport • modal split • traffic volumes
Climate Factors	• reduce greenhouse gas emissions • reduce vulnerability to the effects of climate change e.g. flooding, disruption to travel by extreme weather, etc.	• electricity and gas use • electricity generated from renewable energy sources and CHP located in the area • energy consumption per building and per occupant • carbon dioxide (CO_2) emissions • flood risk
Cultural heritage and landscape	• preserve historic buildings, archaeological sites and other culturally important features • create places, spaces and buildings that work well, wear well and look well • protect and enhance the landscape everywhere and particularly in designated areas • value and protect diversity and local distinctiveness • improve the quantity and quality of publicly accessible open space	• percentage of Listed Buildings and archaeological sites 'at risk' • number and proportion of vacant dwellings • building functionality: use, access, space • building impact: form and materials, internal environment, urban and social integration, character and innovation • percentage of land designated for particular quality or amenity value, including publicly accessible land and greenways • proportion of population within 200m of parks and open spaces • percentage of residents rating improvement/other in activities for teenagers, cultural facilities including for children and sport, leisure and parkland facilities
Adapted from *Local Quality of Life Counts, Regional Quality of Life Counts*, ODPM guidance on integrated policy appraisal, *Environmental Appraisal of Development Plans: A Good Practice Guide, Guidance on the Methodology for Multi-Modal Studies*, Counsell and Haughton (2001), Sustainable Development Plans Group (2001), Construction Industry Council		

Appendix 2.4: Requirements of EU SEA Directive (ODPM, 2005a; Glasson, 2007)

Preparing an environmental report in which the likely significant effects on the environment of implementing the plan, and reasonable alternatives taking into account the objectives and geographical scope of the plan, are identified, described and evaluated. The information to be given is (Article 5 and Annex I):

a. an outline of the contents, main objectives of the plan, and relationship with other relevant plans and programmes;
b. the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan;
c. the environment characteristics of areas likely to be significantly affected;
d. any existing environmental problems which are relevant to the plan including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43 EEC;
e. the environmental protection objectives, established at international, Community or national level, which are relevant to the plan and the way those objectives and any environmental considerations have been taken into account during its preparation;
f. the likely significant effect on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors (these effects should include secondary, cumulative, synergistic and short-, medium- and long-term permanent and temporary, positive and negative effects);

ci the measures envisaged to prevent, reduce and as fully as possible offset any
significant adverse effects on the environment of implementing the plan;

h. an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken, including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
i. a description of measures envisaged concerning monitoring in accordance with Article 10;
j. a non-technical summary of the information provided under the above heading.

The report shall include the information that may reasonably be required taking into account current knowledge and methods of assessment, the contents and level of detail in the plan, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process to avoid duplication of the assessment (Article 5.2).

Consultation:

— Authorities with environmental responsibilities, when deciding on the scope and level of detail of the information which must be included in the environmental report (Article 5.4).

— Authorities with environmental responsibilities and the public shall be given an early and effective opportunity within appropriate time frames to express their opinion on the draft plan or programme and the accompanying environmental report before the adoption of the plan or programme (Article 6.1, 6.2).

— Other EU member states, where the implementation of the plan or programme is likely to have significant effects on the environment in that countries (Article 7).

Taking the environmental report and the results of the consultations into account in decision making (Article 8).

Provision of information on the decisions

When the plan or programme is adopted, the public and any countries consulted shall be informed and the following made available to those so informed:

— the plan or programme as adopted;

— a statement summarising how environmental considerations have been integrated into the plan or programme and how the environmental report pursuant to Article 5, the opinions expressed pursuant to Article 6 and the results of consultations entered into pursuant to Article 7 have been taken into account in accordance with Article 8, and the reasons for choosing the plan as adopted, in the light of the other reasonable alternatives dealt with; and

— the measures decided concerning monitoring (Articles 9 and 10).

Monitoring the significant environmental effects of the plan's or programme's implementation (Article 10).

Quality assurance: environmental reports should be of a sufficient standard to meet the requirements of the SEA Directive (Article 12).

Appendix 2.5: Baseline indicators for Sustainability Appraisal of Camden's Local Plan (London Borough of Camden, 2014)

Environmental indicators	
Transport and traffic	• Location of major transport demand generating Developments against PTALs (public transport accessibility levels) • % reduction in number of people killed or seriously injured in road accidents • Number of agreements signed for car-free or car capped housing • % Reduction in motor traffic flows through the borough • % increase in proportion of resident trips by walking • % increase in cycling traffic • % Increase in bus traffic
Cultural heritage and Landscape	• Conservation areas • Listed buildings and buildings at risk • Extent of archaeological priority zones • Number and condition of scheduled ancient Monuments
Open space	• Open spaces • Open space deficiency • Area of designated open space /improvements to open space • Public opinion of open spaces in Camden • Number of Tree Preservation Orders (TPOs) served • Number of applications affecting trees protected by TPOs and number of applications permitted that involved the loss of trees protected by TPOs
Biodiversity, flora and fauna	• Change in priority species (by type) • Change in priority habitats (by type) • Net loss/gain of Sites of Nature Conservation Importance and other sites of special biodiversity value, such as open spaces • Number of developments that have incorporated green roofs, landscaping or open space to improve biodiversity
Air quality	• Carbon dioxide (CO_2), Nitrogen dioxide (NO_2) and particulate matter (PM_{10}) emissions
Soil	• Number of sites of potential land contamination
Water and flooding	• %/Number of new developments incorporating water conservation measures (e.g. SUDS)

	• Number of planning permissions granted contrary to the advice of the Environment Agency on flooding or water quality • Number of properties at risk from 1% and 0.1% floods
Noise and vibration	• Number of noise complaints received by the Council • Number of important areas 'noise hotspots' defined by Defra
Climate factors	• Proportion of energy generated from renewable sources • Domestic energy efficiency • Number of new developments accompanied by a BREEAM assessment • Number of new developments achieving BREEAM ratings of very good or excellent • Number of new developments achieving Code for Sustainable Homes Level 3 and above & Number of new developments accompanied by a BREEAM assessment with ratings of very good or excellent • % Number of new developments incorporating water conservation measures (e.g. SUDS)
Recycling and waste management	• % of household waste recycled • % of new developments using sustainable construction
Development on previously developed land	• % of new housing on previously developed land
Socio-economic indicators	
Population	• Population by age and sex • Population by ethnic group • Population by place of birth • Population growth • Household size and composition • Household projections • Population density (persons/ha)
Health and community	• Schemes involving a gain/loss in community premises (museums, community halls, places of worship) • % people describing their health as '*good*' or '*not good*' • % people with limiting long term illness • Major causes of death in Camden • % people with a low satisfaction score (self-reported well -being) • % of people using outdoor space for health/exercise • % of active adults • Excess weight • Mortality rate from causes considered preventable • Under 75 mortality rate from cardiovascular disease considered preventable • Number of care homes for older people • Number of care homes for mental health • Number of sports/playing fields and outdoor

	recreation spaces • Levels of crime in Camden • Violent crime • % of developments incorporating Secured by Design principles
Deprivation and social exclusion	• Household income • Number of Super Output Areas (SOAs) within 10% most deprived in England • Life expectancy • % of unemployed who have been out of work for over one year • Claimant count unemployment rate • Unemployment by ward and sex and long term unemployment • Households with children in families on Key Benefits
Education	• Area of new education facilities created • Indices of deprivation – education skills and training • Proportion of adults with poor literacy and numeracy skills • School capacity figures, primary and secondary, and areas of education provision deficiency • Number of NEET's
Housing	• Housing stock by tenure • % of dwellings by type • House prices and rents • Ratio of average house price to earnings • Houses with special needs • Number of homeless households • % number of households in unsuitable housing • Number of affordable housing completions • Mix of housing sizes • Number of new homes completed • Vacant residential units • %/Number of all new housing units designed to wheelchair accessibility & Lifetime Homes standards • Number/ proportion of households needing affordable housing per annum.
Leisure	• Completed leisure (D2) floorspace • Access to open space
Town Centres and Employment	• Completed retail, food, drink and entertainment floorspace • Vacancy in town centres and other designated frontages • Retail, food, drink and entertainment uses • Employment floorspace completed and available • Growth areas projected floorspace • Change in VAT registered businesses • Number of secured apprenticeship in Camden

Appendix 2.6: BREEAM weightings (BRE, 2014a)

BREEAM environmental section weightings

Environmental section	Weighting		
	Fully fitted out	Shell only	Shell and core only
Management	12%	12.50%	11%
Health and Wellbeing	15%	10%	10.50%
Energy	15%	14.50%	15%
Transport	9%	11.50%	10%
Water	7%	4%	7.50%
Materials	13.5%	17.50%	14.50%
Waste	8.5%	11%	9.50%
Land Use and Ecology	10%	13%	11%
Pollution	10%	6%	11%
Total	100%	100%	100%
Innovation (additional)	10%	10%	10%

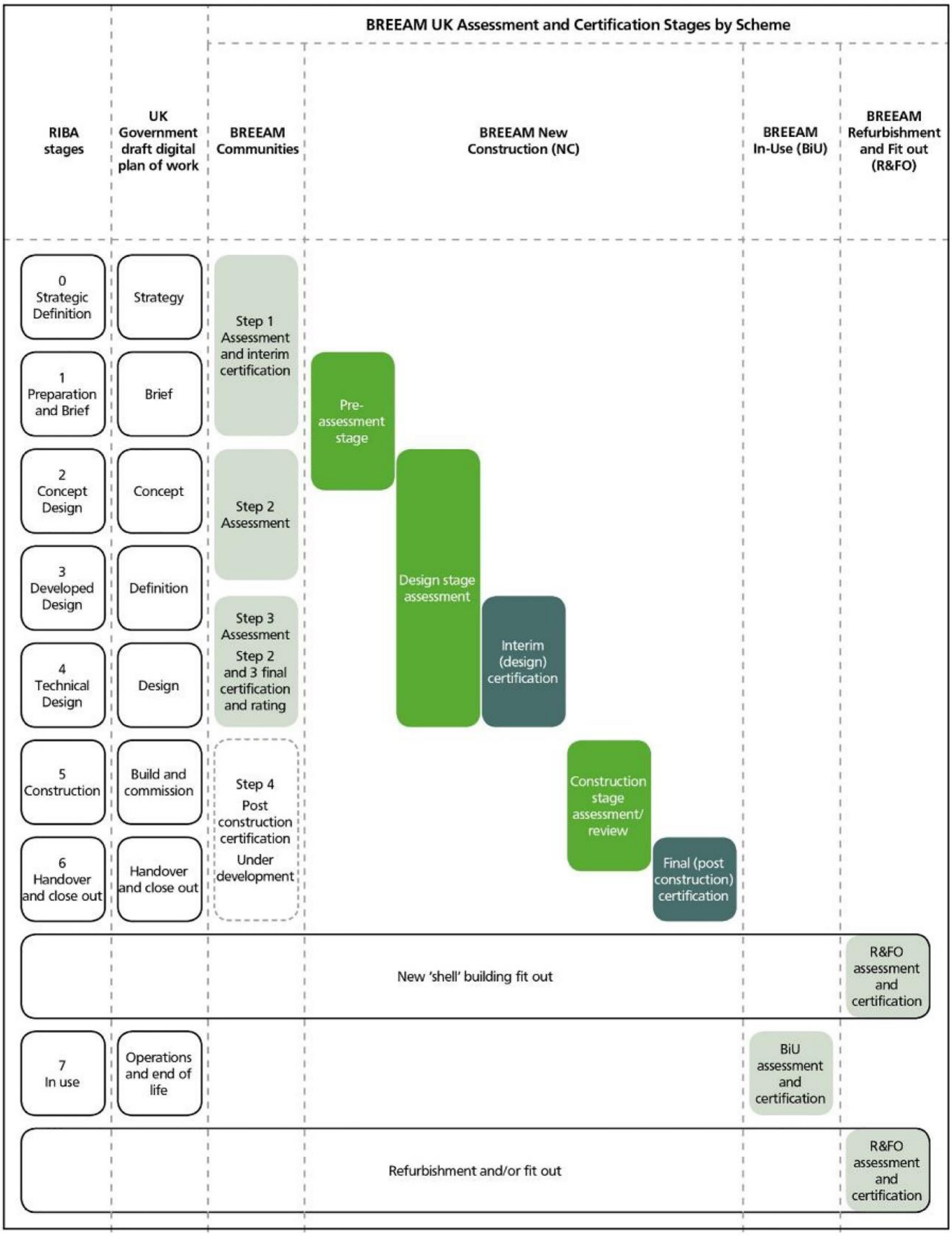
Weightings definitions

Option 1: Shall Only Assessment
This assessment and certification option is available where the developer's scope of works covers new build works to the fabric, sub and superstructure of the building only, including: • External walls, windows, doors (external), roof, core internal walls, structural floors • Hard and soft landscaping areas (where present and within scope of works)
Option 2: Shall and Core Assessment
This option is available where the developer's scope of works covers shell works, as described in Option 1, plus core building services. Core building services relates to the installation of central or communal transportation systems, water systems, fit-out of common areas, central mechanical and electrical systems including HVAC, but without local fitting of systems within tenant areas. The systems will typically be centralised with capped off distribution to each tenanted area (for future connection as part of a tenant's fit-out works). This does not include the full scope of a typical Category A fit-out, due to the fact that the specification of items such as ceiling finishes, raised floors and the zoning of local services above the let table floor area and other Category A works are not typically finalised until the space undergoes final fit-out according to the tenant's specification and are liable to change. These items are, therefore, excluded from a shell and core assessment.
Option 3: Fully Fitted Assessment
Combination of options 1 & 2

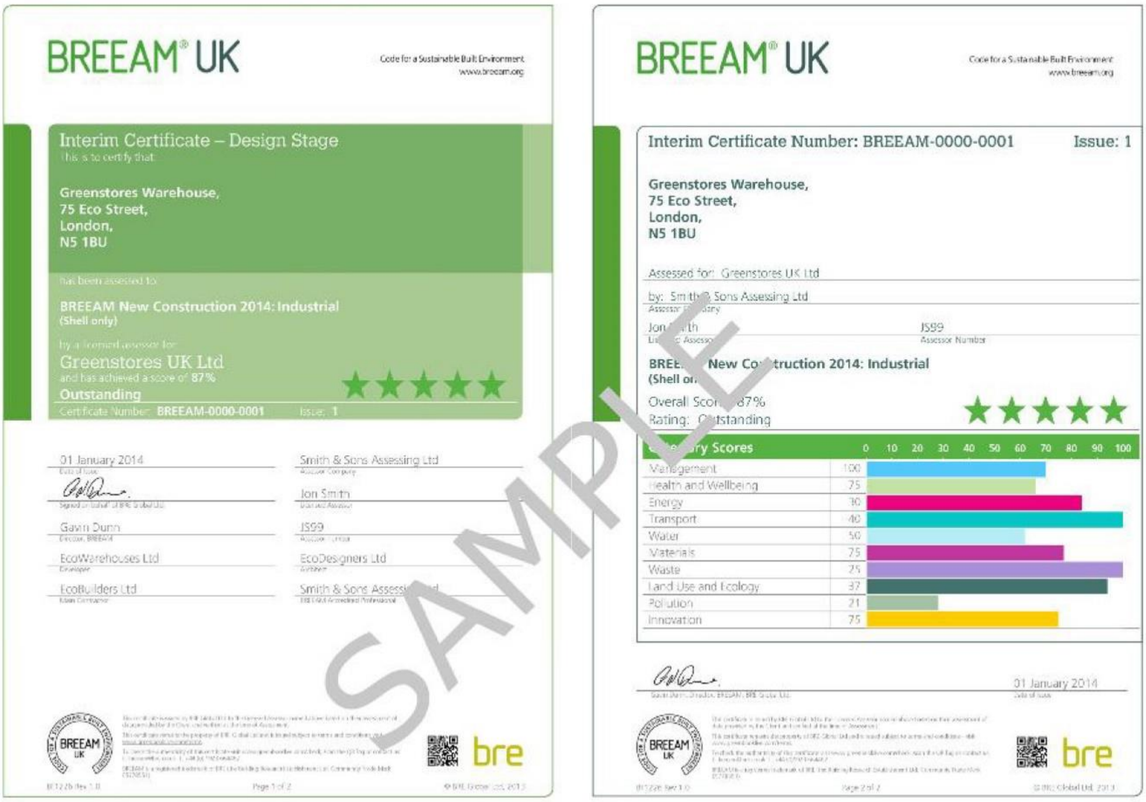
Example of BREEAM score and rating calculation

BREEAM Section	Credits Achieved	Credits Available	% of Credits Achieved	Section Weighting (fully fitted)	Section Score
Management	10	22	45%	0.12	5.45%
Health and Wellbeing	8	10	80.00%	0.15	12.00%
Energy	16	30	53.33%	0.15	7.99%
Transport	5	9	55.56%	0.09	5.00%
Water	5	9	55.56%	0.07	3.89%
Materials	6	12	50.00%	0.135	6.75%
Waste	3	7	42.86%	0.085	3.64%
Land Use and Ecology	5	10	50.00%	0.10	5.00%
Pollution	5	13	38.50%	0.10	3.85%
Innovation	2	10	20.00%	0.10	2%
Final BREEAM score				55.57%	
BREEAM Rating				VERY GOOD	

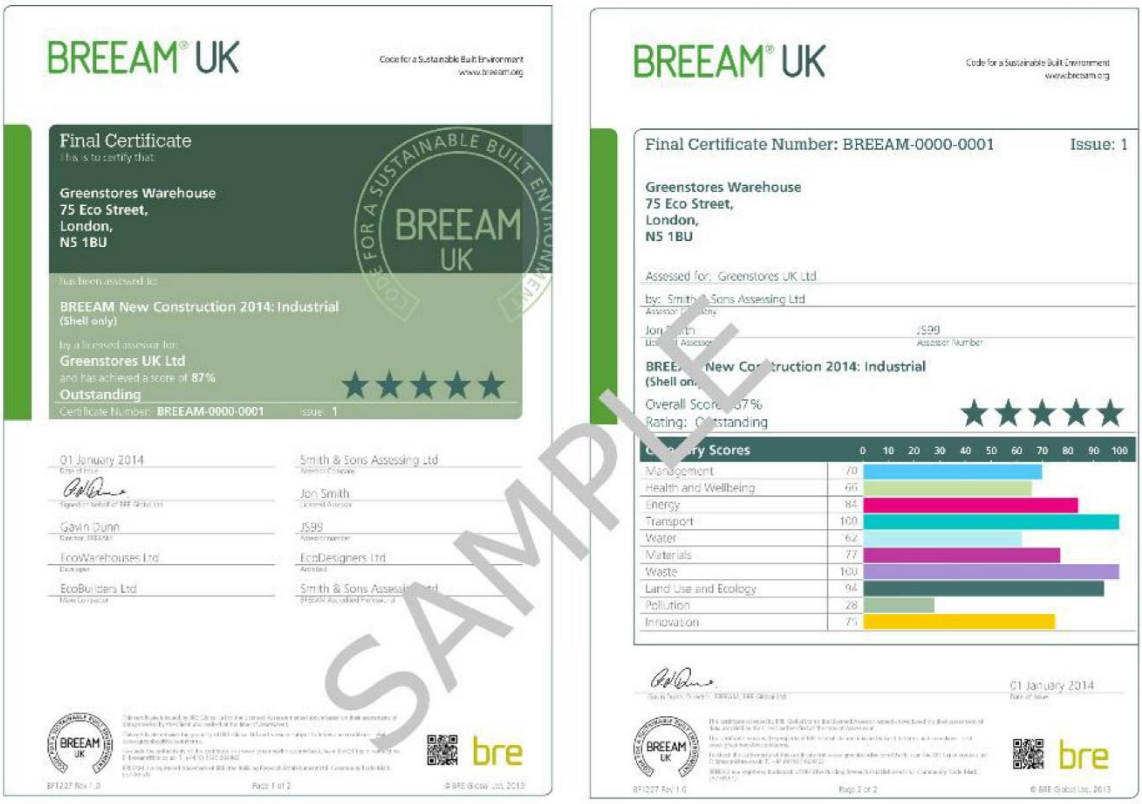
Appendix 2.7: Incorporating BREEAM assessment stages within RIBA Plan of Work (BRE, 2014a)



Appendix 2.8: Examples of BREEAM UK New Construction certificates (BRE, 2014a)



Example of certificate at design stage



Example of certificate at post-construction stage

Appendix 2.9: Home Quality Mark sections and assessment issues (BRE, 2015)

Section		Issue	Available Credits
Our Surroundings	Transport and Movement	Accessible Public Transport	16
		Alternative Sustainable Transport Options	15
		Local Amenities	19
	Outdoors	Ecology	30
		Recreational Space	20
	Safety and Resilience	Flood Risk	18
		Managing the Impact of Rainfall	16
		Security	10
My Home	Comfort	Indoor Pollutants	10
		Daylight	16
		Internal and External Noise	4
		Sound Insulation	8
		Temperature	20
		Ventilation	12
	Energy and Cost	Energy Forecast and Cost	62
		Decentralised Energy	10
		Impact on Local Air Quality	11
	Materials	Responsible Sourcing of Construction Products	31
		Environmental Impact from Construction Products	31
		Life Cycle Costing of Materials	18
		Durability of Construction Products	10
	Space	Drying Space	3
		Access and Space	10
		Recyclable Waste	10
	Water	Water Efficiency	10
Knowledge Sharing	Home Delivery	Commissioning and Performance	10
		Quality Improvement	10
		Considerate Construction	4
		Construction Energy Use	5
		Construction Water Use	5
		Site Waste	15
	User Experience	Aftercare (Mandatory Criteria)	10
		Home Information	5
		Smart Homes	7
	Future Learning	Post Occupancy Evaluation	9

Appendix 2.10: Example of 'summary of results' for London 'quality of life' (LSDC. 2012)

	Indicator	Trends	Measure in 2009 report / Baseline	Measure in 2012 report	Movement / Progress	National average for 2012 report
18	Physical activity	≈	20.2%	20.2%	Overall there has been no change in the percentage of Londoners participating in moderate intensity sport and active recreation since 2007-08. Participation in sport and recreation for London was lower than England as a whole (20.2% and 21.9% respectively). There is also significant variation in activity levels between boroughs.	21.9%
19	Happiness[13]	≈	7.41 New indicator	7.65	This is a new indicator for the QoL indicator set. London's happiness score has remained broadly stable between 2006-07 and 2010-11. However Londoners subjectively rate themselves less happy than the rest of the UK.	7.87
20	Satisfaction with London	✓	73%	77%	In 2011, 77% of Londoners were satisfied with the capital as a place to live. This is an improvement on satisfaction levels in 2007. Londoners' satisfaction with their neighbourhood, meanwhile, has remained fairly static over the last decade. People from higher or middle classes are more likely to be satisfied than people from lower classes.	Not available
21	Voting[14]	✗	45% turnout	38% turnout	Turnout for the 2012 London Mayoral and London Assembly elections was lower than in 2008. However, this was still higher than the turnout for the 2004 and 2000 elections. Furthermore, turnout in London for the General Election and for Borough elections has risen since 2002, although General Election turnout in London is lower than the national average.	Not available
22	Volunteering[15]	≈	23% New Indicator	24%	Levels of formal and informal volunteering in London have increased from 23% in 2008-09 to 24% in 2011-12, according to the Taking Part Survey. Levels in London are now higher than the average for England. The rise might in part be explained by the publicity in volunteering generated by the 2012 Olympic and Paralympic Games, which have involved large numbers of volunteers but have not been included in this data. The rise bucks a national downward trend. London is now performing better than the national average, although it is still behind levels in the South East, South West and East of England.	23% (England)

Appendix 2.11: 'Travel to School' indicator, London QoL, (LSDC, 2012)

LONDON
SUSTAINABLE DEVELOPMENT COMMISSION

3. TRAVEL TO SCHOOL

Measure	Change since 2004 QoL report	Change since 2008-09 QoL report	Year of data used for 2012 QoL report
Proportion of 5-16 year olds travelling to school by means other than car	✓ (2001 data)	✓ (2005-06 data)	2010

Trend (2005-06 to 2009-10)

Summary

Overall, the proportion of 5-16 year olds travelling to and from school by means other than car has increased slightly since 2005/6. The proportion of 5-16 year olds walking to and from school has continued to fall but this has been counterbalanced by the rise in the proportion of children travelling to and from school by 'other' modes, including cycling.

Why is this issue important to London's quality of life?

How children get to school is important for a variety of reasons. Increasing the proportion of children who walk or cycle to school increases physical activity amongst children, and should help to counter the growing levels of childhood obesity. The more children that are taken to school by car, the more pollution and congestion are created. A significant proportion of weekday morning peak trips are due to 'the school run'. Reducing dependence on cars for travel to school is important to keep London moving whilst also meeting the challenge of climate change and improving London's environment and the health of its communities.

The National Travel Survey collects figures on travel to school by 5-10 and 11-16 year olds in Great Britain on an annual basis. For children in the younger age-group (5-10 years), 47% of trips to and from school were made on foot in 2010, while for secondary school children this proportion was lower (36%) partly because of pupils travelling further to school. For trips to school under 1 mile in length, walking was the most prevalent mode of travel for both primary and secondary school children, accounting for 82% and 90% of trips respectively. For longer school trips, the most popular mode for primary school children was by car, with 75% of 2 to 5 mile trips, and 67% of trips over 5 miles made in this way. For secondary school pupils 50% of all trips of 2 to 5 miles in length, and 63% of trips over 5 miles, were made by bus.

In London, a slightly lower proportion of children aged 5-16 walked to school in 2009-10 (40% compared to the national average of 42%). This figure was down from 44% in 2005-06 and 50% in 2001. However, more children took the bus (30% compared to the national average of 21%) and this had increased significantly from 25% in 2005-06 and 20% in 2001. The proportion of children travelling to school by car in London stayed broadly unchanged, rising from 22% in 2001 to 26% in 2005-06 and then falling again to 23% in 2009-10. This compares to a national average of 32% in 2009-10. The proportion of children in London travelling to and from school by other modes, including cycling, increased steadily from 1% in 2001 to 4% in 2005-06 and 7% in 2009-10. This last figure compares to 4% for Great Britain as a whole.

LONDON
SUSTAINABLE DEVELOPMENT COMMISSION

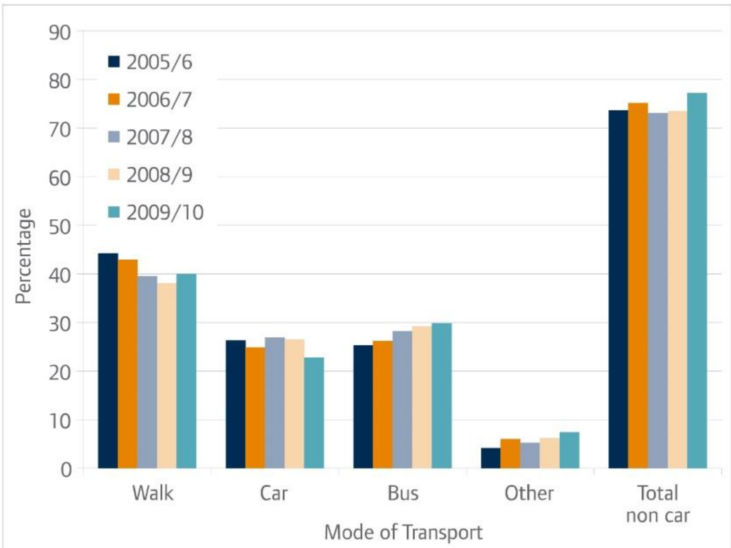
Image from the TfL Image library

The increase in bus usage and cycling for school trips in London is consistent with broader figures for overall traffic volumes. Higher bus usage would be expected in London compared to elsewhere in the UK, owing to better access to public transport. However, car use for school trips in London has not fallen as much as overall car use in the city, highlighting that travel to school is still an issue to be tackled.

Despite the trend towards increased parental choice for schools, the average journey length for London school children had not changed significantly between 2005-06 and 2009-10: from 1.2 to 1.3 miles for primary school children, and 3.0 to 2.9 miles for secondary school children. These journeys are slightly lower than the averages for Great Britain in 2009-10, which were 1.5 miles for primary school children and 3.4 miles for secondary school children.

Figure 3 Trips to and from school in London – by transport mode (%)

Source: National Travel Survey (Table NTS 9908 – Trips to and from school by main mode, region and area type: Great Britain, for 5-16 year olds).



Appendix 2.12: London 'Quality of Life' indicator set (LSDC, 2012)

Environmental	
Headline indicator	**Measure**
Air quality	Tonnes of PM10 emitted in London
CO_2 emissions	Tot al CO2 emissions in London
Travel to school	Proportion of 5-16 year olds travelling to school by means other than car
Traffic volumes	Levels of road traffic in London: – Traffic volumes in Greater London (vehicle km, millions) – Estimated daily average number of passenger journey stages in Greater London
Access to nature	Areas of deficiency in access to nature by borough
Bird populations	Bird populations (number of species)
Ecological footprint	London's ecological footprint: – Ecological Footprint per capita - London and UK – Breakdown of Ecological Footprint
Flooding	– Number of properties at risk – Number of people signed up to flood warning system
Household recycling	Household recycling rates: – Percentage of household recycling and composting in London
Waste	Household waste in London – Local authority collected waste in London
Water consumption	Per capita consumption (household)– five year mean
Social	
Headline indicator	**Measure**
Childcare	Childcare places for under 8s
Education: primary	Average proportion of pupils making expected progress from Key Stage 1 to Key Stage 2, across English and Maths.
Education: secondary	Proportion of pupils obtaining at least 5 GCSE passes at A*-C or equivalent
Crime	– Total recorded crime in London – quality of life affected by the fear of crime (great / moderate / minimal)
Decent housing	Percentage of decent housing stock: – Percentage of homes above the Decent Homes Standard by region – Percentage of homes in London below the Decent Homes Standard by tenure
Life expectancy	– Life expectancy at birth for men (years) – Life expectancy at birth for women (years)
Physical activity	Percentage of people participating in moderate exercise three times a week
Happiness	Self-scored happiness levels (out of 10):

	– Satisfaction with life in London and the rest of the UK,
Satisfaction with London	Percentage of Londoners satisfied with the capital as a place to live
Voting	– London Mayoral Election turnout – London Borough Elections turnout – General Election turnout in London
Volunteering	Participation in formal or informal volunteering over previous 12 months

Economic

Headline indicator	**Measure**
Employment rates	– Employment rate by gender – Employment rate by ethnic group – youth employment rates versus overall employment rates in London
Business survival	– Percentage of new businesses still trading after 1 year – Percentage of new businesses still trading after 3 year
Income inequality	Disposable income differentials in London: – Decile distribution of net disposable household income for individuals (whole population)
Child poverty	Children living in households below 60% median income
Fuel poverty	Fuel poor households in London: – Estimates of fuel poverty in London, based on 'full income' measure
Housing affordability	Ratio of lower quartile house prices to lower quartile earnings
Gross value added	Gross value added per capita
Carbon efficiency	Carbon dioxide emissions per unit of output produced
Low carbon and environmental jobs	Number of jobs in Low Carbon and Environmental Goods and Services
Skills	Percentage of adults (16-64) with level 4 qualifications or above
Innovation	– Percentage of firms reporting introducing 'product innovations' – Percentage of firms reporting introducing 'process innovations'

Appendix 2.13: SPeAR Indicator Set (ARUP, 2012)

Segment	Indicator	Sub-Indicator
Core Indicators		
Social	**Community Facilities**	Recreation
		Education
		Healthcare
		Retail
	Culture	Respecting socio-cultural identity
		Cultural and religious facilities
		Use of environment
		Intergenerational and gender practices
		Archaeology and local heritage
		Art
	Form and Space	Density, height, scale and massing
		Public, private and communal space
		Landscape, townscape and visual impact
		Security
		Connectivity
		Microclimate
	Stakeholder Engagement	Identification and analysis
		Engagement process and feedback
		Integrating stakeholders comments
	Health and Wellbeing	Access to green space
		Community cohesion
		Institutions and social networks
		Indoor environment
		Social vibrancy
	Transport	Public transport infrastructure
		Pedestrian design and facilities
		Cycle design and facilities
		Waterways
		Freight traffic (logistics)
		Low emission vehicles
		Private vehicle use
		Air travel

Segment	Indicator	Sub-Indicator
Additional Indicators		
	Health and Safety	Health and Safety on construction sites
		Health and Safety in design
		Health and Safety in operation
	Sustainable Behaviours	Encouragement
		Engagement
		Leadership
		Enabling
	Indigenous Culture	Socio-cultural identity
		Local heritage
		Cultural and religious facilities
		Use of environment
		Intergenerational and gender practices
		Archaeology
		Art
	Non-indigenous Culture	Socio-cultural identity
		Local heritage
		Cultural and religious facilities
		Use of environment
		Intergenerational and gender practices
		Archaeology
		Art
Core Indicators		
Environmental	**Soil and Land**	Contaminated land
		Soil quality
		Drainage systems
	Biodiversity	Protected species and habitats
		Conserving and improving local biodiversity
		Habitat connectivity
	Waste	Construction waste management plan
		Waste in operation
		Hazardous/ special waste
		Composting
		Designing out waste
	Materials	Materials efficiency in design
		Use of recycled or reused materials
		Environmental and sustainability impacts of materials
		Healthy materials

Appendix 2.13: SPeAR Indicator Set (ARUP, 2012)

Segment	Indicator	Sub-Indicator
Core Indicators		
	Water	Water pollution
		Water resources
		Wastewater treatment & disposal
		Water sources
		Water monitoring
		Water supply
		Construction
	Energy	Energy supply
		Energy conservation and efficiency
		Energy monitoring
		Daylighting
	Climate Change	Carbon management plan
		Social impacts of climate change
		Physical impacts of climate change
		Carbon sequestration
		Economics of climate change
	Air Quality	Ambient air quality
		Direct emissions
		Indirect emissions
		Ozone depleters
Additional Indicators		
	Food and Agriculture	Land use
		Resilience
		Resource and synergies
		Community food growing
	Energy Generation	Renewables
		Low carbon energy
		Energy security
	Energy Demand	Lighting
		Heat demand
		Cooling/ ventilation
		Construction energy reduction
		Energy monitoring
		Industrial energy reduction
		Appliances
		ICT
	Noise and Vibration	Construction noise
		Operational noise (internal to site)
		Operational noise (external)
		Vibration
	Light Pollution	Street lighting
		Indoor lighting
		Lighting in open spaces

Appendix 2.13: SPeAR Indicator Set (ARUP, 2012)

Segment	Indicator	Sub-Indicator
Core Indicators		
Economic	**Facilities Management**	Usability
		Appropriate technologies
		Whole-life flexibility
		Operation and maintenance
	Governance and Reporting	Monitoring and evaluation
		Information disclosure and reporting
		Strategy
		Risk management
		Donations to voluntary and community organisations
	Economic Effect	Value for money
		Distortions to local economy
		Vitality and regeneration
		Carbon pricing
	Employment and Skills	Labour standards
		Employment creation
		Training
		Access to finance
		Employment creation in construction
		Employment creation in operation
		Social mobility
	Site Selection	Site location
		Planning intent
		Diversity/mixed use
	Procurement	Local sourcing
		Global sourcing
		Procurement strategy
	Equality	Affordability
		Designing for equality
		Impacts and benefits
		Land tenure
		Displacement
Additional Indicators		
	Informatics	Smart resource systems
		Social interaction
		Public information
		Transport
		Environmental quality
	Innovation	Research and innovation
		Knowledge exchange
		Replication
		R&D spend

Appendix 4.1: The consent form

Informed Consent Form

Research topic	Measuring Cities: A Study on the Development of Iranian Urban Sustainability Assessment Mechanisms; from a UK Perspective
Researcher	Ahmadreza Hakiminejad, PhD Candidate at University of West London, London, UK
Supervisors	Supervisors: Dr Changfeng Fu, Dr Anthony Olden, Professor Thomas Roth-Berghofer Advisor: Dr Hamideh Mohammadzadeh Titkanlou
Researcher's emails	ahmadreza.hakiminejad@uwl.ac.uk reza1549@yahoo.com ahmadreza.hakimi@gmail.com

Introduction
This interview/workshop is conducted as part of a PhD research project based at University of West London, School of Computing and Engineering. The research title is *'Measuring Cities: A Study on the Development of Iranian Urban Sustainability Assessment Mechanisms; Based on the UK Experience'*. The study being carried out under the supervision of Dr Changfeng Fu, Associate Professor at University of West London; and Dr Hamideh Mohammadzadeh Titkanlou who is the member of managerial board of Andisheh New Town Development Company in Tehran, Iran. The following paragraphs will give a brief introduction to this study which, as noted, **is purely an academic research and it is being implemented for the purpose of researcher's PhD thesis completion.**

The research particularly focuses on the evaluation, measurement, and assessment of sustainable urban development in Iran. Since Iranian cities suffer from major challenges towards sustainable development, the recognition, analyses, and assessment of this problematic situation is imperative. This is what exactly this study concentrates on. In Iran, due to the lack of sufficient research on the approaches of urban sustainability assessment mechanisms and the absence of comparing and assessing their results, this study aims to provide a deeper insight and develop a better understanding of these approaches to define a theoretical framework regarding urban sustainability assessment mechanisms and systems. Through research, it aims to explore at a systematic solution on how to improve a theoretical framework and to develop a better understanding of urban sustainability assessment mechanisms, based on Iranian national and local characteristics. Therefore, to achieve this aim it is necessary to:

- Review in-depth the UK experience and achievement in urban sustainability assessment through indicator systems; data sources; and assessment methods and techniques.
- Investigate the existing situation of Iran in terms of urban sustainability development (regulations and legislation, technologies, assessment).
- Explore the urban sustainability assessment mechanisms in Iran through indicators; data sources; and assessment techniques
- Research and develop the principles and methods for development of a systematic sustainability assessment mechanism in an Iranian case study with a comprehensive plan of an integrated indicator system, data sources and assessment techniques.
- Re-assess the interim suggestions and draw final conclusion of this study (collecting feedback from academics; practitioners; policy and decision makers through workshop/seminar/interviews in Iran).

The findings of this study provide insights into the issues that policy makers and practitioners should consider in developing programs and efforts dealing with the problems of urban sustainability assessment mechanisms. This piece of work draws a comprehensive study on the urban sustainability assessment mechanisms in Iran. It tries to delve deeply into the environmental, social and economic aspects of systems and mechanisms of urban sustainability assessment with regards to indicators, data sources, and assessment techniques based on a comparative study. It will develop a guideline to the theory and literature within the knowledge bases of evaluation of urban sustainability in Iran. Tackling the existing issues and making suggestions, it will depict the most appropriate way for the development of Iranian urban sustainability assessment mechanisms considering the three substantial pillars of sustainability: environment; society; and economy. It would also develop a detailed proposal for developing a sustainability assessment mechanism in Iran with detailed indicators, data requirements and assessment techniques.

Confidentiality

With regards to this interview/workshop, your participation will remain confidential and the researcher is committed to avoid using your identity without your authorised permission. It means if you wish to be quoted by name on anything in particular in this research, you need to grant the researcher a written permission, so he would be happy to accommodate this request.

Please read the following statements and, if you agree, initial the corresponding box to confirm agreement:

I freely agree to participate in this study. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. ☐

I understand that my data will be treated confidentially and any publication resulting from this work will report only data that does **not** identify me. ☐

Signatures:

______________________	______________________	______________________
Name of participant (block capitals)	Date	Signature
AHMADREZA HAKIMINEJAD	______________________	______________________
Researcher (block capitals)	Date	Signature

I hereby do greatly appreciate your time, consideration and contribution to this study.

If you would like a copy of this consent form to keep, please ask the researcher. If you have any queries about this research, you can direct these, in writing, to the researcher by email at: ahmadreza.hakiminejad@uwl.ac.uk

Appendix 4.2: **The questionnaire**

PART A (5 QUESTIONS)

Personal information

1. Age:
2. Sex:
3. Education (degree and field of study):
4. Occupation: (please tick the relevant box(es))

- Architect ☐
- Urban designer ☐
- Urban planner ☐
- Civil engineer ☐
- Other fields of engineering ☐

  Please specify: …………………

- Other fields ☐

  Please specify: …………………

5. Working status: (please tick the relevant box(es))

- Private company ☐
- Public / local authority/governmental organisation ☐

PART B (11 QUESTIONS)

NOTE: As we define indicators to assess urban sustainability, we also need to use relevant data sources to be able to measure those indicators against the existing data. Questions **2**, **3**, and **4** focus on what you think of the availability/existence of data sources, quality of existing data sources, and the accessibility of existing data in Iran for urban sustainability assessment processes.

1. If you were asked to design an urban sustainability indicator system for Iran, which one of these three aspects you will more focus on? Please rate your choices in importance from 1 to 3.
   NOTE:
   Priority 1: highest focus
   Priority 3: lowest focus

Category Indicator	Priority 1	Priority 2	Priority 3
Environmental			
Social			
Economic			

Please comment here if you would like to add any ideas/ opinions/ recommendations:

2. What do you think of the situation of availability/existence of data sources in Iran regarding urban sustainability assessment processes? Please rate.

Excellent	Good	Satisfactory	Poor	Very poor

Please comment here if you would like to add any ideas/ opinions/ recommendations:

3. If the data are available (if the data exist in the first place), how good you could get access to those existing data in Iran? How would you rate the accessibility of existing data in Iran regarding urban sustainability assessment processes?

Excellent	Good	Satisfactory	Poor	Very poor

Please comment here if you would like to add any ideas/ opinions/ recommendations:

4. What do you think of the quality of existing data sources (data reliability) in Iran regarding urban sustainability assessment processes? Please rate.

Excellent	Good	Satisfactory	Poor	Very poor

Please comment here if you would like to add any ideas/ opinions/ recommendations:

5. How would you rate the overall state of **sustainable urban development** in Iran?

Excellent	Good	Satisfactory	Poor	Very poor

Please comment here if you would like to add any ideas/ opinions/ recommendations:

6. How would you rate the overall state of **urban sustainability assessment** in Iran?

Excellent	Good	Satisfactory	Poor	Very poor

Please comment here if you would like to add any ideas/ opinions/ recommendations:

7. How significant is the role of GIS (Geographic Information System) in current Iranian urban planning procedures?

Highly significant	significant	No idea	insignificant	Highly insignificant

Please comment here if you would like to add any ideas/ opinions/ recommendations:

8. If you were asked to design an urban sustainability indicator system for Iran, how would you prioritise the following 'environmental headline indicators', given Iran's environmental situation?

NOTE:
Priority 1: highest priority
Priority 9: lowest priority

Environmental Headline Indicator	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 6	Priority 7	Priority 8	Priority 9
Air									
Water									
Soil and land									
Noise									
Waste									
Access to nature									
Traffic volume									
Natural disaster									
Biodiversity									

Please comment here if you would like to add any ideas/ opinions/ recommendations:

9. If you were asked to design an urban sustainability indicator system for Iran how would you prioritise the following 'social headline indicators', given Iran's social situation?

NOTE:
Priority 1: highest priority
Priority 11: lowest priority

Social Headline Indicator	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 6	Priority 7	Priority 8	Priority 9	Priority 10	Priority 11
Population											
Education											
Healthcare											
Housing & Services											
Social security											
Culture											
Life expectancy											
Satisfaction											
Transport											
Social capital											
Image of the city											

Please comment here if you would like to add any ideas/ opinions/ recommendations:

10. If you were asked to design an urban sustainability indicator system for Iran how would you prioritise the following 'economic headline indicators', given Iran's economic situation?

NOTE:
Priority 1: highest priority
Priority 10: lowest priority

Economic Headline Indicator	Priority 1	Priority 2	Priority 3	Priority 4	Priority 5	Priority 6	Priority 7	Priority 8	Priority 9	Priority 10
Employment										
Business survival										
Poverty										
Economic prosperity & income										
Research & Development										
Environmental goods and services										
Physical infrastructure										
Non-oil export										
Inflation										
Energy										

Please comment here if you would like to add any ideas/ opinions/ recommendations:

11. What is the most important obstacle/challenge in the process of evaluation of urban sustainability in Iran, in your opinion? Please rate your choices in importance from 1 to 6.

NOTE:

Priority 1: most important

Priority 6: least important

Category Indicator	**Priority 1**	**Priority 2**	**Priority 3**	**Priority 4**	**Priority 5**	**Priority 6**
Data						

Indicators						
Assessment techniques						
Expertise						
Institutional management						
Public awareness						

Please comment here if you would like to add any ideas/ opinions/ recommendations:

PART C (3 QUESTIONS)

1. Should the following **environmental sub-indicators** be included in the proposed Iranian urban sustainability assessment mechanisms?

Environmental Headline Indicator	Environmental sub-indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Soil and Land	soil quality					
Soil and Land	Desertification					
Soil and Land: Land contamination	Number of sites of potential land contamination					
	State and number of Landfills					
Soil and Land: Cultural heritage and landscape	Number and area of Conservation Areas					
	Number of Listed buildings and number of Listed buildings at risk: A building is “Listed” when it is of special architectural or historic interest considered to be of national importance					

	and therefore worth protecting.					
	Archaeological Priority Area: An Archaeological Priority Area is a defined area where, according to existing information, there is significant known archaeological interest or particular potential for new discoveries					
Soil and Land: Open space	Number and area of registered parks and gardens per capita					
	Rate of deforestation (hectare per year)					
	Area of designated open space /improvements to open space					
	Number of Tree Preservation Orders (TPOs): A Tree Preservation Order is an order made by a local planning authority in England to protect specific trees, groups of trees or woodlands in the interests of amenity. An Order prohibits the cutting down, topping, lopping, uprooting, wilful damage, wilful destruction of trees without the local planning authority's written consent.					
	Number of applications affecting trees and number of applications permitted that involved the loss of trees					
Soil and Land: Land use by type	Total Croppable Area					
	Permanent Grassland and Rough Grassland					

	Forestry and woodland					
	Inland water					
	Desert					
	Urban land use by types					
Water	**Water pollution sources**: Household wastewater/ Industrial wastewater/ Agricultural pollutants (wastewater/ fertilizer)/ Oil spill					
	Water resources -Surface water: rivers, lakes, sea -Groundwater: well, qanat, spring -Precipitation: rain and snow					
	Proportion of households with access to clean water					
	Proportion of households with access to sanitation facilities					
	Water quality: drinking water/ rivers/ lakes/ groundwater					
	Water stress index					
	Household water consumption per capita per day					
	Intensity of water use in agriculture					
	Groundwater level/ quantity of groundwater					
	Abstractions from non-tidal surface waters and groundwater (billion cubic metres)					
	Number of regular water outage in warm seasons due to water ration					
	use of sustainable urban drainage solutions in new development: Rain water harvest / Grey water harvest					

Waste	Household waste recycled and composted					
	Industry/ construction waste recycled and composted					
	Total amount of waste generated per capita per year					
Traffic	Traffic volume by vehicle type: Cars and taxis / Light vans / Goods vehicles / Motorcycles / Buses and coaches / All motor vehicles (vehicle km)					
Access to nature	Areas of Deficiency (AoD) in access to nature by borough: Areas of Deficiency in access to nature are defined as localities where people live more than 1km walking distance from a green space, which is designated as a Site of Importance for Nature Conservation (SINC) at borough level or higher					
Noise	Number of complaints per 1000 people					
	percentage of road network with lower noise surface material					
	percentage of buses in fleet at least 2 dB quieter than the legal limit					
	Estimated number of people and dwelling above various noise levels due to road traffic					
	Estimated number of people and dwelling above various noise levels due to railways					
	Aviation noise: Estimated number of people					

	exposed to various Lden bands					
	Aviation noise: Estimated number of people exposed to various Lnight bands					
Natural disaster (earthquake and flooding)	Number and length of active faults					
	Building structure by type: Steel frame/ Concrete frame/ Others/ Unknown					
	Seismic vulnerability of school buildings					
	Vulnerability of deteriorated urban areas					
	Gas network vulnerability					
	Water network vulnerability					
	Number of properties at risk of flooding					
	Number of people signed up to the "flood warning system"					
Air	Number of pollution days (exceeded the national standard)					
	Population living in Air Quality Management Areas (AQMA): Areas that need a Local Air Quality Action Plan due to their poor air quality					
	Number of Air Quality Management Areas (AQMA)					
	Vehicles' Fuel Consumption Inefficiency					
	Nitrogen dioxide (NO_2)					
	Carbon monoxide (CO)					
	Sulfur dioxide (SO_2)					
	Particulate Matters (PM2.5) – mg/m^3					
	Particulate Matters (PM10) – mg/m^3					
	Ozone (O_3)					
	Benzene					

	CO_2 emission					
	Number of cars produced under *Euro 6 Emissions Standards* per year					
Biodiversity	Population of wild birds					
	Status priority species and habitats: Improving/ Declining/ Stable/ Unknown					
	Sustainable fisheries: Percentage of fish stocks harvested sustainably and at full reproductive capacity					
	Percentage of endangered species					
	Percentage of marine (coastal) protected areas					
	Percentage of the land protected areas					
	Number of developments that have incorporated green roofs, landscaping or open space to improve the diversity					
Ecological Footprint	Ecological Footprint per capita					
	Ecological Footprint by land type: forest land/ fishing ground/ built land/ grazing land/ crop land/ carbon land					

Please comment here if you would like to add any ideas/ opinions/ recommendations:

2. Should the following **social sub-indicators** be included in the proposed Iranian urban sustainability assessment mechanisms?

Social Headline Indicator	Social sub-indicator	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Population	Population by age, sex, and ethnic group					
	Rate of population growth					
	Population density (person/ha)					
Education	Adult literacy rate					
	Number of NEETs (young people aged 18-40 who are Not in Education, Employment or Training)					
	School capacity Number of state-funded schools/ number of school places/ number of pupils enrolled per year					
	Number of schools with poor quality facilities					
	Area of new education facilities created					
	Higher education Proportion of people enrolled in higher					
	Higher education Proportion of people holding a degree in HE					
	Primary education proportion of last-year-pupils who completed the primary level					

	Secondary education proportion of last-year-pupils who completed the secondary level					
Healthcare	**Mortality** Mortality rate from causes considered preventable					
	Obesity Proportion of adults overweight and obese					
	Obesity Proportion of children overweight and obese (2-15 year olds)					
	Lifestyle Prevalence of smoking in adults					
	Lifestyle Proportion of adults doing 150 minutes of exercise per week					
	Lifestyle Rate of drug/alcohol addiction					
	Lifestyle Proportion of urban trips under 5 miles taken by sustainable methods: walking, cycling, public transport					
	Lifestyle Average daily consumption of fruit and vegetables					
	Community Area of sports/playing fields and outdoor recreation spaces per capita					
	Community Number of care homes for older people					
	Community Number of care homes for mental health					
	Community Number of people with Mental illness					

	Community Number of healthcare facilities					
	Community Number of cafes/restaurants without public toilet					
Barriers to housing & Services	**Household overcrowding** The proportion of all households in an LSOA which are judged to have insufficient space to meet the household's needs					
	Homelessness The rate of acceptances for housing assistance under the homelessness provisions of housing legislation					
	Housing affordability Proportion of households under 35 unable to afford to enter owner occupation					
	Road distance to a GP surgery The mean distance to the closest GP surgery for people living in the LSOA					
	Road distance to a food shop The mean distance to the closest supermarket or general store for people living in the LSOA					
	Road distance to a primary school The mean distance to the closest primary school for people living in the LSOA					
	Road distance to a post office The mean distance to the closest post office or sub post office for people living in the LSOA					
	Durability					

	Ratio of durable buildings					
Social safety and security	**Crime** Total recorded crime					
	Crime Fear of crime by neighbourhood It refers to the fear of being a victim of crime as opposed to the actual probability of being a victim of crime					
	Crime Domestic violence Number of people killed/injured due to domestic violence					
	Crime Number of deaths due to suicide					
	Crime Number of deaths due to intentional accidents (homicide)					
	Crime Number of Disabilities due to violence					
	Childcare Total places available per 100 children for children under 8					
	Disability Proportion of disabled people in the social activities					
	Form and Space Public lighting by neighbourhood Area of public spaces with poor lighting					
	Form and Space Visibility and natural surveillance by neighbourhood					
	Form and Space Mix of uses by neighbourhood					
	Form and Space Number of places complied with design guidance such as **CPTED** (Crime Prevention Through					

	Environmental Design) or **SBD** (Secured By Design) by neighbourhood					
Culture	**Sense of belonging** Percentage of people who feel that they belong to their city or community or neighbourhood					
	Cultural and religious facilities Number and state of mosques					
	Cultural and religious facilities Number of museums per capita					
	Cultural and religious facilities Number of public libraries per capita					
	Cultural and religious facilities Number and state of historical sites					
	Cultural and religious facilities Number of people attended cultural venues: cinemas/ theatres/ museums/ concerts/ religious premises					
	Number of tourism visits to the city					
Life expectancy	Life expectancy at birth for men (years)					
	Life expectancy at birth for women (years)					
Satisfaction	Trend of overall satisfaction with living in the city					
Transport	**Travel to school** Proportion of 6-18 year olds travelling to school using sustainable modes of transport: bus/ walk/ cycle/ other					
	Travel to work Proportion of people travelling to work using sustainable modes					

	of transport: bus/ walk/ cycle/ other					
	Estimated daily average number of passenger journey stages (millions of journey stages) Public transport/ private transport/ cycling/ walking					
Social capital	**Voting** proportion of people engaging in actions designed to identify and address issues of public concern at least once a year					
	Volunteering proportion of people engaging in any volunteering activity at least once a year					
	Relationship proportion of people, who have a partner, family member or friend to rely on if they have a serious problem					
	Trust proportion of people agreeing that people in their neighbourhood can be trusted					
Image of the city	Total area of green spaces					
	Total area of motorways					
	Total area of pedestrianized areas					
	Total area of cycling routes					
	percentage of Walkable/ pedestrian friendly neighbourhoods					
	Public art Monuments/ Sculptures/ symposiums/ street arts and performances					
	Number of buildings with unfinished façades					

	Identity Does the city recognise and support or enhance positive local cultural and historical (including aboriginal) identities and traditions?					

Please comment here if you would like to add any ideas/ opinions/ recommendations:

3. Should the following **economic sub-indicators** be included in the proposed Iranian urban sustainability assessment mechanisms?

Economic Headline Indicator	**Economic sub-indicator**	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Employment	Rate of employment					
	Proportion of economically active adults unemployed for over 12 months					
Business survival	Percentage of new businesses still trading after 1 year					
	Percentage of new businesses still trading after 3 years					
Poverty	**Child poverty** Proportion of children in low-income households					
	Fuel poverty					

	Number of households living in fuel poverty under the low income high cost (LIHC) definition					
	Proportion of households living below poverty line					
Economic prosperity & income	Indices of Gross Domestic Product (GDP), GDP per head and median income					
	Pension provision Percentage of eligible workers in a workplace pension					
	Income inequality Decile distribution of net disposable household income for individuals					
	Debt Public sector net debt (percentage of GDP) and public sector net borrowing (percentage of GDP)					
Research & Development	Expenditure on R&D performed in businesses					
	Expenditure on R&D related to environmental expenditure					
Environmental goods and services	Total sales in the Environment goods and services Sector: Environmental/ Low carbon/ Renewable Energy					
Physical infrastructure	Asset net worth by structure type: Dwelling/ Other buildings and structures/ Total non-financial assets/ Machinery and equipment					
Non-oil export	Rate of non-oil exports					
Inflation	Inflation rate					
Energy	Energy consumption per household					

	Share of renewable energy in electricity generation (percentage)					
	Number of buildings (residential/ non-residential) obtained EPC (Energy Performance Certificate)					
	Energy intensity Energy consumption per unit of GDP					

Please comment here if you would like to add any ideas/ opinions/ recommendations:

Appendix 5.1: List of local authorities and government departments visited in Iran

1	Water and Wastewater Company of Andisheh New Town
2	Water and Wastewater Company of West Tehran Province' Towns and Cities (Research Centre)
3	Water and Wastewater Company of Shahriar Region: Deputy of monitoring urban water operation
4	Tehran Municipality (Region 12): The Mayor Office
5	Tehran Municipality (Region 12): Department of Landscape and Green Spaces
6	Tehran Municipality (Region 12): Deputy of Social and Cultural Affairs
7	Tehran Municipality (Region 12): Department of Social Studies
8	Tehran Municipality (Region 12): Education Department
9	Tehran Municipality (Region 12): Deputy of Architecture and Urban Planning
10	Tehran Municipality (Region 12): IT Centre
11	Tehran Municipality (Region 4): The Mayor Office
12	Ministry of Energy (Deputy of distribution)
13	Tehran Air Quality Control Company
14	Department of Environment (Office for Monitoring Environmental Pollutions)
15	Department of Environment (Deputy of Human Environment)
16	Ministry of Economic Affairs and Finance (The Head of PR and Information Centre, Ministerial advisor)
17	Ministry of Economic Affairs and Finance: Deputy of Economic Affairs: Office for Managing and Modelling Economic Information
18	Office for Water Resources Basic Studies
19	Andisheh New Town Development Company: Deputy of Architecture and Urban Planning
20	Andisheh New Town Development Company: Director of Urban Planning and Development
21	Andisheh New Town Development Company: Office for GIS Development
22	Andisheh New Town Municipality: Deputy of Architecture and Urban Planning
23	Andisheh New Town Municipality: Deputy of Sociocultural Affairs
24	Tehran Regional Water Company – Head of environment and quality of water resources –Task Force on prevention of contamination of Tehran drinking water
26	Cultural Heritage, Handcrafts and Tourism Organisation: Deputy of Tourism
27	Environmental Protection Administration of Tehran Province: Department of Natural Environment
28	Environment and Sustainable Development Department **of** Tehran Municipality: Environmental Assessment Committee
29	Road, Housing and Urban Development Research Centre: Research Institute
30	Road, Housing and Urban Development Research Centre: Fundamental Studies Group
31	Department of Environment: National Committee for Sustainable Development
32	Tehran Urban Planning and Research Centre
33	Urban Development and Revitalisation Organisation

Appendix 5.2: Set of indicators for environmental sustainability in Iran (DoE, 2014), Translated and reproduced by the author

Category	Sub-category	Indicator	indicator sources			article	Indicator unit	international source	domestic source
			MDG	CSD	EPI				
Weather	Climate change	Carbon dioxide emissions per capita	✓	✓	✓	139, 193ب	Mt/Capita	WRI-CAIT, WDI-WB	Air
		Carbon dioxide emissions for generating electricity			✓	133, 139	g CO_2/kWh	IEA	Air
		Intensity of carbon dioxide emissions in industry	✓		✓	138, 139	Mt/$mill	WRI-CAIT, WDI-WB	Air
	Air quality	PM_{10}		✓	✓	193ب	$\mu g/m^3$	WDI-WB	Air
		Emissions of sulfur dioxide		✓	✓	193ب	Gg/1000 km^2	EDGAR WHO	Air
		Emissions of nitrogen oxides		✓	✓	193ب	Gg/1000 km^2	EDGAR WHO	Air
		Emissions of volatile organic compounds (non-methane)		✓	✓	193ب	Gg/1000 km^2	EDGAR WHO	Air
Water	Water quantity	Access to clean water	✓	✓	✓	——	percent	UNICEF WHO	Energy
		Access to sanitation facilities	✓	✓	✓	——	percent	UNICEF WHO	Energy
		Intensity of water use in agriculture		✓	✓	141, 143, 146	m3/ US $	UNSD	Agriculture
		Water stress			✓	140	percent	WSAG	Energy
	Water quality	Refer to Iran water quality indicators for surface/ground water resources *(developed by Department of Environment, 2014)*		✓	✓	192	percent	UNEP/GEMS EEA	Water and Soil
Land (soil)	Desertification	Land affected by desertification		✓		148ز	percent	LADA-FAO	Forest
	Forests	Percentage of forest area to the total area of the country	✓	✓	✓	148	percent	FAO	Forest
		Rate of growing stock (Standing Volume)			✓	148	m^3/hectare	FAO	Forest
		Carbon sequestration rates	Proposed indicator					FAO	Forest
	Agriculture	Efficient use of fertilizers (organic and chemical)		✓		143د، 143ز	kg/kg	FAO	Agriculture
		Use of agricultural pesticides		✓	✓	143د	kg/hectare	FAO	Agriculture
Biodiversity	Ecosystem	Percentage of the land protected area	✓	✓	✓	187, 190, 191 (a)	percent	UNEP-WCMC	Environment
	Coasts and Seas	Percentage of marine protected areas	✓	✓	✓	187, 191 (b)	percent	UNEP-WCMC	Environment
		Percentage of sustainable exploitation of fish stocks	✓	✓	✓	——	percent	FAO	Agriculture
	Species	Percentage of endangered species	✓	✓		187, 104, 191 (a)	percent	Zero Extinction	Environment

Appendix 5.2: Set of indicators for environmental sustainability in Iran (DoE, 2014), Translated and reproduced by the author.

Category	Sub-category	Indicator	indicator sources			article	Indicator unit	international source	domestic source
			MDG	CSD	EPI				
Production and consumption pattern	Raw materials	Raw material consumption intensity in the economy		✓		190	Kg/ $1,000GDP	Eurostat	Industry
	Energy consumption	Energy consumption intensity		✓		134, 190	Tons of Oil/ GDP	IEA	Energy
		Waste generated per capita per day		✓		190, 193 (a)	kg/capita	UNSD	Interior
	Waste management	Percentage of waste recycled (recycling rate)		✓		190, 193 (a)	percent	UNSD	Interior

Keywords for domestic and international data sources

Domestic data sources	International data sources
Environment: Department of Environment **Forest:** The Forest, Rangeland and Watershed Organisation **Agriculture:** Ministry of Agriculture **Interior:** Ministry of Interior Affairs **Energy:** Ministry of Energy **Industry:** Ministry of Industry, Mine and Trade **Water and Soil:** Department of Environment, Office for Water and Soil **Air:** Department of Environment, Office for Air	**UNSD:** United Nations Statistics Division (environmental indicator) **IEA:** International Energy Agency **Eurostat:** European Commission (European Statistics) **Zero Extinction:** Alliance for Zero Extinction **FAO:** Food and Agriculture Organisation of the United Nations **UNEP:** United Nation Environment Environment Programme **WCMC:** World Conservation Monitoring Centre **LADA:** Land Degradation Assessment **WHO:** World Health Organisation **UNICEF** **WDI (WB):** World Development Indicators (The World Bank) **CAIT (WRI):** Climate Analysis Indicators Tool (World Resources Institute) EDGAR: Emission Database for Global Atmospheric Research **WSAG:** Water Systems Analysis Group **GEMS:** Global Environment Monitoring System **EEA:** European Environment Agency

Appendix 5.3: **Tehran Urban Development Index (Tehran Municipality, 2014), translated and reproduced by the author**

Headline Indicator	Sub-indicator		Measure
Sociocultural	Promoting Islamic-Iranian identity and strengthening revolutionary values		Expansion on and institutionalization of religious, cultural and artistic activities
			establishment and maintenance of cultural centres
			family-oriented promotion and development of the culture of citizenship
			enrichment of leisure with cultural packages
			advertisement and cultural programs production
	Health		developing the urban health and promoting a healthy life style
			sport (public exercise)
	Neighbourhood management and local capacities		citizenship training
			social participation/contribution
			cultural promotional activities (women)
			increasing local capacities in culture and citizenship
	Research		strengthening the culture of reading
			conference arrangements and cultural knowledge management
			database management
	Entrepreneurship and dealing with social pathology		empowering and encouraging social engagement
			planning to deal with social harms
			Entrepreneurship and career lead
	Physical development		establishment and maintenance of religious centres
			establishment and maintenance of cultural/educational/sports centres
Traffic and transport	Public transport	Rail (metro)	development of railways and stations
			Metro fleet development
			technical and technological development
			development of travel services
			economic and environmental impacts of metro operation
			development of facilities and services in the stations
		Bus	development of bus routes and stations
			Bus fleet development
			development of travel services
			technical and technological development
			development of BRT system
			economic and environmental impacts of bus operation
		Taxi	privatisation of fleet management
			organising private taxis
			welfare and professional services for taxi drivers
	Traffic management	Supervision, control and lead	automated control of congestion charge zone
			development of SMART motoring offences records
			developing technology-oriented transport services

			development of integrated transport SMART Card
			Self-ticketing parking management
			development of traffic video surveillance
			mechanisation of congestion charge zone processes
			Establishment of local traffic control centres
			travel demand management
		Infrastructures	public awareness and educational programs
			enhancing traffic culture
			expansion of public transport for elderly and disabled
	Environmental pollutants		expanding air/noise quality monitoring stations
			public awareness and education towards air and noise pollution
			implementation of vehicle inspection
	Road safety		reorganising intersections
			Street sign and traffic lines (road markings)
			parks (marginal and non-marginal)
			bridges and pedestrian safety islands
	Active transportation (non-motorised transport)		expansion of walkways and promoting the culture of walking
			expansion of cycling routes and promoting the culture of cycling
Urban services	Waste management		development of new systems in waste management
			construction waste management
			automation
			developing process of waste separation at source
			improving waste processing and disposal
			mechanisation of urban services
			recycling special waste
			generating energy from waste
	Green space development		development of women-only parks
			urban green belt
			green space (physical development)
			growth of urban green space per capita
			application of new systems in development and maintenance of urban green space
	Sustainable urban environment		Environmental Performance Assessment
			use of sustainable and low-polluting energies
			control of and monitoring air/noise pollution
			education, culturalisation and transorganisational cooperation
			monitoring the implementation of article 19 regulation
	organising pollutant businesses and industries		improving urban health
			identifying and removal of pollutant businesses
			development of trade unions and business removal
			organising supply of goods and services
	Beautification and urban space management		improving the quality of image of the city
			monuments and urban furniture
			development of walkways and urban squares
			development of river-valleys
			development of urban leisure places
	Supply management		fruits & veg supply in local markets
			improving the performance index of chain stores

	Cemetery management	development of sociocultural and religious spaces
		improving welfare services
Safety and disaster management	Safety hazards	risk prevention and reduction
		identifying crisis factors
		improving the ability to cope with crisis
		development of passive defense
		developing crisis management support bases
		physical and informatics development
		development of training, preparation and operation
		establishing neighbourhood emergency response volunteering
		creating crisis management groups for public places
		improving knowledge and culture
	Fire and rescue infrastructures	improving capacity and facility
		expanding on the areas covered by fire stations
		improving the operation and performance ratio
		training, culturalisation and public participation
		immunization
Architecture, planning and urban infrastructures	fulfilment of urban development vision	implementation of Tehran's strategic master plan
		implementation of Tehran's "detailed plan"
		implementation of local initiatives and thematic projects
		improving the spatial organisation and zoning
		creating strategic vision in 'detailed plan' (borough level)
	Lawfulness of physical development and image of the city	control and monitoring of construction works
		improving the management of city boundary
		smartisation and outsourcing
		standardization of urban agendas
		performance of *article 5* and *article 100* commissions
		developing urban regeneration in deprived areas
		Public participation: encouraging private sector investing in deprived urban fabrics
		Organising historic and valuable places
	Urban traffic infrastructures	development and maintenance of motorways/roads/paths
		development and maintenance of underground motorways/roads/paths
		improving streets surfaces
		development of bridges and interchanges
		development of urban tunnels
	Surface water management	surface water drainage
		dredging controlled surface water (canals and valleys)
		use of recycled water sources
		revitalization of Qanats
	Innovative and knowledge-oriented urban development	technical and managerial institutionalization
		use of modern technologies in design and implementation
		compilation of relevant agendas and standards
Managerial development, smartisation and organisational transformation	Strategic planning and management	development of plan-oriented and *jihadi* management
		implementation of urban plans
		organisational agility

		creating a monitoring and assessment procedure regarding organisational performance
		improving managerial standards and quality
		moving towards smart city and e-municipality
		development of IT infrastructure
		development of inter-organisational E-services
		development of urban E-services
		managing and improving the quality of human capital
		developing and training organisational management
	Financial resources management	resource and income allocation
		developing status of sustainable incomes
		improving financial optimization
		price management and optimization
		reforming consumption pattern and reducing costs
		investment and financing
		inter-organisational engagement
		development of financial management
	Rule of law and legal systems	effective and mutual engagement with major decision-making/legislating bodies
		active engagement with *Islamic City Council of Tehran*
		improvement of legal systems and regulations
		improving knowledge and developing legal education
	Knowledge-based and research-oriented management	Institutionalizing culture of research
		leading and management of practical studies and researches
		research-oriented performances (executive programs)
	Good urban governance	decentralisation, localisation, and developing citizen engagement
		institutionalizing accountability and public oversight
		improving administrative integrity and transparency
		improving social justice
		communication, interaction and notification
		honouring clients/ interaction with citizens
	International cooperation	Sister city partnership
		International institutes membership
		Organising international gatherings

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
HOUSING	1	proportion of households who are property owners
	2	the average area of residential units per household
	3	the average number of rooms per residential unites
	4	percentage of residential units without bathroom
	5	percentage of residential units without toilet (inside)
	6	percentage of residential units with more than one household (with communal toilet and bathroom)
	7	the average number of residential units per block
	8	percentage of residential units without parking
	9	average of monthly service charge for a flat
	10	average cost of residential land per m^2
	11	average cost of a flat per m^2
	12	average rental cost of a flat (residential)

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
FOOD, SERVICES, AND CONSUMER GOODS	1	number of bakeries per 10,000
	2	number of bakeries per 10,000
	3	number of restaurants per 10,000
	4	number of takeaways and fast food restaurants per 10,000
	5	number of barbershops per 10,000 (male)
	6	number of salons per 10,000 (female)
	7	number of bookshops and stationary shops per 10,000
	8	number of shoe shops per 10,000
	9	number of home appliance repair shops per 10,000
	10	number of men's and women's tailor shops per 10,000
	11	number of banks per 10,000
	12	mens and women tailor shops per 10,000
	13	number of offices for E-government services per 10,000

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
MEDICAL SERVICES & HEALTHCARE	1	Number of GPs per 1000
	2	number of specialists per 1000 (doctors)
	3	number of family consultants per 10,000
	4	number of psychological consultants per 10,000
	5	number of midwifes per 10,000
	6	number of hospital beds per 1000
	7	number of medical laboratory per 1000
	8	number of local medical clinics per 10,000 clinics in Tehran
	9	number of dental clinics per 1000
	10	number of radiology clinics per 10,000
	11	number of medical clinics per 1000
	12	number of *Khaneye Salamat** per 10,000
	13	number of offices for E-government services per 10,000

**Khaneye Salamat*: Farsi for *House of Health*; a subsidiary of Tehran Municipality which performs as part of the Local Community Centres at the neighbourhood level.

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR	INDICATOR
EDUCATION	1 number of primary school students (public schools)
	2 number of guidance school students (public schools)
	3 number of high school students (public schools)
	4 number of college students (public schools)
	5 % of juveniles who have access to quality schools (from parents' point of view)
CULTURAL & LEISURE FACILITIES	1 % of young women visiting public libraries
	2 % of young men visiting public libraries
	3 % of adolescents (female) visiting public libraries
	4 % of adolescents (male) visiting public libraries
	5 % of young women going to cinema
	6 % of young men going to cinema
	7 % of adolescents (female) going to cinema
	8 % of adolescents (male) going to cinema

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
CULTURAL & LEISURE FACILITIES	9	% of young women going to theatre
	10	% of young men going to theatre
	11	% of adolescents (female) going to theatre
	12	% of adolescents (male) going to theatre
	13	% of households who use newspapers (daily)
	14	% of people who have access to libraries
	15	% of people who have access to cinemas
	16	% of people who have access to theatres
	17	% of people who have access to cultural centres
	18	% of people who have access to reading rooms (*Qeraat Khaneh*)
	19	% of people who have access to newspaper kiosks
	20	% of people who have access to bookshops
	21	% of people who have access to Culture Houses

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
CULTURAL & LEISURE FACILITIES	22	% of people who have access to Quran Centres
	23	% of people who have access to *Khaneye Mashq**
	24	% of people who have access to *Khaneye Javan***
	25	% of people who have access to audiovisual institutions
	26	% of people who have access to cultural products stores
	27	% of people who have access to museums and galleries
	28	% of people who have access to the mosques
	29	% of people who have access to art schools/workshops
	30	% of people who have access to *Khaneye Akhbar*
	31	% of people who have access to parks and green space
	32	% of people who have access to public sport centres
	33	% of people who have access to private sport centres
	34	% of people who have access to *Khaneye Asbabbazi* (Municipality kindergartens)

* *Khaneye Mashq*: Frsi for *House of Practise*; a charity centre which provides space for children who live in poverty and poor conditions to do their homeworks.

** *Khaneye Javan:* Frsi for *Youth Club.*

SOCIAL INDICATORS

SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR	INDICATOR
PUBLIC TRANSPORT	1 Number of buses (with end/start point stops) per 1000
	2 number of taxis (operating in defined routs) per 1000
	3 average time of waiting for bus
	4 average time of waiting for taxi
	5 average time of commute to work
	6 average cost of commute to work
	7 number of taxi service agents per 1000
COMMUNICATION EQUIPMENTS	1 % of people who use mobile phones
	2 % of households who have landline telephone
NEIGHBORHOOD PLEASANTNESS	1 share of green space per capita
	2 share of mobility spaces
	3 number of industrial workshops and vehicle repair shops per 1000 residential units
	4 average lifespan of residential units
	5 % of under development residential buildings/ facade-less buildings

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Distribution and Dispersion

HEADLINE INDICATOR		INDICATOR
SOCIAL SERVICE	1	Number of support centres per 10,000
	2	number of fire stations per 10,000
	3	number of consultancy and care centres per 10,000
	4	number of NGOs per 10,000
	5	number of charities per 10,000
ENVIRONMENT	1	number of days with weather warnings per year
	2	area of spaces affected by noise pollution
	3	% of green space

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR		INDICATOR
TRAFFIC SAFETY	1	sense of having social support in the course of traffic accident
	2	sense of having social support in the course of medical emergency
	3	number of road accidents led to death or injury per 1000
HEALTH AND SAFETY	1	number of GPs per 1000
	2	number of specialists per 1000
	3	number of family consultants per 10,000
	4	number of psychological consultants per 10,000
	5	number of midwifes per 10,000
	6	number of hospital beds per 1000
	7	number of medical laboratory per 1000
	8	number of local medical clinics per 10,000 clinics in Tehran
	9	number of dental clinics per 1000

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR	INDICATOR
HEALTH AND SAFETY	**10** number of radiology clinics per 10,000
	11 number of medical clinics per 1000
	12 number of *Khaneye Salamat** per 10,000
	13 number of mechanized waste containers
	14 number of public toilets per 1000
	15 % of businesses fined due to health and safety issues
DELINQUENCY (PUBLIC SAFETY)	**1** number of identifiable drug/alcohol addicts in the past three months
	2 number of identifiable street beggars in the past three months
	3 number of declared robberies in the past three months
	4 number of identifiable criminals in the past three months
	5 number of group street fights and quarrels observed in the past three months
	6 number of homeless people identified in the past three months

**Khaneye Salamat*: Farsi for *House of Health*; a subsidiary of Tehran Municipality which performs as part of the Local Community Centres at the neighbourhood level.

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR		INDICATOR
DELINQUENCY (PUBLIC SAFETY)	7	number of people who committed suicide to death in the past three months
	8	number of murders identified in the past three months
	9	number of rape crimes identified in the past three months
	10	number of street abuse (beating and stabbing) identified in the past three
	11	number of divorce cases identified in the past three months
	12	number of adolescents who scaped home, identified in the past three months
FINANCIAL SECURITY	1	average cost of hair dressing (male)
	2	average cost of hair dressing (female)
	3	average cost of taxi (one ride for taxi agencies)
	4	average cost of home cleaning (daily)
	5	average cost of home moving
	6	average cost of repairing an electric fuse
	7	average cost of repairing a tap
	8	average cost of shoe repair (men)

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

	HEADLINE INDICATOR		INDICATOR
Security	**FAMILY SAFETY**	1	% of people over 18 who are married
		2	% of people who are divorced/ separated/ widowed
		3	% of households (family)
		4	% of households (people who live in dorms or nursing homes)
		5	% of single-parent families
		6	% of single-mom families
		7	% of single over 18
		8	% of extended-family households
		9	% of polygamous households
		10	number of one-person households / or same-sex households

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR		INDICATOR
SOCIAL SECURITY	1	levels of trust in government employees
	2	levels of trust in media
	3	levels of trust in neighbours
	4	levels of trust in locals (who live in the neighbourhood)
	5	levels of trust in ethnic groups
	6	levels of trust in citizens
	7	levels of trust in countrymen and women
GENDER SECURITY	1	% of illiteracy (women)
	2	% of unemployed educated women
	3	% of women landlords
	4	life expectance (women)

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR	INDICATOR
NUTRITION SECURITY	1 % of households below poverty threshold
	2 % of women who own cars
	3 % of children (under 2 yo) below growth chart standards
	4 % of households under support of *Komiteh Emdad**
JUDICIAL SECURITY	1 % of households who filed lawsuit against their neighbours
	2 % of households who filed lawsuit but the case remained uninvestigated
	3 % of local traders who faced legal punishment
	4 number of lawsuits against neighbourhood residents per year
CULTURAL SECURITY	1 % of people who are unsatisfied with cultural facilities
	2 rank of neighbourhood's cultural facilities

* *Komiteh Emdad*: a governmental charitable organisation

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Security

HEADLINE INDICATOR	INDICATOR
ENVIRONMENTAL SECURITY	1 number of days with weather warnings
	2 area of spaces affected by noise pollution
	3 % of green space
NATURAL DISASTER	1 % of residential buildings awarded IRCEO* certification
	2 % of residential buildings with steel structure or block joist
	3 % of residential buildings with sewerage system
	4 % of residentials built on seismic faults or alongside watercourses

* IRCEO: Iran Construction Engineering Organisation

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Participation / Isolation

HEADLINE INDICATOR		INDICATOR
ENVIRONMENTAL/ ECONOMIC PARTICIPATION	1	number of members of environmental organisations (NGOs) per 10,000 people
	2	number of people who participate in environmental group trips per 10,000 people
	3	average water consumption per household
	4	average electricity consumption per household
	5	average gas consumption per household
	6	percentage of people who are members of Housing Co-operative (over 20 year old)
	7	percentage of people who are members of Consumer Co-operative (over 20 year old)
	8	% of people over 20 who are members of private joint-stock or public-held companies
POLITICAL-MANAGERIAL PARTICIPATION	1	participatory rate in Neighborhood Community Council election (over 18)
	2	rate of telephone contacts for Complaints (138, 1818) in neighborhood scale
	3	percentage of active members of *Basij* (over 15 year old)

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Participation- Isolation

HEADLINE INDICATOR		INDICATOR
SOCIAL ENGAGEMENT	1	proportion of households who use large trash bins in the neighborhood
	2	proportion of people over 18 who are active members of NGOs organisations and NGOs
	3	proportion of households who pay their taxes on time
CULTURAL ENGAGEMENT	1	proportion of people who participate in religious mourning ceremonies
	2	proportion of people who participate in daily Public Prayer
	3	proportion of people who are members of local sport teams

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Cultural homogeneity/diversity

HEADLINE INDICATOR	INDICATOR
CULTURAL CONSUMPTION	1 % of adolescents (male) who take part in art training programmes
	2 % of adolescents (female) who take part in art training programmes
	3 % of young males who take part in art training
	4 % of young females who take part in art training
	5 average spare time of young males (hours per week)
	6 average spare time of young females (hours per week)
	7 number of visits to amusement parks with family in past 3 months
	8 % of households having leisure travels and tours
	9 number of visits to restaurants with family in past 3 months (excluding travels)
	10 % of adolescents (male) who take part in sport programmes in their spare time
	11 a% of adolescents (female) who take part in sport programmes in their spare
	12 % of young males who take part in sport programmes in their spare time
	13 % of young males who take part in sport programmes in their spare time

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.4: Socio-Cultural Indicators for Tehran Neighbourhoods (Tehran Municipality, 2014b), translated and reproduced by the author.

Cultural homogeneity/diversity

HEADLINE INDICATOR	INDICATOR
CULTURAL ENGAGEMENT	1 % of people who participate in religious mourning ceremonies
	2 % of people who participate in public prayers
	3 % of people who are members of the local sport teams
ETHNIC BACKGROUND	1 % of people who was born in Tehran
	2 % of people who was born in the neighbourhood
	3 % of people who speak Farsi
SENSE OF BELONGING	1 length of household residence in the neighbourhood
	2 % of households keen to leave the neighbourhood
	3 number of households who are relatives
APPEARANCE & SIMILARITY	1 % of women over 20 who wear *Chador*
	2 % of buildings with stone facade
	3 % of people who use domestically-produced vehicles
	4 % of households who have home cinema setup

SOCIAL INDICATORS
SOCIO-CULTURAL DEPUTY OF TEHRAN MUNICIPALITY

Appendix 5.5: The UK Comprehensive Indicator Set

Environmental				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment method**
Air		NO	DECC (Department of Energy and Climate Change), Department for Environment Food and Rural Affairs (Defra)	SDIs, BREEAM, SA, SPeAR
		NO2		
		CO		
		SO2		
		PM2.5		
		PM10		
		Benzene		
		CO2 emission		
		VOCs/SOVOCs		
		Number of pollution days (exceeded the national standard)		
		Population living in AQMA		
		Number of AQMA		
Water		Biological quality of rivers	Defra	SDIs
		Chemical status of rivers	Defra	SDIs
		Abstractions from non-tidal surface waters and groundwater (billion cubic metres)	Defra, Environment Agency	SDIs
		Abstractions from non-tidal surface waters and groundwater by sector (billion cubic metres)	Defra, Environment Agency	SDIs
		quality and quantity of groundwater	Defra, Environment Agency	SEA
		Water consumption by sector	Environment Agency	SEA
		use of sustainable urban drainage solutions in new development	Defra, Environment Agency	SEA
		Proportion of households with poor water quality	Defra, Environment Agency	SEA
		proportion of waterways classified as “Moderate” or better under the terms of the WFD (Water Framework Directive)	Defra, Environment Agency	SA
		Household water consumption per capita	Defra	BREEAM
Noise		Number of complaints per 1000 people	Defra, CIEH, PHOF	SDIs, SA
		percentage of road network with lower noise surface material	TFL	London State of Environment
		percentage of buses in fleet at least 2 dB quieter than the legal limit	TFL	
		Estimated number of people and dwelling above various noise levels due to road traffic	Defra Noise Action Plan for the	

			London agglomeration	
		Estimated number of people and dwelling above various noise levels due to railways	Defra Noise Action Plan for the London agglomeration	
	Aviation Noise	Estimated number of people exposed to various Lden bands	Defra Noise Action Plan for the London agglomeration	
		Estimated number of people exposed to various Lnight bands	Defra Noise Action Plan for the London agglomeration	
Natural disaster		Number of dwellings at risk of flooding more often than once every 100 years	Environment Agency	SA
Biodiversity	Population of wild birds	water and Wetland Birds	Royal Society for the Protection of Birds, British Trust for Ornithology, Defra, The wildlife and Wetlands Trust, Centre for Ecology and Hydrology	SDIs
		Seabirds		
		Woodland birds		
		Farmland Birds		
	Priority species and habitats	Percentage of UK species of European importance in improving or declining conservation status	UK Biodiversity Partnership, Natural England, JNCC (Join Nature Conservation Committee)	SDIs
		Percentage of UK habitats of European importance in improving or declining conservation status		
	Sustainable fisheries	Percentage of fish stocks harvested sustainably and at full reproductive capacity	International Council for the Exploration of the Sea, Centre for Environment, Fisheries and Aquaculture Science	SDIs
		Number of developments that have incorporated green roofs, landscaping or open space to improve the diversity	Camden's Local Plan	SA
Waste	Household recycling	Percentage of households recycled and composted their waste	Defra, Local Authority collected waste for England	QoL
	Household waste	Amount of household waste collected (million tonnes)		QoL
Traffic		Traffic volume (vehicle km)	ONS, Department for Transport,	QoL
	Estimated daily average –	Public transport		

	number of passenger journey stages (millions of journey stages)	Private transport Walk and Cycle	Motor vehicle traffic, Travel Patterns and Trends	
Access to Nature		Area of Deficiency (AoD) in access to nature by borough	Greenspace Information for Greater London (GiGL)	QoL
Soil and Land		soil quality	BGS, UK Soil Observatory	SPeAR
	Land contamination	Number of sites of potential land contamination	British Geological Survey (BGS)	SA
	Cultural Heritage and Landscape	Number and area of Conservation Areas Number of listed buildings and Listed buildings at risk Extent of archaeological priority zones Number and condition of scheduled ancient Monuments	English Heritage	SA
	Open space	Number and area of Registered Parks and Gardens Area of designated open space /improvements to open space Public opinion of open spaces Number of Tree Preservation Orders (TPOs) Number of applications affecting trees protected by TPOs and number of applications permitted that involved the loss of trees protected by TPOs	National Heritage List for England (NHLE)	SA
	Land use by types	Total Croppable Area Permanent Grassland and Rough Grassland Forestry and woodland Inland water Other land (including built up areas)	Defra, DCLG, Forestry Commission, Center for Ecology and Hydrology	SDIs

Social				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment Method**
Population		Population by age and sex	ONS, UK DATA CENSUS	SA
		Population by ethnic group	ONS, UK DATA CENSUS	SA
		rate of population growth	ONS, UK DATA CENSUS	SA
		Population density (Persons/ha)	ONS, UK DATA CENSUS	SA
Education		The proportion of working age adults aged 25-54 with no or low qualifications	ONS, Department for Education	IMD
	Primary education	The proportion of pupils making expected progress from Key Stage 1 to Key Stage 2 in English and Maths	ONS, Department for Education	QoL, IMD
	Secondary education	The proportion of Key stage 4 pupils obtaining at least 5 GCSE passes at A*-C or equivalent	ONS, Department for Education	QoL, IMD
		Number of NEETs (people who are Not in Education, Employment or Training)	ONS, Department for Education	SA
		Area of new education facilities created	ONS, Department for Education	SPeAR, SA
	School capacity	Number of state-funded schools	Department for Education, Education Funding Agency	SA
		Number of school places		
		Number of pupils enrolled per year		
Barriers to Housing and Services	Household overcrowding	The proportion of all households in an LSOA which are judged to have insufficient space to meet the household’s needs	ONS	QoL, IMD, SA
	Homelessness	The rate of acceptances for housing assistance under the homelessness provisions of housing legislation	Department for Communities and Local Government (DCLG)	QoL, IMD
	Housing affordability	Proportion of households under 35 unable to afford to enter owner occupation	Family Resources Survey, Regulated Mortgage Survey, Annual Population Survey, Annual Survey of Hours and Earnings	IMD
	Road distance to a GP surgery	The mean distance to the closest GP surgery for people living in the LSOA	Health and Social Care Information Centre (HSCIC)	IMD
	Road distance to a food shop	The mean distance to the closest supermarket or general store for people living in the LSOA	DCLG	IMD

	Road distance to a primary school	The mean distance to the closest primary school for people living in the LSOA	Department for Education	IMD
	Road distance to a Post Office	The mean distance to the closest post office or sub post office for people living in the LSOA	Post Office Ltd	IMD
Satisfaction		Trend of overall satisfaction with living in the city	GLA, Annual London Survey	QoL
Life Expectancy		Life expectancy at birth for men (years)	ONS	QoL
		Life expectancy at birth for women (years)	ONS	QoL
Social Capital	Voting	The proportion of people engaging in actions designed to identify and address issues of public concern at least once a year	Citizenship Survey, DCLG; Community Life Survey, Cabinet Office	SDIs
	Volunteering	The proportion of people engaging in any volunteering activity at least once a year	Citizenship Survey, DCLG; Community Life Survey, Cabinet Office	SDIs
	Relationship	The proportion of people, who have a partner, family member or friend to rely on if they have a serious problem	Understanding Society	SDIs
	Trust	The proportion of people agreeing that people in their neighborhood can be trusted	Citizenship Survey, DCLG; Community Life Survey, Cabinet Office	SDIs
Health	Mortality	Mortality rate from causes considered preventable	ONS	SDIs
	Obesity	Proportion of children overweight and obese (2-15 year olds)	HSCIC (Health and Social Care Information Centre)	SDIs
		Proportion of adults overweight and obese	HSCIC	SDIs
	Lifestyles	Prevalence of smoking in adults	Integrated Household Survey, ONS	SDIs
		Proportion of adults doing 150 minutes of exercise per week	Public Health England, Active People Survey	SDIs
		Proportion of urban trips under 5 miles taken by sustainable methods: walking, cycling, public transport	National Travel Survey, Department for Transport	SDIs
		Average daily consumption of fruit and vegetables	National Diet and Nutrition Survey, Department of Health	SDIs
	Community	Number of care homes for older people	HSCIC, ONS	SA

		Number of care homes for mental health	HSCIC, ONS	SA
		Number of sports/playing fields and outdoor recreation spaces	ONS	SA
Social Security	Crime	Total recorded crime	Metropolitan Police	QoL
		Fear of crime	Metropolitan Police, British Crime Survey	QoL
	Childcare	Total places available per 100 children for children under 8	Ofsted (Office for Standards in Education, Children's Services and Skills)	QoL
	Disability	Proportion of disabled people in the social activities	Department for Work and Pensions: Office for Disability Issues	SA
	Form and space	Public lighting by neighbourhood Area of public spaces with poor lighting	Some relevant data are available via ‘data.gov.uk’ and boroughs’ websites. Presently, there is not any comprehensive dataset for these measures in the UK	SPAeR
		Visibility and natural surveillance by neighbourhood		
		Mix of uses by neighbourhood		
		Number of places complied with design guidance such as **CPTED** (Crime Prevention Through Environmental Design) or **SBD** (Secured By Design) by neighbourhood		
Culture		Sense of belonging	Social Action: Cabinet Office	SPeAR
		Socio-cultural identity	UK DATA SERVICE	SPeAR
		Cultural and religious facilities	ONS	SPeAR
Image of the City		Number of tourism visits to the city	ONS	SA
		Public art	N/A	SPeAR

Economic				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment method**
Employment		Rate of employment	ONS	QoL
		Proportion of economically active adults unemployed for over 12 months	ONS	SDIs
Business Survival		Percentage of new businesses still trading after 1 year	ONS, Business Demography	QoL
		Percentage of new businesses still trading after 3 years	ONS, Business Demography	QoL
Income	Pension provision	Percentage of eligible workers in a workplace pension	ONS, DWP (Department for Work and Pension)	SDIs
	Income inequality	Decile distribution of net disposable household income for individuals	DWP, Households Below Average Income (HBAI)	QoL
	Debt	Public sector net debt (percentage of GDP) and public sector net borrowing (percentage of GDP)	Office for Budget Responsibility	SDIs
Poverty	Child poverty	Proportion of children in low-income households	DWP, Households Below Average Income (HBAI)	QoL, SDIs
	Fuel poverty	Number of households living in fuel poverty under the low income high cost (LIHC) definition	Department of Energy & Climate Change (DECC)	QoL, SDIs
Economic prosperity		Indices of Gross Domestic Product (GDP), GDP per head and median income	ONS	SDIs
		Income distribution of the whole population, before housing costs	DWP	SDIs
Gross Value Added		Gross value Added per capita	ONS, NUTS1 Regional GVA	QoL
Research and development		Expenditure on R&D performed in businesses (£ millions)	ONS, Defra	SDIs, SPeAR, QoL
		Expenditure on R&D related to environmental expenditure(£ millions)	ONS, Defra	SDIs, SPeAR, QoL
Environmental Goods and Services		Total sales in the Environment Goods and Services Sector: Environmental/ Low carbon/ Renewable Energy	K-Matrix	QoL, SDIs
Physical Infrastructure		Asset net worth by structure type: Dwelling/ Other buildings and structures/ Total non-financial assets/ Machinery and equipment	National Balance Sheet, ONS	SDIs

Appendix 5.6: Iran Comprehensive Indicator Set

Environmental				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment method**
Air		Nitrogen dioxide (NO_2) – ppb: parts per billion	AQCC, DoE: Office for Air	AQCC
		Carbon monoxide (CO) – ppm: parts per million	AQCC, DoE: Office for Air	AQCC
		Sulfur dioxide (SO_2) - ppb: parts per billion	AQCC, DoE: Office for Air	AQCC
		Particulate Matters (PM2.5, PM10) – mg/m3	AQCC, DoE: Office for Air	AQCC
		VOCs (volatile organic compounds, non-methane)	DoE: Office for Air	DoE: SIES
		Ozone (O_3) - ppb	AQCC	AQCC
		Vehicles' Fuel Consumption Inefficiency	Iranian fuel conservation company (IFCO)	Iran SoE
		CO_2 emissions per capita (Mt per capita)	DoE: Office for Air	DoE: SIES
		CO_2 emissions for generating electricity (g per Kwh)	DoE: Office for Air	DoE: SIES
		Intensity of CO_2 emissions in industry (Mt per $million)	DoE: Office for Air	DoE: SIES
Water		Access to clean water	Ministry of Energy: Water sector, Ministry of Health and Medical Education	DoE: SIES
		Access to sanitation facilities	Ministry of Energy: Water sector, Ministry of Health and Medical Education	DoE: SIES
		Water stress	Ministry of Energy (Water sector, Abfa)	DoE: SIES
		Water quality (DoE)	Department of Environment, Office for Water and Soil	DoE: SIES
		Number of regular water outage in warm seasons due to water ration	N/A	EQTUE
		Daily water use per capita	SCI: Statistical Centre of Iran	EQTUE
		Intensity of water use in agriculture	Ministry of Agriculture	Iran SoE, DoE: SIES
		State of rivers, lakes, groundwater and drinking water	National Cartographic Center (NCC): National Atlas of Iran, Water and Water Waste Company, Ministry of Enery: Atlas of Water Resources	Iran SoE
		State of coastal rivers	N/A	Iran SoE
		Extraction of groundwater resources	SCI: Statistical Centre of Iran	Iran SoE
Noise		Noise in residential areas	AQCC	AQCC
		Noise in industrial areas	AQCC	AQCC
		Noise in retails/commercial areas	AQCC	AQCC
		Noise residential-commercial areas	AQCC	AQCC
		Noise in residential-industrial areas	AQCC	AQCC

Natural Disaster		Number and length of active faults	JICA: Japan International Cooperation Agency	Tehran SoE
		Population density (person per sqkm)	SCI	Tehran SoE
	Buildings structure by type	Steel frame	Census: SCI	Tehran SoE
		Concrete frame		
		Others		
		Unknown		
		seismic vulnerability of school buildings	N/A	(Panahi, Rezaei, Meshkani, 2014)
		vulnerability of deteriorated urban areas	Ministry of Road and Urban Development, Tehran Detailed Plan	Tehran SoE
		Gas network vulnerability	JICA	Tehran SoE
		Water network vulnerability	JICA	Tehran SoE
Biodiversity	Ecosystems	Percentage of Terrestrial Protected Areas	DoE	DoE: SIES
	Coast and Seas	Percentage of Marine Protected Areas	DoE	DoE: SIES
				DoE: SIES
		Percentage of sustainable exploitation of fish stocks	MoA: Ministry of Agriculture	DoE: SIES
	Species	Percentage of endangered species	DoE	DoE: SIES
Land (Soil)	Forest	Percentage of forest area to the total area of the country	FRWO: Forest, Rangeland and Watershed Organisation	DoE: SIES
		Rate of growing stock (Standing Volume)	FRWO	DoE: SIES
		Carbon sequestration rates	FRWO	DoE: SIES
	Agriculture	Efficient use of fertilizers (organic and chemical)	MoA	DoE: SIES
		Use of agricultural pesticides	MoA	DoE: SIES
	Urban land	Urban land use by type	Tehran Municipality: Tehran Detailed Plan	Tehran SoE
Production and consumption pattern	Raw materials	Raw material consumption intensity in the economy	Ministry of Industry, Mine and Trade	DoE: SIES
	Energy consumption	Energy consumption intensity	Ministry of Energy	DoE: SIES
	Waste management	Percentage of waste recycled (recycling rate)	Ministry of Interior Affairs	DoE: SIES
		Waste generated per capita per day	Ministry of Interior Affairs	DoE: SIES

Social				
Headline Indicator	**Theme**	**Measure**	**Data source**	**Assessment Method**
Population		Rate of population growth	SCI	Tehran SoE
		Population density (Persons/sqkm)	SCI	Tehran SoE
Education		Rate of primary school completion	SCI	Urban HEART
		15-24 year-old literacy rate	SCI	Urban HEART
		Adult literacy rate	SCI	Urban HEART
		Proportion of people over 18 who are in Higher Education	SCI	Urban HEART
Housing		Average area of residential units	SCI	EQTUE
		Ratio of households per residential unit	SCI	EQTUE
		Housing production per 1000 people per year	SCI	EQTUE
		The ratio of durable buildings	SCI	EQTUE
Satisfaction		Trend of overall satisfaction with living in the city	N/A	Urban HEART
Life Expectancy		Life expectancy at birth for men (years)	SCI	SoE Tehran
		Life expectancy at birth for women (years)	SCI	SoE Tehran
Social Capital	Voting	The proportion of people engaging in elections	SCI	SCITN
	Volunteering	The proportion of people engaging social activities like NGOs	N/A	EQTUE
	Trust	The proportion of people agreeing that people in their neighbourhood can be trusted	N/A	Urban HEART
Health	Smoking and addiction	Adults smoking	Iranian National Centre for Addiction Studies (INCAS)	Urban HEART
		13-15 year-olds smoking		
		Drug Addiction		
		Smoke-free places	N/A	
	Mortality	Mortality ratio (infants)	Ministry of Health, Cure and Medical Education (MHCME)	Urban HEART
		Mortality ratio (maternal)	MHCME	Urban HEART
		Disability: Number of disabled people	MHCME	Urban HEART
		Number of Public toilets	MHCME	SCITN
		Number of GPs per 1000 people	MHCME	SCITN
		Number of people with Mental illness	MHCME	Urban HEART
		Number of healthcare facilities	Tehran Municipality	Tehran SoE
Crime		Domestic violence	Iran Police, Expediency Council	Urban HEART
		Street violence	Iran Police, Expediency Council	Urban HEART
		Death due to suicide	Iran Police, Expediency Council	Urban HEART
		Death due to intentional accidents (homicide)	Iran Police, Expediency Council	Urban HEART

		Disabilities due to violence	Iran Police, Expediency Council	Urban HEART
Culture	Art and Culture	Number of museums per capita	Iran Cultural Heritage, Handcrafts and Tourism Organisation (ICHTO)	EQTUE
		Number of public libraries per capita	CHTO	EQTUE
	Cultural Heritage	Number and state of historical sites: local, national, international	Cultural Heritage, Handcrafts and Tourism Organisation	EQTUE
		Use of vernacular architecture and planning style in new developments	N/A	EQTUE
	leisure	area of sport spaces per capita	SCI	EQTUE
		Number of people attended cinemas/ theatres/ museums		Tehran SoE
		area of parks per capita	SCI	EQTUE
Neighbourhood Amenity		Area of green spaces per capita	SCI	SCITN
		Number of industrial workshops/ vehicle repair shops per 1000 household	SCI	SCITN
		percentage of buildings without façade	N/A	SCITN
		Area of motorways and pathways	Municipality	SCITN

Economic

Headline Indicator	Theme	Measure	Data source	Assessment methods
Employment		Rate of economic engagement		Urban HEART, EQTUE
		Share of women in employment		EQTUE
		Rate of economic activity		EQTUE
		Dependency ratio		EQTUE
		Consumer goods and services price index		EQTUE
Poverty		Rate of absolute / relative poverty		Urban HEART
		Social Welfare Index		Urban HEART
Financial security		Fair Financial Contribution Index (FFCI)		Urban HEART
		Household costs		Urban HEART
		Average cost of: home moving / home cleaning /hairdressing / taxi per ride		SCITN
		Residency in normal homes /persons per room		Urban HEART
Energy		Use of solar energy		EQTUE
Human development		Human Development Index		Urban HEART

Appendix 6.1: Main topics discussed in the interviews

Issues and complexities of urban sustainability and sustainable urban development in Iran
State and issues of urban sustainability assessments in Iran
Social, economic, and environmental indicators
Urban development, planning and management in Iran
Urban managerial performance
Urban managerial structure
Urban policies and legislations
Implementation of urban policies and legislations
Sustainable solutions for Iranian cities
Cross-departmental communications
Urban biodiversity and natural environment
Urban air and water pollutions
Performance and state of renewable energies
GIS development
Data availability and accessibility
Data quality and reliability
Data confidentiality
Economic, social, and environmental data
Matter of public awareness towards sustainability
Public participation in planning and development systems in Iran
NCSD (National Committee for Sustainable Development)'s history, organisational structure, and performance
The role of NCSD in urban sustainability evaluations
The role of DoE (Department of Environment) in urban sustainability evaluations
Development of EIA and SEA in Iran

Appendix 7.1: The proposed Urban Sustainability Indicator Set for Iran

Environmental indicators	
Headline Indicator	**Measure**
Soil and Land	soil quality
	Desertification
	Land contamination Number of sites of potential land contamination
	Land contamination State and number of Landfills
	Cultural heritage and landscape Number and area of Conservation Areas
	Cultural heritage and landscape Number of Listed buildings and number of Listed buildings at risk: A building is "Listed" when it is of special architectural or historic interest considered to be of national importance and therefore worth protecting.
	Archaeological Priority Area: An Archaeological Priority Area is a defined area where, according to existing information, there is significant known archaeological interest or particular potential for new discoveries
	Open space Number and area of registered parks and gardens per capita
	Open space Rate of deforestation (hectare per year)
	Open space Area of designated open space /improvements to open space
	Open space Number of Tree Preservation Orders (TPOs): A Tree Preservation Order is an order made by a local planning authority in England to protect specific trees, groups of trees or woodlands in the interests of amenity. An Order prohibits the cutting down, topping, lopping, uprooting, wilful damage, wilful destruction of trees without the local planning authority's written consent.
	Open space Number of applications affecting trees and number of applications permitted that involved the loss of trees
	Land use by type Total Croppable Area
	Land use by type Permanent Grassland and Rough Grassland
	Land use by type Forestry and woodland
	Land use by type Inland water
	Land use by type Desert
	Land use by type Urban land use by types
Water	**Water pollution sources**: Household wastewater/ Industrial wastewater/ Agricultural pollutants (wastewater/ fertilizer)/ Oil spill
	Water resources -Surface water: rivers, lakes, sea -Groundwater: well, qanat, spring -Precipitation: rain and snow
	Proportion of households with access to clean water
	Proportion of households with access to sanitation facilities
	Water quality: drinking water/ rivers/ lakes/ groundwater

	Water stress index
	Household water consumption per capita per day
	Intensity of water use in agriculture
	Groundwater level/ quantity of groundwater
	Abstractions from non-tidal surface waters and groundwater (billion cubic metres)
	Number of regular water outage in warm seasons due to water ration
	use of sustainable urban drainage solutions in new development: Rain water harvest / Grey water harvest
Waste	Household waste recycled and composted
	Industry/ construction waste recycled and composted
	Total amount of waste generated per capita per year
Traffic	Traffic volume by vehicle type: Cars and taxis / Light vans / Goods vehicles / Motorcycles / Buses and coaches / All motor vehicles (vehicle km)
Access to nature	Areas of Deficiency (AoD) in access to nature by district In the UK, Areas of Deficiency in access to nature are defined as localities where people live more than 1km walking distance from a green space, which is designated as a Site of Importance for Nature Conservation (SINC) at borough level or higher
Noise	Number of complaints per 1000 people
	percentage of road network with lower noise surface material
	percentage of buses in fleet at least 2 dB quieter than the legal limit
	Estimated number of people and dwelling above various noise levels due to road traffic
	Estimated number of people and dwelling above various noise levels due to railways
	Aviation noise Estimated number of people exposed to various Lden bands
	Aviation noise: Estimated number of people exposed to various Lnight bands
Natural disaster (earthquake and flooding)	Number and length of active faults
	Building structure by type: Steel frame/ Concrete frame/ Others/ Unknown
	Seismic vulnerability of school buildings
	Vulnerability of deteriorated urban areas
	Gas network vulnerability
	Water network vulnerability
	Number of properties at risk of flooding
	Number of people signed up to the “flood warning system”
Air	Number of pollution days (exceeded the national standard)
	Population living in Air Quality Management Areas (AQMA): Areas that need a Local Air Quality Action Plan due to their poor air quality
	Number of Air Quality Management Areas (AQMA)
	Vehicles’ Fuel Consumption Inefficiency
	Nitrogen dioxide (NO_2)
	Carbon monoxide (CO)
	Sulfur dioxide (SO_2)
	Particulate Matters (PM2.5) – mg/m^3
	Particulate Matters (PM10) – mg/m^3
	Ozone (O_3)
	Benzene
	CO_2 emission
	Number of cars produced under *Euro 6 Emissions Standards* per year
Biodiversity	Population of wild birds
	Status of priority species and habitats: Improving/ Declining/ Stable/ Unknown
	Sustainable fisheries: Percentage of fish stocks harvested sustainably and at full reproductive capacity
	Percentage of endangered species
	Percentage of marine (coastal) protected areas
	Percentage of the land protected areas
	Number of developments that have incorporated green roofs, landscaping or open space to improve the biodiversity
Ecological Footprint	Ecological Footprint per capita
	Ecological Footprint by land type: forest land/ fishing ground/ built land/ grazing land/ crop land/ carbon land

Social indicators	
Headline Indicator	**Measure**
Population	Population by age, sex, and ethnic group
	Rate of population growth
	Population density (person/ha)
Education	Adult literacy rate
	Number of NEETs (young people aged 18-40 who are Not in Education, Employment or Training)
	School capacity Number of state-funded schools/ number of school places/ number of pupils enrolled per year
	Number of schools with poor quality facilities
	Area of new education facilities created
	Higher education Proportion of people enrolled in HE
	Higher education Proportion of people holding a degree in HE
	Primary education proportion of last-year-pupils who completed the primary level
	Secondary education proportion of last-year-pupils who completed the secondary level
Healthcare	**Mortality** Mortality rate from causes considered preventable
	Obesity Proportion of adults overweight and obese
	Obesity Proportion of children overweight and obese (2-15 year olds)
	Lifestyle Prevalence of smoking in adults
	Lifestyle Proportion of adults doing 150 minutes of exercise per week
	Lifestyle Rate of drug/alcohol addiction
	Lifestyle Proportion of urban trips under 5 miles taken by sustainable methods: walking, cycling, public transport
	Lifestyle Average daily consumption of fruit and vegetables
	Community Area of sports/playing fields and outdoor recreation spaces per capita
	Community Number of care homes for older people
	Community Number of care homes for mental health
	Community Number of people with Mental illness
	Community Number of healthcare facilities
	Community Number of cafes/restaurants without public toilet
Barriers to housing & Services	**Household overcrowding** The proportion of all households in an LSOA which are judged to have insufficient space to meet the household's needs
	Homelessness

	The rate of acceptances for housing assistance under the homelessness provisions of housing legislation
	Housing affordability Proportion of households under 35 unable to afford to enter owner occupation
	Road distance to a GP surgery The mean distance to the closest GP surgery for people living in the LSOA
	Road distance to a food shop The mean distance to the closest supermarket or general store for people living in the LSOA
	Road distance to a primary school The mean distance to the closest primary school for people living in the LSOA
	Road distance to a post office The mean distance to the closest post office or sub post office for people living in the LSOA
	Durability Ratio of durable buildings
Social safety and security	**Crime** Total recorded crime
	Crime Fear of crime by neighbourhood It refers to the fear of being a victim of crime as opposed to the actual probability of being a victim of crime
	Crime Domestic violence Number of people killed/injured due to domestic violence
	Crime Number of deaths due to suicide
	Crime Number of deaths due to intentional accidents (homicide)
	Crime Number of disabilities due to violence
	Childcare Total places available per 100 children for children under 8
	Disability Proportion of disabled people in the social activities
	Form and Space Public lighting by neighbourhood Area of public spaces with poor lighting
	Form and Space Visibility and natural surveillance by neighbourhood
	Form and Space Mix of uses by neighbourhood
	Form and Space Number of places complied with design guidance such as **CPTED** (Crime Prevention Through Environmental Design) or **SBD** (Secured By Design) by neighbourhood
Culture	**Sense of belonging** Percentage of people who feel that they belong to their city or community or neighbourhood
	Cultural and religious facilities Number and state of mosques
	Cultural and religious facilities Number of museums per capita
	Cultural and religious facilities Number of public libraries per capita
	Cultural and religious facilities Number and state of historic sites
	Cultural and religious facilities Number of people attended cultural venues: cinemas/ theatres/ museums/ concerts/ religious premises
	Number of tourism visits to the city
Life expectancy	Life expectancy at birth for men (years)
	Life expectancy at birth for women (years)
Satisfaction	Trend of overall satisfaction with living in the city

Transport	**Travel to school** Proportion of 6-18 year olds travelling to school using sustainable modes of transport: bus/ walk/ cycle/ other
	Travel to work Proportion of people travelling to work using sustainable modes of transport: bus/ walk/ cycle/ other
	Estimated daily average number of passenger journey stages (millions of journey stages) Public transport/ private transport/ cycling/ walking
Social capital	**Voting** proportion of people engaging in actions designed to identify and address issues of public concern at least once a year
	Volunteering proportion of people engaging in any volunteering activity at least once a year
	Relationship proportion of people, who have a partner, family member or friend to rely on if they have a serious problem
	Trust proportion of people agreeing that people in their neighbourhood can be trusted
Image of the city	The state and area of green spaces
	The state and area of motorways
	The state and area of pedestrianized areas
	The state and area of cycling routes
	Neighbourhood walkability
	Public art Monuments/ Sculptures/ symposiums/ street arts and performances
	Number of buildings with unfinished façades
	Identity Does the city/neighbourhood/region/community recognise and support or enhance positive local cultural and historical (including aboriginal) identities and traditions?

Economic indicators

Headline Indicator	Measure
Employment	Rate of employment
	Proportion of economically active adults unemployed for over 12 months
Business survival	Percentage of new businesses still trading after 1 year
	Percentage of new businesses still trading after 3 years
Poverty	**Child poverty** Proportion of children in low-income households
	Fuel poverty Number of households living in fuel poverty under the low income high cost (LIHC) definition
	Proportion of households living below poverty line
Economic prosperity & income	Indices of Gross Domestic Product (GDP), GDP per head and median income
	Pension provision Percentage of eligible workers in a workplace pension
	Income inequality Decile distribution of net disposable household income for individuals
	Debt Public sector net debt (percentage of GDP) and public sector net borrowing (percentage of GDP)
Research & Development	Expenditure on R&D performed in businesses
	Expenditure on R&D related to environmental expenditure
Environmental goods and services	Total sales in the Environment goods and services Sector: Environmental/ Low carbon/ Renewable Energy
Physical infrastructure	Asset net worth by structure type: Dwelling/ Other buildings and structures/ Total non-financial assets/ Machinery and equipment
Non-oil export	Rate of non-oil exports
Inflation	Inflation rate
Energy	Energy consumption per household
	Share of renewable energy in electricity generation (percentage)
	Number of buildings (residential/ non-residential) obtained EPC (Energy Performance Certificate)
	Energy intensity Energy consumption per unit of GDP