

SUSTAINABLE CAMPUS DESIGN IN BAGHDAD UNIVERSITY, IRAQ

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To my small family: My beloved wife and children

To my big family: My brothers and sisters

I dedicate this thesis

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All praise be to *Allah*, the Lord of the Worlds, and may His Blessings and Peace be upon our *Prophet Muhammad*. I thank *Allah* very much for enabling me to complete this thesis. My Lord bestow on my parents thy mercy even as they cherished me in childhood.

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ABSTRACT

This study is a fundamental research that deals with the relationship between physical character and sustainability of university campuses in Iraq. There is an absence of a clear and substantive understanding of the role of physical character in supporting sustainability of the campuses. Besides, these university campuses are suffering from problems in their physical settings that have led to weakness in sustainability issues. This study is to establish how physical character affects sustainability issues in university campuses, where the main campus of Baghdad University was selected as a case study for this research. A mix of quantitative and qualitative methods was adopted to conduct this study. While questionnaire survey technique was utilized to collect data quantitatively, observation survey and in-depth interview survey were used to support or explain the findings. Quantitative data were analyzed using statistical frequencies, chi-square and logistic regression. Content analysis was employed to analyze qualitative data. Triangulation was used in the analysis in order to achieve reliable and valid conclusions. Through this method, a cross verification for the findings was possible by the combination of data sources such as statistical data, observations, interviews, theories and secondary data. The physical character was researched through three main components, namely layout and transport, landscape and buildings, which were analyzed to answer sustainability factors or objectives. Several key aspects such as layout and transportation features including distance between campus areas, massing, grouping of buildings, through traffic, permeability and location of bus stop were found to have impact on sustainability such as walkability, car reliance and social interaction. Landscape elements which included trees, awnings, seating, outdoor cafés and sculptures, in addition to their design characteristics were the major features found to have impact on campus sustainability, which were related to comfort, attractiveness and legibility. For buildings, the findings differentiated some key features that were important to the sustainable qualities such as architectural style, building height, building configuration, materials and building orientation that were found to affect environmental response, local identity, legibility and diversity. The study shows that physical characteristics are important in sustaining Iraqi campuses environmentally, socially and economically. Local attributes such as climate, culture and the preferences of local community have had a role in determining the key findings of this study.

ABSTRAK

Kajian ini merupakan kajian asas yang berkaitan dengan hubungan antara peranan fizikal dan kelestarian kampus universiti di Iraq. Terdapat ketiadaan pemahaman yang jelas dan substantif mengenai peranan watak fizikal dalam menyokong kemampanan kampus ini. Selain itu, kampus-kampus universiti ini mengalami masalah dalam tetapan fizikal mereka yang membawa kepada kelemahan dalam isu-isu kemampanan. Kajian ini adalah untuk mewujudkan bagaimana peranan fizikal memberi kesan isu-isu kelestarian dalam kampus universiti. Gabungan kaedah kuantitatif dan kualitatif telah digunakan untuk menjalankan kajian ini. Walaupun teknik soal selidik telah digunakan untuk mengumpul data secara kuantitatif, kajian pemerhatian dan temubual mendalam digunakan untuk menyokong atau menjelaskan dapatan kajian. Analisis data dijalankan secara kuantitatif dan kualitatif, yang mana data kuantitatif dianalisis menggunakan frekuensi statistik, penjadualan silang, chi-square dan logistik regresi. Analisis kandungan telah digunakan untuk menganalisis data kualitatif. Triangulasi digunakan dalam analisis untuk mencapai kesimpulan yang mutlak dan sah. Melalui kaedah ini, pengesahan bersilang untuk penemuan yang mungkin dengan gabungan sumber data seperti data statistik, pemerhatian, temu bual, teori-teori dan data sekunder. Peranan fizikal telah dikaji melalui tiga komponen utama, iaitu susun atur dan pentuk pengangkutan, landskap dan bangunan, yang telah diperiksa bergantung kepada pelbagai elemen dan ciri-ciri mengenai mereka. Ini telah dianalisis terhadap pelbagai kualiti yang mewakili faktor kelestarian atau objektif. Beberapa aspek utama seperti susun atur dan pengangkutan ciri-ciri termasuk jarak antara kawasan kampus, pilihan ke dalam fungsi, kumpulan bangunan, melalui lalu lintas, kebolehtelapan dan lokasi perhentian bas didapati mempunyai kesan ke atas tahap kemampanan seperti kebolehhajanan, kebergantungan kereta dan interaksi sosial. Elemen landskap termasuk pokok-pokok, kajang, tempat duduk, kafe luar dan ukiran, di samping ciri-ciri reka bentuk mereka adalah ciri-ciri utama yang didapati mempunyai kesan ke atas kelestarian kampus, yang berkaitan dengan keselesaan, daya tarikan dan kebolehbacaan. Bagi bangunan, penemuan dibezakan beberapa ciri-ciri utama yang penting kepada kualiti yang mampan seperti gaya seni bina, ketinggian bangunan, konfigurasi bangunan, bahan-bahan dan orientasi bangunan yang didapati memberi kesan atas tindak balas alam sekitar, identiti tempatan, kebolehbacaan dan kepelbagaian. Kajian menunjukkan bahawa ciri-ciri fizikal adalah penting untuk mengekalkan kampus Iraq alam, sosial dan ekonomi. Sifat-sifat tempatan seperti iklim, budaya dan citarasa masyarakat setempat mempunyai peranan dalam menentukan penemuan utama kajian ini.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This study is on the role of the physical characteristics in supporting campus sustainability in the Iraqi university campuses represented by Baghdad University. This chapter introduces a background of this research followed by problem statement. The chapter then presents the research questions and objectives. It also shows the scope and significance of this research, ended by the organization of the thesis.

1.2 Background of the Study

Recently, sustainability has been given an increasingly strong interest by scholars across the world. It has sparked a heated debate, especially after the Earth Summit in 1992 in Rio de Janeiro and 2002 in Johannesburg (Abd-Razak *et al.*, 2012). Therefore, sustainable development for urban settlements, is given a great deal of attention in many countries, particularly those of advanced nation. The wide-cited definition of sustainable development states:

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs

(WCED, 1987)

Much literature suggests that aspects, which include environmental, social and economic factors, are covered by the term 'sustainability', which is a lifestyle that covers all aspects of human life, behaviors, and actions (Bernheim, 2003b, UNGA, 2005).

The first step for sustainability as an ultimate goal, is to make existing cities sustainable and plan new cities in a sustainable way (Beyaztas, 2012). In order to achieve the goal of sustainability, it is expected that all kinds of institutions will try to consider the environmental, social, and economic consequences of their actions and try to balance them (Palazzi, 2006). Hence, sustainability is deemed a key issue for all organizations in the 21st century (Rusinko, 2010). This applies to higher education institutions, as well (McKinne, 2008); and for universities, as principal and important community organizations, sustainability is a fundamental requirement for their campuses.

Many studies have introduced the physical form of an urban area as a significant and influential factor in sustainability issue. Williams et al (2000) mentioned that several, and not one type of urban forms may meet sustainability requirements. UN-Habitat in its *draft working paper 2011* indicated that there are certain urban patterns such as 'compact concentric zone' and 'satellite cities' models are sustainable urban forms as they can provide the best for both human and ecological systems. The report added that this is because these two patterns can reserve a larger number of patches of land within which nature can flourish, and besides, they can allow growth for population and economic. However, the patterns of urban sprawl and uncontrolled developments result in poorer outcomes (UN-Habitat, 2011). Studies conducted within *City Form consortium* have emphasized on testing the claims that high-density, compact, and mixed used urban forms are more sound environmentally, viable economically, and, efficient for transport (Jenks and Jones, 2010, Williams, 1996, Williams *et al.*, 2000). This study deals with the physical dimension of urban form in terms of sustainability requirements in the context of university campus. This is based on that physical components of urban form including characteristics such as size, shape, configuration, land use and

distribution of open spaces, transportation systems and urban design features are claimed to influence sustainability of urban areas.

1.2.1 Importance of Sustainability for University Campus

Because of their fundamental role in the development of societies and their various activities, universities have been afforded great consideration by governments and other authorities regarding sustainability issue, which began in around 1990s. As universities are the places of innovation and learning, their campuses are the ideal location to adopt the notions of urban sustainability in a small scale (Chan *et al.*, 2009). Thus, sustainable development has become an increasingly important issue for universities around the world (Beringer *et al.*, 2008).

The sustainable development of a campus is defined as the development that meets the current needs as well as improves the quality of life without compromising the needs of coming generation, focusing on the balance of environmental, social and economic aspects (Sohif *et al.*, 2009). The focus of this study is on the sustainability of university campuses in Iraq. These universities should adopt sustainability in order to be able to reduce negative impacts on the environment and to create good life for current and future generations of their students.

Merkel and Litten (2007) indicated the great importance of sustainability to colleges and universities when they stated that colleges and universities must be sustainable in order to conduct their traditional missions of education, research, and service. At the same time, these institutions, they added, have a notable role in supporting sustainable progress. This importance can be clearly noticed through being recently many universities across the world have adopted the creation of a green campus (Isiaka, 2008). Blackburn (2007) listed a number of important advantages of pursuing sustainability for a university campus, including energy preservation, reduced pollution and accidents and saving costs. He included aspects such as promoting community as well as attracting students as benefits of creating a

sustainable campus. Therefore, the creation of sustainable campuses has become a necessity for all universities in the 21st century.

1.2.3 Sustainability and the Physical Form of University Campus

The term university campus belongs to an institutional space designed to be used for education and residence of college students (Isiaka, 2008), including buildings and other physical elements existing in the associated area (Shamsuddin *et al.*, 2007). It is required that universities possess residential, institutional, health care and recreational spaces (Chan *et al.*, 2009). University campuses are characterized by a mix of uses allowing students to move through these areas at different times and for different reasons, that provide vitality and positive economic effects (Jacobs, 1961).

A university campus is similar to a city in a smaller scale. According to Nichols (1990), universities function like independent municipalities, where they have their own governance structure, accommodate a residential population, maintain streets and buildings and provide services of public safety. Abd-Razak *et al.* (2012) contended that a campus can be considered as a city, which consists of elements that are highly interdependent. It can be helpful, when university form and design is required to be studied, to discuss city design in a broader context and then bring these ideas back to inform exactly on campus design (Chan *et al.*, 2009). Thus, physical characteristics of cities, towns and settlements can be used to examine campus design in relation to sustainability.

Researchers seek urban forms that has the potential to meet sustainability requirements and allow the urban environment to work in a more constructive way than at present (Jabareen, 2006). According to Burton (2000) physical urban form by its design and planning properties can play a principal role in achieving sustainability with its three components: environmental, economic and social. Physical urban form is described as the 'morphological attributes' of an urban area at all scales (Williams *et al.*, 2000). Physical characteristics range from features at very localized scale such as building materials, façades and fenestration, to other features, at a

wider scale, such as building type, street type and their spatial arrangement, or layout (Jenks and Jones, 2010). Hence, campus physical form at various scales could be related to sustainability.

Achieving a sustainable campus cannot occur without an extensive and detailed campus planning and design (Chan *et al.*, 2009). Campus of 21st century was described by *New Urbanism* as follows:

The campus of the 21st century will distinguish itself by demonstrating how the built environment can fit appropriately with the climate, the landscape and the culture of the region.

(Chapman, 1995: 57)

Abd-Razak *et al.* (2012) indicated the impact of physical aspects on creating sustainable campus, where they determined a number of indicators for sustainable physical planning of a campus. Those indicators included many characteristics of physical campus character such as, structural layout, accessibility, circulation, building design, landscape and surrounding, transport and movement as well as safety and lighting. Beyaztas (2012) identified three of campus physical characteristics as influential elements on campus sustainability performance, namely density, residential character and population. Osmond (2008) concentrated on a group of properties of urban form that are related to more sustainable human settlements. These properties include diversity, efficiency, resilience, permeability, legibility and intensity.

Making a successful place is associated with achieving urban sustainability for a settlement. Successful urban places should combine quality in three essential elements: physical space, the sensory experience and activity (Montgomery, 1998). Hashimshony and Haina (2006) determined a number of aspects related to physical structure that may define the future university: greater density and diversity,

smaller size, compact spatial configuration, better accessibility and open boundaries and organizing functions in zoning. These characteristics are important in designing more sustainable physical structure of a campus.

The concept of Compact City is a valid notion that was supported by the *European Commission's Green Paper* in 1991 as a fundamental model for sustainable urban design, which needs to adopt the concept of 'green structure' (Working-group, 2004). Green structure is defined as everything other than hard and built up structures, which also includes water features. A settlement needs to establish green structure that covers about half of its area (BUUF, 2007). This was reinforced by Jabareen (2006) who indicated that 'greening' is one of the considerable strategies of the process of creating a sustainable urban form. Hence, the green component is essential to establish more sustainable physical forms for campuses.

Physical character has a great influence in achieving sustainability, for any built environment. Physical form directly affects many aspects of sustainability such as, habitat, ecosystems, threatened species, and water quality (EPA, 2001). It also influences travel behavior, which, in turn, affects air quality, wetlands and open space, climate, and noise (Cervero, 1998). Jabareen (2006) determined seven concepts or design attributes as important to create sustainable urban environments, namely compactness, sustainable transport, density, mixed land uses, diversity, passive solar design and greening. According to Jenks and Jones (2010), urban form is characterized by a number of characteristics that include size, shape, scale, density, land uses, building types, urban block layout and distribution of green space. This group of physical characteristics, according to them, is claimed to influence sustainability and human behavior.

It can be concluded that physical character is a crucial factor to achieve campus sustainability. The sustainable urban design and planning of a campus can play a significant role for a more sustainable community of a university. This is based on a notable association between physical characteristics and sustainability aspects in urban areas. Therefore, it is very important that a university when seeks to

get more sustainable, should concentrate on its campus design and planning. This study concentrates on examining the importance of the physical character in creating a sustainable campus.

1.3 Problem Statement

Sustainability of university campuses has become a global issue (Alshuwaikhat and Abubakar, 2008). Beringer *et al.* (2008) revealed that sustainability is an important matter for universities around the world. As an institution, a university cannot avoid the issue of sustainability (Abd-Razak *et al.*, 2012). In Iraq, there is an urgent need for sustainable development, where Iraqi universities need to be promoted towards sustainable development so as to be able to rebuild the country's infrastructures. These universities, also, have to catch up with the scientific progress in the world regarding sustainable development (Al Hakeem, 2012). It can be concluded that sustainable development is currently a new concept in the Iraqi higher education.

Creating a sustainable campus enables a university to perform its tasks well by providing a good life for current and coming students. Abd-Razak *et al.* (2012) contended that creating a campus environment that can inspire the community to lead a sustainable life is a significant matter. A priority of creating sustainable campuses for communities applies to Iraqi situation due to a lack in sustainability implementation in Iraqi higher education institutes (Al Hakeem, 2012).

Physical urban form has taken a considerable importance as a critical factor in sustainability issue. Jenks *et al.* (1996) labeled the relationship between urban form and sustainability as one of the issues that have taken a considerable attention and sparked a hot debate that is related to environmental agenda internationally. Thus, the importance of physical form in urban sustainability has been recognized in recent years (Sheng and Tang, 2011a). This makes the transformation of Iraqi universities to the sustainability needs to originate from their physical forms. This research focuses on the importance of the physical characteristics in making Iraqi

universities more sustainable, especially due to Iraq's need to establish additional 75 new universities in the next period (Iraq-news-agency, 2012). Iraq also needs to develop the existing 30 higher educational institutions to accommodate the increasing numbers of students (Iraq-ministry-of-higher-education, 2011). This establishment and development of the universities in the country should consider sustainability issues due to its necessity for the society as a whole.

It was established that different degrees of sustainability can be achieved by different physical urban forms (Frey, 1999b, Jenks *et al.*, 1996) and more sustainability can be achieved by certain patterns or physical characteristics (Jabareen, 2006, Moughtin, 2004, UN-Habitat, 2011). Physical character has impacts on numerous aspects of sustainability as many studies indicated e.g. (Nam, 2011, Mobaraki *et al.*, 2012, Williams *et al.*, 2000, Denhoed, 2009a, Dempsey *et al.*, 2010, Parsons and Daniel, 2002, Osmond, 2008). This exemplifies an argument to focus on the physical character when researching Iraqi campus sustainability.

Although the significant role that physical character of a built environment can play in sustainability issue and the importance of sustainability for the universities, there is a lack in comprehensive research on the relationship between physical character and sustainability allocated for Iraqi universities. In addition, Iraqi universities are suffering from problems related to sustainability in terms of their physical forms and design characteristics (Al-Akkam, 2015, Matloob *et al.*, 2014, Al-Kilidar, 2006).

Globally, there is a lack in the research dealing with physical campus form in terms of sustainability in which, most of the studies on campus sustainability have not focused on the direct role of physical form in sustainability. Most of these studies, for example Kirsche (2008); Laroche (2009); Hoe (2011a) ; Alshuwaikhat and Abubakar (2008); Shriberg (2002); Henson *et al.* (2007); Rasmussen (2011); Merkel and Litten (2007); Beringer *et al.* (2008) and so on, deal with campus sustainability either abstractly and ignoring physical aspects or addressing the physical side partially in relation to sustainability. This group of studies did not adequately relate sustainability issues to the physical aspects of the campus. As a

result, the relationship between physical character (as a whole) and sustainability has not enough been covered by these studies. However, there are a few studies that have researched some physical features in relation to sustainability on campus e.g. Abd-Razak *et al.* (2012), Beyaztas (2012), Chan *et al.* (2009) and Sisson *et al.* (2008), but they are still inadequate compared to the importance of this subject. Even in the case of a study on this subject exists, it is not necessarily appropriate for Iraqi universities because every region or country has its own context such as culture, history, heritage, local climate, nature of people and current need to sustainability. According to Guy (2000), there is no certain model of sustainable physical form that is applicable in all circumstances. For this reason, Iraqi university campuses need their own unique model of sustainability in relation to their physical forms. Therefore, this research is to focus on the relationship between campus physical form and sustainability in Iraq. It seeks to highlight the importance of physical form through its design elements and principles in the transformation of Iraqi universities to sustainability and identify the sustainable physical character of Iraqi campuses.

1.4 Research Questions

The key question of this research is: Why are physical characteristics of campus form important for sustainability in Iraqi university campuses?

The corollary questions are as the following:

- 1- How does campus physical character influence sustainability for Iraqi universities?
- 2- What are the physical design characteristics that are significant in achieving sustainability on Iraqi campuses?

1.5 Research Objectives

The main goal of this study is: To identify the sustainable physical character for Iraqi university campuses.

In order to achieve the principal goal, the research is to meet the following objectives:

- 1- To find out the relationship between physical character components and sustainability factors on Iraqi campuses.
- 2- To determine the key physical features those are important to support sustainability on Iraqi campus.

1.6 The Scope of the Research

The scope of this study is the physical aspects of university campus in relation to sustainability. This research is limited by researching the contribution of the physical character in supporting sustainability in Iraqi university campuses. It seeks to investigate the relationship between physical attributes represented by the design elements and principles and sustainability aspects identifying the key elements of physical form that have the potential to influence campus sustainability in a selected case study. The case study chosen for this research is the main campus of the University of Baghdad in Iraq. The ultimate goal of this research is to identify the physical character that contributes towards sustainability for Iraqi campuses.

1.7 Research Significance

As mentioned above, based on its research objectives, this study seeks to disclose the contribution of physical characteristics in supporting sustainability for Iraqi university campuses. It aims at identifying the sustainable physical character of campuses in Iraq.

Theoretically, this research will provide a clear understanding of campus sustainability in terms of physical design. A clear relationship between physical campus form and sustainability aspects is established through this study. Claims of how specific physical aspects link to and affect sustainability are objectively examined in the context of a university campus. These claims are proven through this study, which helps to remove the ambiguity related to this matter. The findings of this study outline the sustainable physical character for university campuses for Iraq. These findings can serve as theoretical evidences and arguments for the researchers to support their studies in similar or related topics. In addition, the results of this study contribute to fill in the gap in the research body regarding this matter or support the research previously done in this topic.

In practice, this study represents guidelines for urban designers, planners and decision makers in Iraq to create more sustainable campuses for the current or future universities. Universities everywhere in the world, especially in the smaller regional contexts can also benefit from the findings of this study to pursue sustainability in their campuses, particularly when aspects such as the location and culture are taken into consideration. As a campus is similar to a small city, the findings of this study can be used as indicators for designing and planning sustainable cities, towns, neighborhood and even housing complexes.

Through the outcomes of this research, Iraqi campuses would be expected to possess ideal environments for teaching, innovation, accommodation and healthy life, which affect positively the society as a whole. Hence, this research would contribute to achieve the goal of Iraqi higher education and society to transform towards sustainability.

1.8 Thesis Organization

This thesis is comprised of seven chapters as follows:

Chapter 1: explains the background of the research in terms of research problem, questions, objectives, scope and the contribution of the research.

Chapter 2: contains the review of the relevant literature explaining the theoretical basis of this study through which the variables and indicators required for the research are derived.

Chapter 3: Covers the detailed methodology adopted in the research, where the techniques used for data collection and data analysis are explained.

Chapters 4, 5 and 6: presents data analysis, discussions and findings regarding the relationship between campus physical character and campus sustainability, where:

Chapter 4: identifies the role of campus layout and transport infra-structure in campus sustainability.

Chapter 5: presents the contribution of campus landscape in campus sustainability.

Chapter 6: examines the role of campus buildings to support campus sustainability.

Chapter 7: presents the conclusion and recommendations based on the findings of the research.

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