

EVALUATING THE SUSTAINABILITY OF THE PHYSICAL URBAN FORM OF
SANANDAJ CITY, IRAN

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To my beloved Father and Mother

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ABSTRACT

The study of sustainable urban form has received a major attention around the world. It has triggered a growing concern on how cities are planned and designed. Although the concept of sustainability is well known, the appropriate measurements for sustainability context are still being debated by scholars. The rapid urbanization rate experienced in Iran in the second half of the 20th century has mostly manifested itself in the emergence of large cities without any specific elements of Iranian culture. The old cities are slowly losing their identity due to modern development. This thesis assessed the level of sustainability of the physical urban form of Sanandaj City Iran, using five (5) factors, compactness, accessibility, diversity, identity and environment. The city, located in the western part of Iran, has a population of about 400,000. Chi-square test, Binomial method and Analytic Hierarchy Process techniques were used to test variations that exist among four neighbourhoods (Chaharbagh, Adab, Baharam, Taghtaghan) of the city based on these five (5) measurement values. The chi-square and binomial tests result showed that respondents from the middle city neighbourhood were satisfied with the physical characteristics of their neighbourhood while those from inner, outer and pocket neighbourhoods were unsatisfied. In a similar situation, the Analytic Hierarchy Process showed that the level of sustainability of urban form in the middle city neighbourhood was higher when compared to the other three neighbourhoods. Findings of this research indicate that in order to achieve sustainable urban form, policies for developing urban pattern should be changed and attentive approach is required to guide development in the urban areas to achieve efficiency and sustainability. The results of this study also provide insights into the issues that policy-makers and practitioners should consider in designing and developing programs and efforts dealing with the problems of physical urban form especially for Iranian cities.

ABSTRAK

Kajian bentuk bandar yang mampan telah menerima perhatian yang besar di seluruh dunia. Ia telah mencetuskan kebimbangan yang semakin meningkat tentang bagaimana bandar dirancang dan direka. Walaupun konsep kemampanan diketahui umum, ukuran yang sesuai untuk konteks ini masih diperdebatkan oleh para pakar. Kadar perbandaran pesat yang dialami di Iran pada separuh kedua abad ke-20 kebanyakannya telah dimanifestasikan dalam kemunculan bandar-bandar besar tanpa sebarang unsur-unsur khusus budaya Iran. Bandar-bandar lama secara perlahan-lahan kehilangan identiti mereka akibat pembangunan moden. Tesis ini menilai tahap kemampanan bentuk fizikal bandar Sanandaj di Iran, dengan menggunakan lima (5) faktor yang dibangunkan kepadatan, kebolehan mengakses, kepelbagaian, identiti dan persekitaran. Bandar ini yang terletak di bahagian barat Iran, mempunyai penduduk kira-kira 400,000. Ujian khi-kuasa dua, kaedah binomial dan teknik Proses Hierarki Analitik (*Analytic Hierarchy Process*) telah digunakan untuk menguji perbezaan yang wujud di antara empat kawasan kejiranan (Chaharbagh, Adab, Baharam, Taghtaghan) di bandar ini berdasarkan lima (5) pengukuran nilai. Keputusan ujian khi-kuasa dua dan binomial menunjukkan bahawa responden dari kawasan kejiranan di tengah bandar telah berpuas hati dengan ciri-ciri fizikal kawasan kejiranan mereka manakala mereka yang mendiami kawasan kejiranan dalaman, luaran dan poket tidak berpuas hati. Dalam situasi yang sama, Proses Hierarki Analitik menunjukkan bahawa tahap kemampanan bentuk bandar di kejiranan tengah bandar adalah lebih tinggi jika dibandingkan dengan tiga kawasan kejiranan yang lain. Hasil kajian ini menunjukkan bahawa, bagi mencapai bentuk bandar yang mampan, polisi yang membangunkan corak bandar harus diubah dan pendekatan yang lebih bijak dan penuh perhatian diperlukan untuk memandu pembangunan di kawasan bandar untuk mencapai keberkesanan dan kemampanan. Keputusan kajian ini juga memberikan pandangan kepada isu-isu di mana pembuat dan pengamal polisi perlu dipertimbangkan dalam mereka bentuk dan membangunkan program dan usaha yang menangani masalah bentuk fizikal bandar terutamanya bandar-bandar di Iran.

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LIST OF ABBREVIATIONS

AHP	-	Analytic Hierarchy Process
CMHC	-	Canada Mortgage and Housing Corporation
EDI	-	Ecological Design Institute
NRTEE	-	National Round Table on the Environment and Economy
SAB	-	Sustainable Area Budget
SD	-	Sustainable Development
SCD	-	Sustainable Community Design
SCI	-	Statistical Center of Iran
TOD	-	Transit Oriented Development
UNCED	-	United Nations Conferences for Environment and Development
UNCSD	-	United Nation Commission on Sustainable Development
UGB	-	Urban Growth Boundaries
ULL	-	Urban Limit Line
WCED	-	World Commission on Environment and Development

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CHAPTER 1

BACKGROUND

1.1 Introduction

Cities are now recognized as being one of the major challenges in the transition towards a sustainable world. They are both a subject and an object of sustainable development. Cities are also often considered an appropriate place for testing the concept of sustainable development, or even a catalyst for sustainable development.

There has been much debate in recent years over the influence of urban form on the way we live. The discussion can be traced back nearly a half century to the seminal work of Kevin Lynch (1960, 1981) and Jane Jacobs (1961) on the relationship between city form and people. While their perspectives were quite distinct, each argued persuasively that existing planning paradigms did not adequately understand how cities really work and what makes them good places to live.

Cities are physical objects that display extreme variety of size and form. Current cities are undergoing unprecedented social-cultural, economic,

environmental and institutional transformations as their sizes, structures, functions and roles change. These rapid transformations are still poorly understood and raise fundamental questions that cannot be answered yet.

The question of what is the sustainable city, and the relationship between urban form and sustainability is currently one of the most hotly debated issues on the international environmental agenda. The way that cities should be developed in the future, and the effect that their form can have on resource depletion, social and economic sustainability are central to this debate. So far, sustainability of the city as a whole has not been a guiding principle for the development of these urban planning tools. Current knowledge of city dynamics, however, indicates that changes in the physical and economic infrastructure strongly interfere with changing social, cultural, ecological and institutional dynamics (Miller and de Roo, 1999).

The relationship between urban form and sustainability in general, and the impact of urban form on the quality of life in particular, have become established amongst academics and governments particularly after the United Nation Rio Janeiro Conference in 1992. This has resulted in the increasing demand for sustainable urban form. However, the existence of contradictory theories such as the compact city and urban dispersal, and a lack of empirical research in the field were found to be a major obstacle in identifying alternative models.

The phenomenon of increasing world urban population and sharply decreasing global arable lands is also evident in the contemporary Iran. Construction and expansion of cities have been accelerated due to vigorous economic growth and migration of people to urban areas. Many of these cities have not set a goal on how to achieve sustainability. However, these cities are not demonstrating whether their urban forms are effectively responding to the principles of sustainability, beyond plausible visual images.

The questions of how and where to channel urban growth for sustainability have consequently become widely discussed. The study of sustainability therefore is no longer restricted to western economies; it is now receiving considerable attention in Iran. Although the concept of sustainability is well known, appropriate measurements for sustainable development in Iran are still debated.

In particular, the measurements for urban form present challenges to planners and city managers. The question of urban space and form has not been sufficiently examined in Iranian research especially by using a case study. There is a further aspect that needs attention, and that is the physical and spatial analysis as well as internal transformation of Sanandaj subject to the pressures of globalization and growth.

1.2 Statement of the Problem

In recent decades, the urban environment of neighborhood areas and the social relationships between individuals and their environment have received a great deal of attention and has become the core of many investigations about local community studies. This has also been the case in wide range of concerns in later urban literature.

Urban form or city physical form is interdependently affected by the environment, economic development, social and the political life of our cities (Bramley and Krik, 2005). Also human activities in the city are influenced by physical form and vice versa. So the analysis of major forces which shape current urban form and impact human activities are very important in identifying key urban form values to facilitate sustainability. Planners need to understand the forces that affect urban form. That is, they must understand the influences of their decisions.

Establishing appropriate urban form indicators and assessment systems can help planners understand the forces behind changes in urban form (Seasons, 2003).

While sustainability of city is multifaceted, physical and spatial urban form and its relation to the efficiency of the city is the most acknowledged issue in the world environmental agenda (Jenks *et al.*, 1996). Many scholars argue that sustainable urban form is a key towards achieving a sustainable development and that quality of life is a vital component of it. This is so because efforts to promote sustainability are unlikely to be fruitful if they imping too severely on perceptions of human well-being. Urban quality of life is a multi-dimensional concept and has a long history of research. The efforts to explore this concept have been witnessed in multiple disciplines and very recently being recognized as an important components of sustainability (Rogerson, 1999). Whatever the definition and scale, historical concern for the most desirable urban form has been focused on quality of life improvement and the aesthetics of urbanity (Breheny, 1996), primarily as a reaction to the evils of the 19th century industrial city (Hall, 1998).

Recently, the quality of life studies have drawn the attention of environmental designers, urban planners, and policy makers, due to its usefulness in assessing the overall satisfaction of citizens with life, and monitoring public policies. Even so, the importance of the neighborhood environment remains the most fundamental base of life. People spend the majority of their lives in the neighborhood that influences their economic and social life. Consequently, satisfaction with the neighborhood features is an imperative indicator of the neighborhood quality, which affects residents' quality of life. Despite the growing arguments that implementation of sustainable systems can not be successful if they detract from quality of life of the people in these system (Bell and Morse, 1990), empirical studies still have not reached a consensus on the effect of sustainable urban forms on quality of life. This is more so because different studies employ different definitions, variables and measurement methods, which make it difficult to generalize the findings.

Moreover due to insufficient documentation and huge gap about studies to establish the relevance in less developed countries has also raised the question as to whether a spatial pattern of urban system in the cities of developing countries also has similar effects in determining people's quality of life. The little work that has been done are largely confined to developed nation and this dimension of urban form is usually taken for granted as an integral part in advocating sustainable urban forms.

The growing concentration of people in urban areas, although at very different rates across the world, is a fundamental feature of modern times. Characterizing this process is the expansion of built environment to accommodate the ever-increasing urban populations and activities. There is no doubt, that the progressively complex physical forms that these conglomerations take have some relationships with the general societal processes which have led to the redistribution of population in favor of towns and cities and the creation of urban fabrics. Although many studies have centered on urban form, the arrangement of urban fabric with its social and physical dimensions, there is still a large conceptual gap as regards this relationship. This implies that many more studies are required to provide frameworks for understanding sustainable urban form in relation to wider sustainable urban structure and urban contexts and it is towards this end that this study hopes to take a step. However, it is clearly obvious that the patterns of city development in most part of the world especially in developing countries, is not desirable considering the social and psychological suitability. Cities and existing habitats are by no means built in accordance with desired standards and regulations. Most urban centers are often unplanned and are devoid of activities. Urban suburbs lack city spirit and are heavily reliant on the automobile.

Since the early twentieth century, most cities in Iran have experienced an unprecedented increase in structure, which has led to the transformation of the city area into different sub areas. These changes are rapidly extending the boundaries with unbalanced figures. Indeed these kind of developments led to the problem of non-suitable proportion between land uses and good per capita. The population distribution in Iran from 1956 to 2011 is shown in figure 1.1.

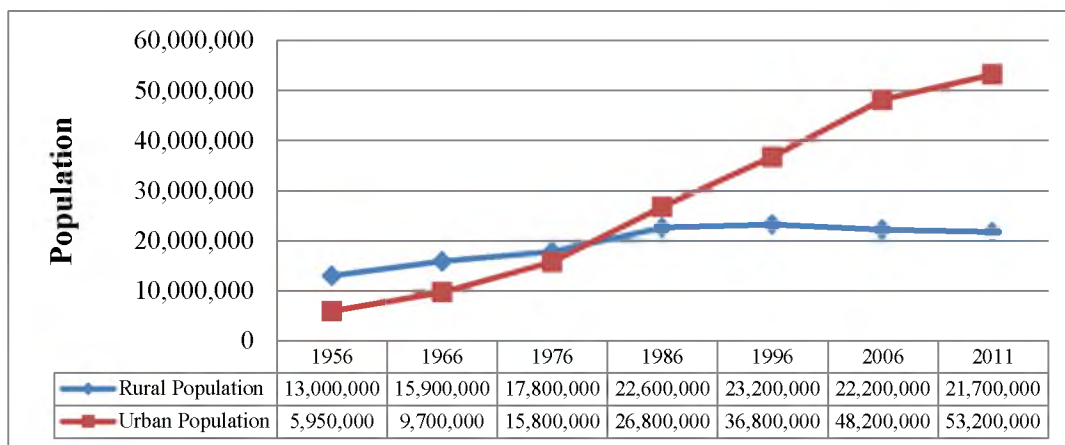


Figure 1.1: Population Distribution by Urban and Rural Area from 1956-2011
Source: Statistical Center of Iran, 2012

Based on the increasing population, it has been projected that the population will be 130 million with current urbanization rate by year 2021. In order to meet the demand of this increase in population, total land areas of about 700,000 hectares are needed to be developed (Habibi, 2005). In many ways, this will involve high quality land and damage to ecosystem.

The rapid rate of urbanization experienced in Iran in the second half of the 20th century has mostly manifested in the emergence of large cities without any specific elements of Iranian culture. This has led to the disappearance of the rich architectural and urban design of the past. In addition, the old city centers, that still have some elements of Iranian culture they are slowly vanishing, as a result of modern developments. After about half a century, these cities represent modern life standards with little or no Iranian cultural identity. The only linkage is their old city centers, which have helped them to keep their physical appearance as historic cities, but in reality urban development problems have put the present life and the future destiny of these cities in danger.

The Islamic Revolution of 1979 has influenced all aspects of the Iranian societies. The major task of the new Islamic government was naturally to settle down the socio-economic and political unrests in the first few years. Urbanization has

entered a new era as the Islamic Revolution had to realize many of its promises to the urban masses and rural poor. The city became a focal point and the main destination of rural migration, without any planned urban projects which fuelled urban problems. However, Kurdistan province has experienced different periods compared to other regions in the country. The area faced too much transitions due to the imposed Iraq-Iran war and regional political conflicts. These two issues led to rapid urban growth and spatial changes of the Sanandaj city as a center of Kurdistan province.

The sudden influx of migrants to the city has caused a mushroom-like growth next to the villages around the city and its margins. These sites were formed by new comers seeking housing and jobs, without any scheme beyond the prospects of the city' comprehensive plan and were based according to the original rural migrants' needs that mostly chose the informal lands around the city. Intensive construction of buildings with little organization on elevated heights that could be used as natural landscapes was rampant. The resultant effect was the creation of an undesirable physical structure of the city due to the use of unresisting building materials. These sites have no positive identity and represent only the place where the residents live. Following the natural increase of the population, majority of the constructions were done outside the city limits of the comprehensive plan. Based on the report on a study by Farafza Consulting Engineers, the physical growth of the city has increased twice based since the previous comprehensive plan in 1985.

Following the explosion in growth of the city, the city officials have decided to take necessary measures by providing master plans so that the physical development of the city will be based on pre-approved plans. Most of the fertile agricultural lands and gardens were used for physical development as the city is surrounded by high lands; land preparation usually incurs high costs due to massive excavation work that needs to be done.

Population growth and migration have been identified as the two major problems of urban development in Sanandaj, the center of Kurdistan province in the last two decades. The population has increased from 95,000 in 1976 to 320,000 in

2001. This shows that the population has increased more than three times in less than thirty years.

The rapid increase in population experienced during this period has led to the expansion of the urban structure. The development of the urban form has spread due to the intense structural development that has taken place within this period (from $\frac{1}{4}$ km² in 1960 to 36 km² in 2001). As a result of this expansion, mountainous slopes that could have been used for natural urban landscapes have been encroached upon. Historically, the city has a diverse blend of heritage structures and modern development, land uses that were developed over hundreds of years with no apparent cohesiveness in architecture or development pattern. Figure 1.2 shows the spatial development of urban area in Sanandaj from 1956-2012.

Due to rapid development, Sanandaj has become characterized by juxtapositions of building typologies and urban forms. The city may be said to be losing identity as large sections of traditional urban fabric are being replaced. Urban growth in Sanandaj mostly follows a sprawling, unformed morphology that is rapidly transforming rural land in the urban fringe into suburban, tracts and suburbs enclaves. This form of growth negatively affects the use of resources and the environment. The starting point for this research is that, there is a lack of clarity and also a significant gap in understanding of the current relationships between the physical form of the urban environment and environmental performance. These relationships exist and can be described and explained with coherent methodological and policy framework to support the evaluation of sustainable urban form in Sanandaj. With focus on the physical shape of the city and urban spaces that link the spatial formation and transformation of the physical form of Iranian cities with respect to urban sustainability, this urban landscape has been identified and developed as a basis for theoretical discussions and empirical case study.

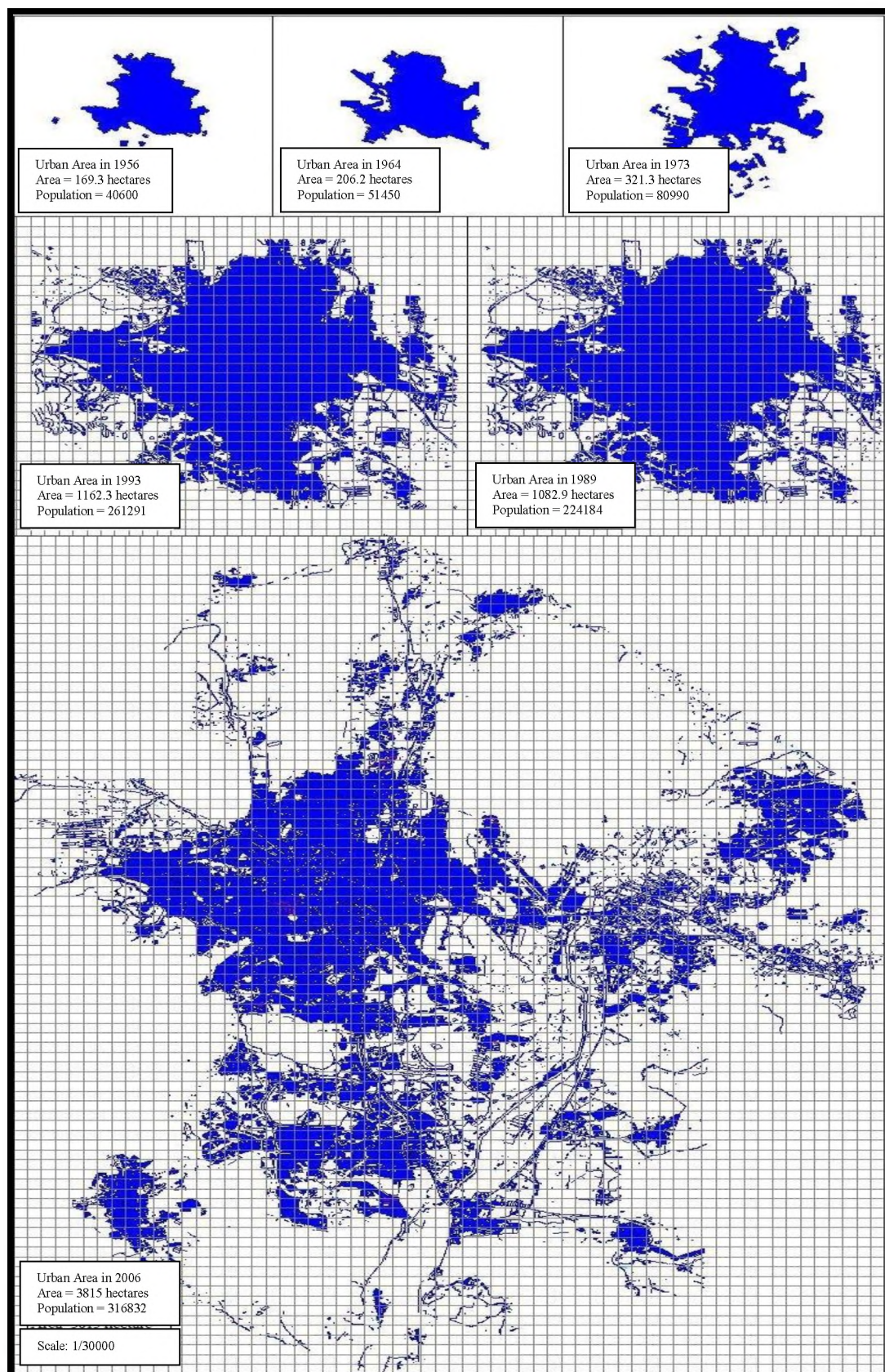


Figure 1.2: Urban Development in Sanandaj City from 1956 to 2006

Source: Author, 2012

An important reason for such an interest in evaluating the physical dimension of urban form lies in the question of effective allocation of scarce resources. In fact improvement of life quality in each society is one of the important aims of public policies. Clearly the increase of urban population and the increasing tendency for living in the city is one of the main incentives to expand an independent movement on life quality and physical urban form researches. Sanandaj, is a traditional and small city in west of Iran .The city was chosen for this study because it is a paradigmatic region which clearly displays the fundamental features and trends of rapidly growing and changing urban systems in Iran.

1.3 Research Questions

The central premise of this research is that the urban form of a city can affect its sustainability. This thesis will attempt to answer a specific but important question: Is Sanandaj's existing physical urban form sustainable? There are several questions in this thesis that will help to answer this main question:

- i. What are the theoretical frameworks to formulate and measure sustainable physical urban form?
- ii. What are the sustainability indicators that can be used for analyzing Sanandaj city?
- iii. What urban form patterns are sustainable in Sanandaj city?
- iv. What are the relationship between physical form and quality of life?

1.4 Objectives of the Study

The major thrust of this study is to analyze the urban development patterns in terms of sustainable physical principles and evaluate the neighborhood's sustainability in terms of physical form and citizen's satisfaction level. It takes as its foundation on the proposition that identifiable relations exist between urban sustainability and form. Also, the evolution of urban forms in Sanandaj city and their future sustainability are examined. The objectives of this research are focused on six (6) aspects:

- i. To develop a theoretical framework for formulating and measuring sustainable physical urban form.
- ii. To develop indicators that can be used for analyzing the sustainability of physical urban form.
- iii. To evaluate the sustainability of physical urban form of Sanandaj city.
- iv. To assess the relationship between sustainability of physical form and quality of life using neighborhood satisfaction as an empirical definition of quality of life.

1.5 Research Hypotheses

Many scholars argue that sustainable urban form is a key towards achieving a sustainable development and that quality of life is a vital component of it. This is so because efforts to promote sustainability are unlikely to be fruitful if they imping too severely on perceptions of human well-being. From a policy perspective, a reasonably good and useful conception of quality of life is an individual's perception, evaluation, and satisfaction with various aspects or domains of their life (Campbell, 1981). Thus this research assesses how people's subjective attitudes toward their

environments are related to the characteristics of physical form at the neighborhood community scale. This corresponds closely to Kevin Lynch's (1981) suggestion to evaluate urban form based on its effect on "satisfaction and development of individuals" (pp. 102). The physical texture of urban form in study area has been divided to four (4) different types of neighborhoods that nominated inner, middle, outer and pocket. The study goals are achieved through the testing of the following hypothesis with all the four (4) categories of residential areas:

- i. There is no significant difference among the four (4) neighborhoods with respond to the residents' satisfaction over their physical characteristic.

1.6 Importance of this Research

Since this is an empirical study of the relationship between urban form and sustainability, it is necessary to know why this is important. First, the important role urban form plays in sustainable development of cities since the late twentieth century. Second, the response to the recent call for empirical research on how to overcome the existing contradictions associated with alternative urban forms and a move towards sustainability. Although many studies have been carried out on urban form and its arrangement with social and physical dimensions, there is still a large conceptual gap as regards this relationship. This implies that more research is needed to provide frameworks for understanding sustainable urban form in relation to wider sustainable urban structure and contexts. Hence, the present study aims at achieving this for Iranian cities.

1.7 Contributions of the Research

By focusing on the impact of sustainability on urban physical form, growth and change, this study will provide a better understanding of the prospects and problems associated with moving towards sustainable urban centres in rapidly growing developing countries. It will contribute to an increased understanding of the causal relationship between urban growth and sustainable development with emphasis on urban growth and change. This study is also expected to provide valuable knowledge needed for urban planners and policymakers in addressing the challenges of urban growth more effectively and how to devise sustainable urban management strategies. The research findings are expected to add to the existing knowledge base in such a way that future development and growth in metropolitan regions in developing countries can be guided in a manner that enhances long-term sustainability.

1.8 Scope of the Study

This study starts from a theoretical review of sustainable development and physical urban form and their relationships. The significance of the urban form in terms of sustainable development is identified and a theoretical framework was formulated after the literature review. It attempts to generate a sustainability impact assessment checklist thorough identifying the relevant urban form elements and good city form dimensions.

Through a case study of Sanandaj city, the sustainability of physical urban form was identified, which shows that urban form is a vital element for promoting sustainable city environment. Sustainable development involves many environmental, social and economic factors at the neighborhood and city levels. This research covers sustainable physical urban form in Sanandaj city. This choice of

scope does not mean that other aspects of urban sustainability are of less important, but for clarity of purpose in terms finite boundary and focus the two dimensions were chosen. For the purpose of this study scopes 1 and 2 were considered to determine the level of sustainability both objectively and subjectively these are:

- i. Direct measuring of physical urban form by sustainable indicators that were developed based on best practices and covers five (5) dimensions factors: compactness, diversity, identity, accessibility and environment.
- ii. Direct measuring of physical urban form from resident's points of view and those who are living in place based on developed factors; compactness, diversity, identity, accessibility and environment.

1.9 Research Flowchart

The overall research strategy was focused upon a case study of the neighborhoods. Using SPSS and GIS, the study conducted spatial and statistical analysis of the urban form for each of the neighborhoods. In addition, the statistical analysis compared the results among different neighborhoods.

The urban form of the neighborhoods was measured by five (5) dimensions. Based on the anticipated research results, the specific methods employed were documentation and archival records, survey and interview. Chapter four (4) will further elaborate the research methodology used in this research. The figure 1.3 shows the overall research methodology that is used for this study.

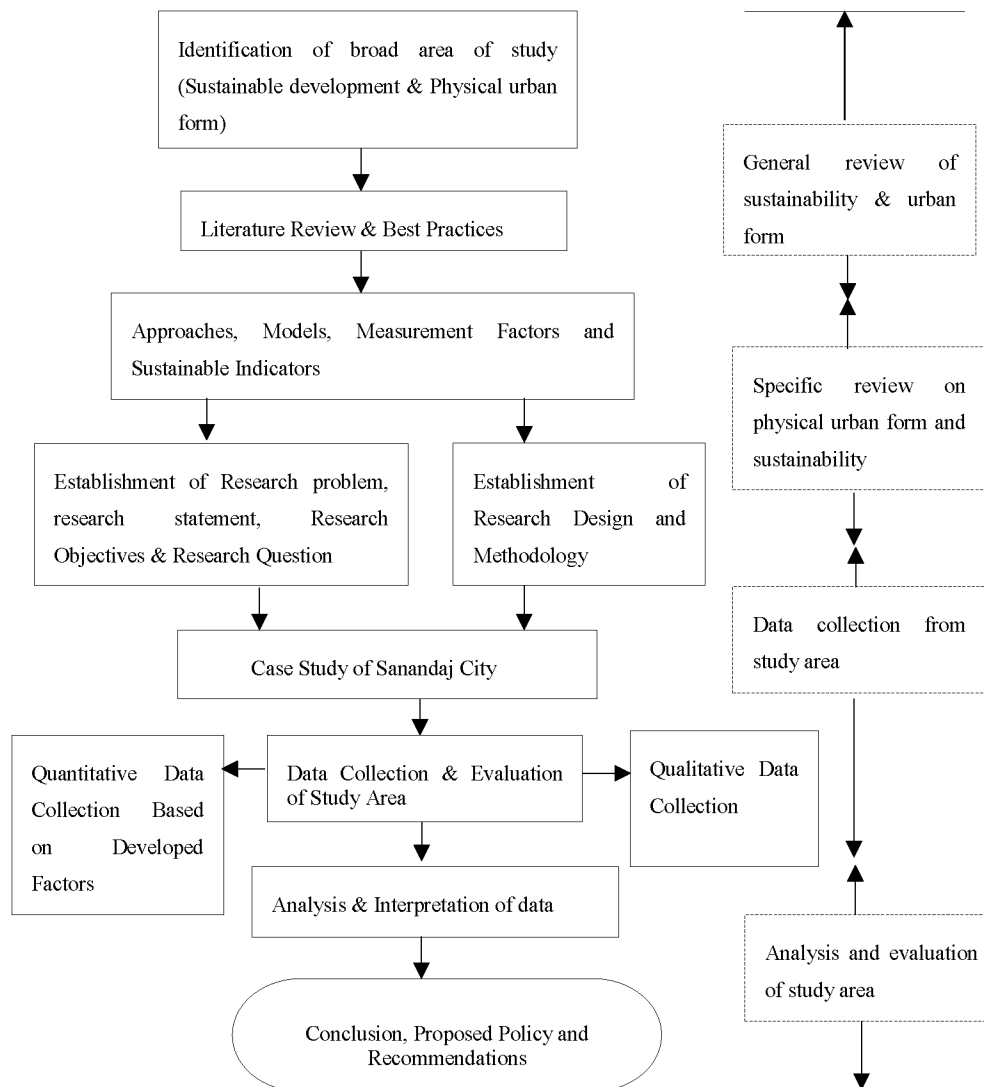


Figure 1.3: Flowchart for Overall Research Methodology

1.10 The Structure of the Study

The dissertation consists of eight (8) chapters. **Chapter One** introduces the research background and issues, articulates the aim and objectives of the study, and briefly describes the conceptual framework, the research methodology and the structure of dissertation.

Chapter Two addresses the theoretical perspectives and approaches on urban form. The theoretical research foundation for this study is derived from the growing literature on the multidisciplinary review on urban form, urban geography and morphology. The key ideas from these research studies are used to structure a conceptual framework for this study and to guide the empirical analysis of data collected from the field.

Chapter Three discusses of the new approaches of smart growth's and new urbanism theory in assessing sustainable urban form. Meanwhile, the empirical and contextual foundation of this study is based on the body of literature on quantitative measurement of sustainable urban form. The brief examination of relevant theories, models, views, and experiences in each of these areas provides a background and suitable framework for the study and helps in achieving the set objectives through derivation of sustainable indicators for measuring the city and neighborhood scale.

Chapter Four focuses primarily on methodological approaches adopted for the study. Following the aim and objectives set for the study, it first identifies the overall research strategy of this study, and then explains the rationale of choosing Sanandaj and its different fabrics as the case study. Data collection, qualitative and quantitative analysis and interpretation methods are also explained in this chapter.

Chapter Five highlights the significance of urban development and history of urban form in Sanandaj. This chapter also examines the challenges encountered in Sanandaj's urban growth and land development practice, focusing on urban development and growth, political cultures, zoning attempts in the past, annexation policy and major infrastructures.

Chapter Six examines and measures of urban form in Sanandaj's selected four neighborhoods by different socioeconomic status and discusses the qualitative characteristics of the neighborhoods. In contrast to the previous chapter, chapter six focus on the citywide land use issues, this chapter focuses on land development

control issues and urban form at the neighborhood level. It selects four neighborhoods according to their socioeconomic and distance from the city center status, and measures their urban form by using different dimensions. The chapter investigates how the history of urban form and changes in the current land use controls in selected neighborhoods has impacted upon urban physical form.

Chapter Seven evaluates the effect of block and neighborhood housing density, land use mix, the mix of housing structure types, and street network connectivity and the impact of physical form variables on residents' ratings of neighborhood satisfaction. This chapter examines the relationship between physical form and quality of life using neighborhood satisfaction as an empirical definition of quality of life in resident's perception of their neighborhood form.

Chapter Eight consists of recommendations and discusses the policy implications of Sanandaj's land use plans and regulations. In analyzing the problems revealed in the urban form development in Sanandaj, the study attempts to find out the problems that underlie the current land use governance mechanism and draw policy implications and recommendations.

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