Sudan University of Science and Technology
College of Graduate Studies

EFFECTS OF POPULATION GROWTH AND ECONOMIC ACTIVITIES UPON A CITY MORPHOLOGY

With Emphasis on Khartoum Metropolitan City

تأثيرات النموالسكاني والأنشطة الإقتصادية على مورفولوجية المدينة

مع التركيز على مدينة الخرطوم الكبرى

A Thesis Submitted in Fulfilment of the Requirements of the Degree of Doctor of Philosophy in

Urban Planning

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بسم الله الرحمن الرحيم

قال تعالى:

(...نَرْفَعُ دَرَجَاتٍ مَّن نَّشَآءُ وَفَوْقَ كُلِ ذِي عِلْمٍ عَلِيمٌ)

صدق الله العظيم

القرآن الكريم- سورة يوسف -الأية(76)

In the name of Allah, the most Beneficent, the most Merciful

Allah said:

(…We raise to the degrees (of wisdom) those We please: but overall endued with knowledge is one, the All-knowing).

Holly Quran- Yusuf -(76)

ABSTRACT

This research investigates the effects of population growth and economic activities upon a city morphology, and it takes *Khartoum* metropolitan city as a case study. This research is important because it discuss the challenges that face city development in real time. The main objectives of this research are to find out the effects of such factors upon a city morphology at both micro and macro scales of development; and provide strategy for what improves cities' efficiency to convoy the concept of the ideal real time city. This strategy impacts on limited economy cities, focuses on the urban development constraints on them.

The methodology adopted in this research- depending on previous theoretical studies- is producing a theoretical model to study, measure, deduct and compare between cities morphological efficiency. The model is able to be applied on different cities, concerning their unique characteristics and the factors which support or constraint development strategy implication on each one of them.

The results of this research are identification the effects of population growth and economic activities upon the city morphology, and proposing development strategy for that with a fixable frame which can be adopted in different cities and which helps in enhancing or keeping city efficiency to convoy real time circumstances or establishing development in cities from the stage of under development. The research tests its proposed model in the case of *Khartoum* city and suggests special recommendations for its morphological development as in accordance to the pre-identified research problem.

ملخص

هذا البحث يستقصي عن تأثيرات النمو السكاني والأنشطة الإقتصادية على مورفولوجية المدينة، و يتناول مدينة الخرطوم الكُبرى كدراسة حالة. وتتأتى أهمية هذا البحث من إنه يناقش التحديات الأساسية التي تواجه تنمية المُدن في الوقت الحالي. الأهداف الرئيسية للبحث هي إيجاد تأثيرات العوامل السابقة على مورفولوجية المدينة في كلا المستويين المحلي والشمولي للتنمية، وتقديم إستراتيجية لتزيد من كفاءة المُدن لتواكب مفهوم المدينة المثالية في الوقت الحالي. ولذلك هذه الإستراتيجية يجب ان تُسلط الضوء على المُدن المحدودة الإقتصاد، وتركز على محددات التنمية الحضرية بها.

ان المنهجية المُتبعة في البحث - إستناداً على الدراسات النظرية المُسبقة- هي تقديم نموذج نظري للدراسة والقياس والإستنباط والمقارنة بين الكفاءة المورفولوجية للمدن. هذا النموذج قابل للتطبيق على مُدن مُختلفة، ويراعي مظاهر التميز بينها والعوامل التي قد تدعم أو تحد من تطبيق إستراتيجية التنمية بكل منها.

نتائج هذا البحث حددت تأثيرات النمو السكاني والأنشطة الإقتصادية على مورفولوجية المدينة، وإقتراح إستراتيجية تنمية لذلك بإطار مرن قابلة للأخذ في مُدن مختلفة، تساعد على التحسين أوالحفاظ على كفاءة المدن لمواكبة ظروف الوقت الحالي أو البدء في التنمية للمدن منذ مرحلة ماقبل التنمية. البحث قام بتجربة نموذجه المقترح في دراسة لحالة مدينة الخرطوم واقترح توصيات خاصة لتنمية مورفولوجية مدينة الخرطوم وفقاً لمُشكلة البحث المطْروحة.

DEDICATION

This research is dedicated to my parents, grandparents, the extended family, friends, teachers, colleagues, and students.

Alia Taha

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Sincerely: Alia Taha

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LIST OF ABBREVIATIONS

Abbreviation	Definition
Nominated by Research	
(CMM)	City Morphological Model
(LEC)	Limited Economy City
(LER)	Limited Economy Region
Nominated Generally	
(AFU)	African Union
(CBD)	Central Business District
(DFD)	Data Follow Diagram
(FDI)	Foreign Direct Investment
(GDP)	Gross Domestic Product
(GNI)	Gross National Income
(HABITAT)	United Nations Conference on Human Settlements
(HDI)	Human Development Index
(HIV)	Human Immune Virus
(ICT)	Information and Communication Technologies
(IDP)	Internal Displaced Person
(LAS)	League of Arab States
(LDR)	Less Developed Region
(LUT)	Land Uses Transportation
(MDR)	More Developed Region
(MNCs)	Multinational Corporations
(MT-km)	Meters to Kilometres Conversion
(NGOs)	Non-Governmental Organisations
(NICs)	Newly Industrialising Countries
(NIDL)	New International Division of Labour
(ODA)	Overseas Development Aid
(PD (p/hectare))	Population Density (Person per Hectare)
(PPP)	Purchasing Power Parity
(PU)	Pre-Urban Areas
(SSP)	Site-and-Service Programme
(TNCs)	Multinational and Transnational Corporations
(TOC)	Theory of Constraints
(U.S.EPA)	US. Environment Protection Agency
(UGB)	Urban Growth Boundary
(UN)	United Nations
(UNDP)	United Nations Development Programme
(UNEP)	United Nations Environment Programme
(UNHCR)	United Nations High Commissioner for refugees
(UNICEF)	United Nations International Children's Emergency Fund
(UNSC)	United Nations Security Council
(US)	United States of America
(WFP)	`World Food Programme

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Chapter (1):

INTRODUCTION

1.1 Introduction:

Cities are places of civilisation: the characteristics of cities, throughout the world are the outcome of the interaction of many important factors including: the environment, economy and society which operate in urban areas at various levels ranging from the global to the local.

In recent times, city planners turned their attention to the physical aspects of cities; with the objective of understanding all issues related to a city life. The attempt is to produce models that set standards relevant to the people aspiration. Such attempts were faced by numerous difficulties; including: the difficulty to isolate and analyse the objects of city study, coordinate the findings of separate studies, define interrelated aspects related to city study to make city planning 'comprehensive' and control political factors hindering implementation of well laid plans (Cullingwort and Roger - 2005).

The act of city plan preparation must be concerned with all aspects related to issues of performance and appearances; the overriding object must not only be production and profit, nor beautification against ugliness. This is not a sufficient approach in this pragmatic and increasingly 'scientific' age; what is needed is a plan which increases efficiency and consider the different city development situations. (Cullingwort and Roger - 2005).

1.1.1 Importance of City Morphology:

Focusing on city morphology, as functional relations and structural composition within the city gives a clear vision for understanding how a city works, interacts and grows. This expands to a bigger scale/region or compacts to a smaller scale/district within the city. There are two ways for discussing issues of cities, linked together in all levels of the city planning and each of them affects and explains the other. First: city as multi-functional units that consist of different categories of activities, and have to work in many different ways-climatically, economically, socially, aesthetically. The difficulty in such situation is that city changes slowly while functions change rapidly. Second: city

as a spatial system acts as a unit from higher spatial and functional system with a strong sense of local place. The difficulty here is in making unity with the clear distinctions between places (Droege-1997).

1.1.2 Population Growth and Economic Activities:

As population naturally increases and more and more people move to live in cities, urban growth involves changes in the environment, economic, social and political structures of cities. Rapid growth of cities strains their capacity to secure needs of residents and to provide social and basic services. Central and local urban governments are responsible for satisfying their citizen's needs. Cities act as central places in a country and the globe. Development strategies and policies have to focus on urban economic issues, because economic activities generate employment and wealth.

1.2 Problem Statement:

Growth of cities and the continuous change in economic systems induce daily changes on a city morphology, services distribution systems and land use development. This research focuses on the impact of population growth and economic activities as main factors causing morphological changes in order to provide appropriate intervening solutions for city development. Figure (1-1) below outlines the research problem by explaining how city morphology is modified and what causes such modification. *Khartoum,* the capital of *Sudan,* is used as case study; the selection of *Khartoum* is for its position as a primer city that faces a high rate of population growth combined with economic difficulties.

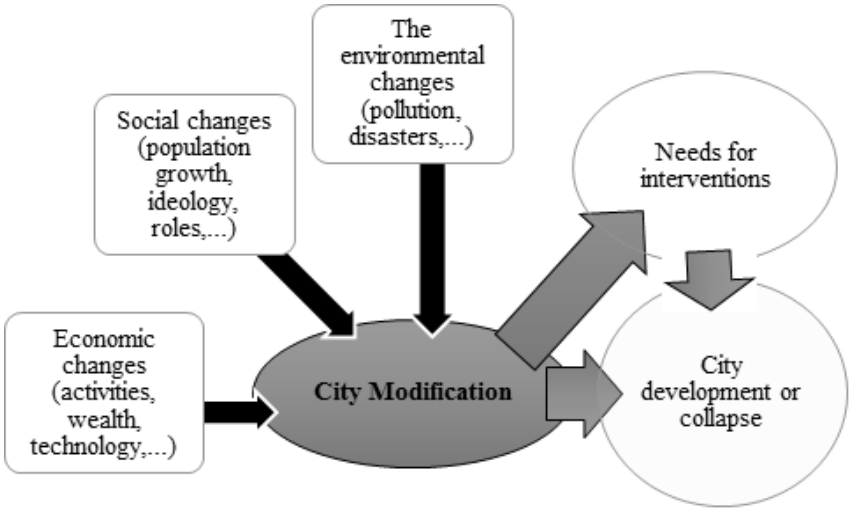


Figure (1-1): City Life Cycle. (Researcher/ Alia- 2018)

1.2.1 Research Objectives:

This study aims to explore the effects of population growth and economic activities upon a city morphology. This is concerned with the city in different development situations, and introduces a utopian form for the real time city to measure a city efficiency. According to that the study aims also to produce a development strategy for city morphology. Last, to support understanding and to reassert research's findings, a case study is made about *Khartoum* city.

1.2.2 Research Questions:

The key questions of the study are:

1. How do population growth and economic activities make changes in city morphology?
2. What is the effect of such morphological changes on a city efficiency?
3. And, what are the factors that contribute to, and maintain, a city efficiency?

1.2.3 Research Value and Expected Outcomes:

The research is very useful in:

1. Developing a model for studying the real time city morphology, as an approach to design a new city or redeveloping an existing city;
2. Explaining the effects of population growth and economic activities, within the city morphology for the formulation of any development policies;
3. Explaining the role of urban morphological development and its interventions in comprehensive planning;
4. Projecting factors that linking between a city economic strategy and the city growth strategy;
5. Providing useful tools for discussing local and global urban morphological systems and forces;
6. Building a model for a limited economy city morphology; as an approach to designing development programmes for it;
7. Helping in formulating future strategy for *Khartoum*.

1.2.4 Hypothesis:

In this study, the following hypothesis have been made: City morphology affects city efficiency, so a city development should focus on city morphology and solve mainly problems related to population growth and economic activities, because they are the main factors that create dynamic morphological modification.

1.2.5 Variables:

In this research city morphological development is taken as the dependent variable while population growth and economic activities are taken as independent variables. This enables comparing the changeable impacts of population growth and economic activities on city morphology. Also this enables the generalization of research findings for all cities with emphasis on cities with limited economy.

1.3 Research Scope and Limitation:

- **Place of research:** Towns and cities are commonly named as urban areas. Urban areas are where farming is a marginal activity while industry and service activities are the major contributors to the economy. There are principal criteria, employed worldwide, to identify urban places. These include: population size[1] (more than 500.000), economic base (availability of industries, and high hierarchical services), administrative criteria (local governing authorities) and functional definitions (related to region and state strategy). In addition to that every town and city has its own character, related to cognitive or subjective factors. This research focuses on city impacts issues related to population growth and economic activities.
- **What are the main sources of a city knowledge?** City, as a topic combines different sources of knowledge; architecture, urban design, urban planning, regional planning, spatial planning, national planning as well as the other related professions that contribute to city modelling (economy, technology, demography, politics, sociology, culture, environment, geography, ecology, philosophy, etc.). This research takes city morphology as a main focus, so city planning is the basis of

[1]Pacione\2009 (P: 19)\ Small city: more than 50.000 pop. Normal city: more than500.000. Big city: more than 1 million. Huge city: more than 5 million.

research theories, besides urban geography (globalised scale), regional planning (comprehensive scale) and urban design (detailed scale), which are fundamental to complete the vision.

- **What are the relevant city theories?**

1. There are materialistic and un-materialistic components of cities. This research concentrates on the city morphology and the related socio-economic interactions. This is mainly materialistic components of a city.
2. Multi-functionality of cities; the research concentrates on cities which are multi-functional and act as primary urban area;
3. The partial/whole problem of city scale; the research is studying the city in a shape of functional model considering inner and outer-city interactions at urban and regional considerations;
4. Location differences in humans experiences and identities; the research activates focus on the globalisation concept of city settling system, which is affected by the modern life of the post-industrial cities;
5. Complexity in city economy system; the research focuses on physical economic factors related to city morphology, defines economic activities and discusses the other economic elements in relation to them.
6. Cities as product of time not a momentous plan with daily development in their inner entrepreneur methods; so the research introduces an abstractly morphological model for the contemporary ecology of a real time city with futuristic view.

- **Generalization of study:** Cities exhibit common problems to varying degrees, including inadequate housing, infrastructure or public services, economic decline, poverty, ill health, social polarization, traffic congestion, noise and environmental pollution, etc. Many characteristics and concerns are shared by urban places. All cities contain areas of residential space, transportation lines, infrastructure, economic activities, commercial areas and public buildings (Pacione- 2009) to differentiate between cities, the concept of measuring variables of cities is in relation to the effects of the above aspects must be explained.[2]

[2] For Wirth, a member of the Chicago school of human ecology; urban quality depends on level of economic and social disorganisation.

1.4 Methodology:

1.4.1 Research Methods:

1.4.1.1 Research components:

The research design is of three components:

1) Literature search and evaluation: relevant literature to the research matters (city morphology, city efficiency and city development) and variables (city population growth, city economic activities and city morphological development), documented data from hard and soft references, seminars, interviews and discussions with experts are analysed and evaluated. The outcome of this: achieves defining literature background, mapping research, determining and defining research outlines and problems and putting together general information about the study.
2) Model design: a model is designed to simulate study hypothesis, formulate internal relations between its variables, and conclude the impact of each variable in this form of relations. The model is supported by illustrations tables and diagrams. The outcome of this stage provide an expected answers to the posed research questions, outlines development constraints and provide the proposed frame for development strategy.
3) Model testing: the case study provides an opportunity to apply and test the research findings including the model, and to generate quantitative data needed to answer research questions and realize research goals.

1.4.1.2 Research analysis:

To study how the two variables identified by this research (population growth and economic activities) affect the morphology of the city, depending on the information of the theoretical background, the study analysis starts with building a model of a city morphology and explaining the internal relations within it. This model is regarded as a base for all analysis made by this study. Hence, all observations and outcomes are generated by this model to establish a general understanding of the complex issues. The model is designed to project changes in city morphology that are intervened by continual transition of human civilisation.

This model is taken as a ruler to evaluate city efficiency and to discuss the effects of population growth and economic activities upon a city morphology. It is also used to make hypothetical utopian assumptions characterising real time city to judge its efficiency and create standards to measure its quality. The model considers population growth and economic activities as independent variables and city morphological development as a dependent variable. The model explains the differentiation of the limited economy city as an early stage or the starting point for a development process of cities. The model formulates a comprehensive development strategy for the city morphology, and considers urban development constraints in limited economy city as well as the characteristics of a real time city.

For more accuracy, and to emphasise the possibility of applying this study on different cities, *Khartoum* city is taken as a case study, using the produced morphological model to define the effect of population growth and economic activities on it. The Model also measures *Khartoum* efficiency, evaluates its morphological diagram and proposes a strategy frame for its development that considers its development situations.

1.4.2. Data Processing:

The research uses both qualitative and quantitative data. The base of study is qualitative data, but the quantitative data analysis is used in the case study stage. This study has several objectives: to describe effects of population growth and economic activities within the city morphology as a phenomenon, to identify the conditions on which such effects are based and to develop a model and strategy frame for this phenomenon from the analysis of empirical material.

As a basic methodology the research uses qualitative data analysis to make structures of meaning-making in the material and what is represented in it. That is represented in a narrative format, collected through references, focus groups, interviews, and opened ended questionnaire. Quantitative research techniques described and explored data by tables, drawing graphs and charts, doing cross tabulations and calculating means and standard deviations. The process of measurement is central to this research because it provides the fundamental connection between qualitative observations and mathematical expression of quantitative relationships.

- The steps of using qualitative data analysis in this research include:

  1. Gathering needed data for study from references;
  2. Documentation of the data and the process of data collection and organisation/categorisation of the data into concepts;
  3. Comparing data to explain how one concept may affect another, with corroboration/legitimisation, by evaluating alternative explanations, disconfirming evidence and searching for negative cases;
  4. Reporting the findings; and
  5. Feedback, to develop concept.

- The steps of using quantitative data analysis in this research, include:

  1. Define in quantity the variables, hypotheses and assumptions formulating the study and identifying relevance data to understand each;
  2. Define the units of measuring;
  3. Determine suitable measuring methodology, including: nominal, ordinal, quantitative values, interval\ratio, frequency tables, measures of central tendencies, measures of variability and association and correlation;
  4. Determine the shape and use of statistics; and
  5. Feedback, to develop variables and hypotheses.

- The procedures adopted to ensuring the correction of analytical process in this research, include:

  1. Describing the methods of data analysis relevant to research structure;
  2. Justifying the appropriateness of the used methodology to deal with the study context;
  3. Documenting the process of generating themes, concepts and theories ;
  4. Defining external evidences to all relevant topics, to test the appropriation of conclusions. (Lacey A. and Luff D. 2007)

1.4.3 Research Organisation:

The research contains nine chapters, starting with chapter (1), an introduction, and the final chapter (9): summary, conclusions and recommendations. The other seven chapters discuss the research study in two parts: Part (1): literature review, to find theoretical base to discuss research problems, which includes three chapters: chapter (2): city morphology. This chapter starts by defining city morphology and how to evaluate it. Chapter (3): city modifiers: population growth and economic activities, discusses the independent variables of the research and their influences on city morphology. Chapter (4): morphological development and city modifiers, it explains the city development process and its relation to city modifiers, and it also includes a global perspective for urban development with emphasis on limited economy cities.

Part (2): study analysis and discussion, falls in four chapters: chapter (5): City Morphological Model (CMM), introducing a conceptual morphological city model for researching. Chapter (6): is about the effects of population growth and economic activities upon the (CMM), modulates and diagrams the utopian city model and links the definition of limited economy to it, then studies and defines the effects of population growth and economic activities within the (CMM). Chapter (7): introduces the proposed strategy frame for city morphological development, focusing on the effects of population growth and economic activities that considers urban development constraints in limited economy cities and the characteristics of the real time city. Chapter (8): application of the study on *Khartoum* metropolitan city, starts by modulating *Khartoum* (CMM), judging *Khartoum* efficiency in relation to population growth and economic activities, then proposes a strategy for *Khartoum* morphological development based on its development constraints. Table (1-1) explains researching process internal relations and feedbacks.

Table (1-1): Research information sequences. (Researcher/ Alia- 2018)						
Chapters		**Description**	**Methodology**	**Assumptions**	**Problem statement**	**Outputs**
(1)INTRODUCTION		Research topic, problems, scope, limitation, methodology and organisation.	As stated	To be stated	What is the research problem?	**(1) Study Outlines**
LITERATURE REVIEW	(2) CITY MORPHOLOGY	Defines city morphology and how to modulate it.	Description and comparison.	Provide definitions, guides and measurements	How to explain, modulate and judge city morphology?	**(2) Study Basis**
	(3) CITY MODIFIERS\ POPULATION GROWTH and ECONOMIC ACTIVITIES	Discusses independent variables of the research: population growth and economic activities.			Do city modifiers affect its morphology?	
	(4)MORPHOLOGICAL DEVELOPMENT AND CITY MODIFIERS	Explains the relation between city variables and describes the case of limited economy cities.			What are the relations between city modifiers and its morphological development?	
STUDY ANALYSIS AND DISCUSSION	(5) GENERATING A CITY MORPHOLOGICAL MODEL (CMM)	Introduces a conceptual morphological model.	Analytical deduction.	Design model	How to modulate city morphology, and what is the model efficient performance?	**(3) Study Form**
	(6) EFFECTS OF POPULATION GROWTH AND ECONOMIC ACTIVITIES UPON THE (CMM)	Modulates the utopian form of real time city and the case of limited economy city to define the effects of population growth and economic activities.	Analytical deduction.	Deduce directions	What are the effects of population growth and economic activities upon the city morphology? And how to deal with differences between cities?	**(4) Study Results**
	(7) STRATEGY FRAME FOR CITY MORPHOLOGICAL DEVELOPMENT	Introduces a proposed strategy frame for city morphological development.	Analytical deduction.	Formulate strategies	How to make a morphological development strategy able to generalise and concerns effects of population growth and economic activities?	
	(8) APPLICATION OF THE STUDY ON *KHARTOUM* METROPOLITAN CITY	By using the research morphological model, define the effect of growth and economic activities within *Khartoum* and proposes recommendations.	Testing the assumptions using *Khartoum*	Testing	Is this study applicable? And is it useful?	**(6) Study Testing**
(9) SUMMARY, CONCLUSIONS AND RECOMMENDATIONS		Discuses research outlines and outputs, and introduces recommendations.	----------	Results and conclusions	What are the research findings? What are its feasibility and further possibilities?	**(7) Conclusion**

Chapter (2):

CITY MORPHOLOGY

2.1 Introduction to City Morphology:

A city morphology is the pattern of the development of its component parts that shows the spatial relations and process of its transition. Morphological analysis of settlements allows comparison between different stages of a city development as well as between their efficiency and physical forms, of different cities. There are different concepts and schools of thoughts, regard morphological aspects of cities include:

2.1.1 British School: this based on the work of M.R.G. Conzen in 1899s, who defined the pattern of building forms and pattern of land, population, and environment as key components of morphological development. This divided into three elements: streets system; blocks; and buildings, in the form of block-plans.

2.1.2 Chicago School: this based on the work of Burgess in 1920s who established a concentric-zonal theory which divided city morphology into several zones/areas that included a central business district, transition area and upper class apartment's area and several commuter zones and suburbs on the edge of the city.

2.1.3 Italian School: this based on the work of Saverio Muratori and Gianfranco Caniggia's in 1940s, who provided historical and political-economic forces as the basis for the integration of urban morphology and they shape built landscape conditioned by a particular logic, set of elements and characteristic processes.

2.1.4 French School: this based on the works of Versailles School of Architecture in 1970s, which is generated by the relationships between the built landscape and the social context. That is in shape of analysis of the urbanisation processes and related architectural models.

2.1.5 Morphogenetic School: this based on the work of Christopher Alexander and Nikos Salingaros in 2002s, who studied urban morphology based on morphogenesis and emergence. Alexander proposed that urban development is a computational process similar to cell growth in an organism. (Wikipedia-2010)

2.2 Ecological Models of City Morphology:

2.2.1 City Basic Components:

In general, any city, whatever its characteristics, could be described as physical form that contains five components/zones: city centre, inner-city, outer-city, suburbs and countryside. Each zone has its especial characteristics as an area of densities related to a city position, as illustrated in Figure (2-1). This diagram is very helpful to dissect a city physical form into its various parts and to examine each part separately. It is also a way to understand how a city works and to plan toward its improvement.

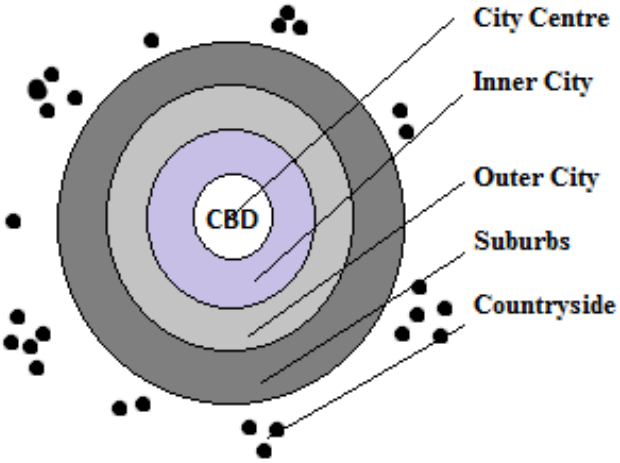


Figure (2-1): City Diagram - (Simonds and Starke-2006- \ (P: 302))

2.2.2 City Ecological Morphological Models:

Those models describe city components and the changes that took place through time. They are linked and complemented to each other. They are also very useful in understanding city form, morphology and future growth. Besides that, they also help in developing cities or designing new ones.

2.2.2.1 Concentric model:

Burgess (1925) derived his general concentric zone model of residential differentiation. The model classified a city into zones starting from the centre towards outside, these zones are: Zone (1), is the central business district (CBD). Zone (2), transition zone, which is adjacent to the CBD. Zone (3), the zone of independent labours' homes. Zone (4), a zone of private housing or good apartment blocks. Zone (5), suburban characterised by single-family dwellings. Zone (6), the surrounding agricultural district. And zone (7), the hinterland of the city. (Pacione- 2009\ (P: 140)).

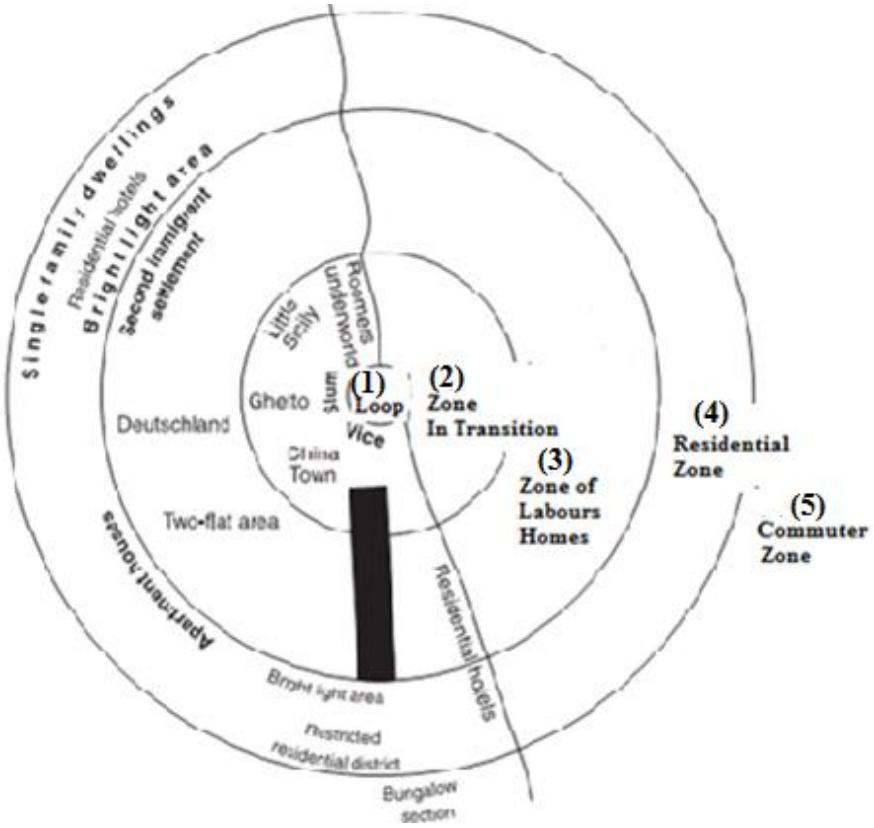


Figure (2-2): Burgess's concentric zone model of urban land uses, applied to Chicago \(Pacione- 2009\ (P: 140))

2.2.2.2 Sector model:

Hoyt in 1939, provided a model that came after constructive criticism of the concentric model. The model is based on the assumption that a mix of land uses develops around the city centre and the city expands in shape of sectors. (Pacione- 2009\ (P: 142))

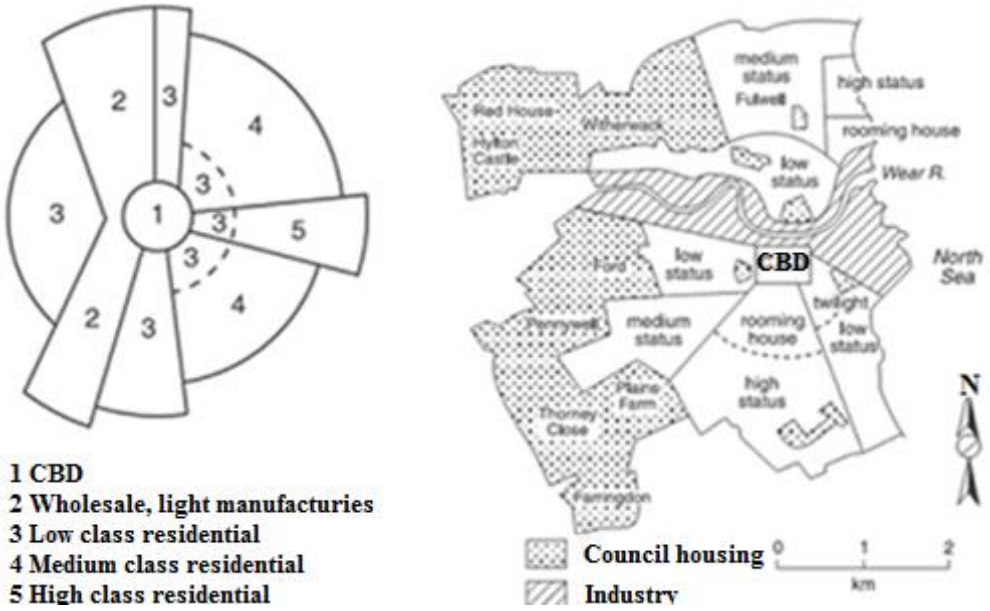


Figure (2-3): Sector model of urban land uses, applications in Sunderland, produced by Hoyt in 1939 \(Pacione- 2009\ (P: 142))

2.2.2.3 Multiple nuclei model:

The excessive simplicity that characterised both concentric ring and sector models of the city was addressed by Harris and Ullman in 1945. They observed that most large cities do not grow around a single CBD but are formed by the progressive integration of a number of separate nuclei. The location and growth of these multiple nuclei are determined by a number of factors. Certain activities require specialised facilities and congregate where these are available. Industry, for example, requires transport facilities and is often located close to railway lines, major roads or port facilities. Similar activities are grouped together to profit from external economies of association, repel each other owing to negative externality effects or benefit from a central location in or near the CBD without demand of high rents and need for large structures. (Pacione- 2009\ (P: 143))

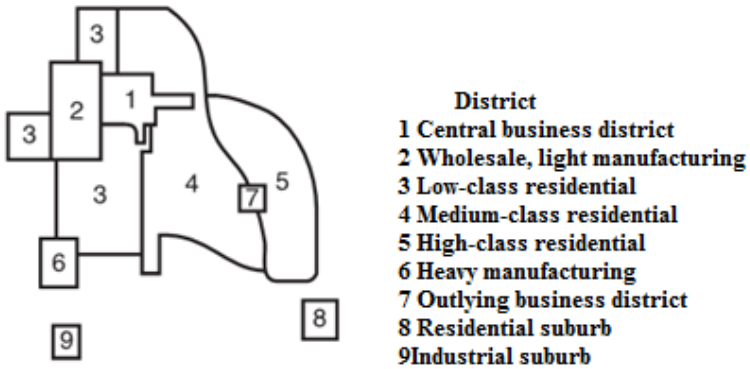


Figure (2-4): Multiple nuclei model of urban land uses, produced by Harris and Ullman in 1945 \ (Pacione- 2009\ (P: 143))

2.2.3 Modification of Urban Models:

The most severe criticisms of the previous models of urban land uses is referred to their economic bias and consequent neglect of social and cultural influences on urban land-use patterns. Since the publication of the previous defined models many new forces have come to influence urban growth, which reflect societal forces including: deindustrialisation of the urban economy, the emergence of a service economy, the domination of the automobile, a decrease in family size, suburban residential developments, decentralisation of business and industry and increased intervention by government in the process of urban growth. Other works on ecological patterns in cities, attempted to reform the previous models to provide concepts of more direct relevance to contemporary urban society; these are:

2.2.3.1 Mann's model of classical British towns:

One of the limitations of the basic ecological models was their focus on the US cities. The mainspring of the concentric-zone model of urban land uses is the expansion of the inner zone outwards. This movement is triggered by excessive demand for central city land. The neoclassical economics 'trade-off' model employs the concept of bid-rent curves to explain the variation in the demand for land and therefore, land-use patterns, across urban areas. The basis of the model is the relationship between accessibility and land rent. The more accessible location is with the greater demand, which is reflected in the distribution of land values, figure (2-12). (Pacione- 2009\ (P: 144))

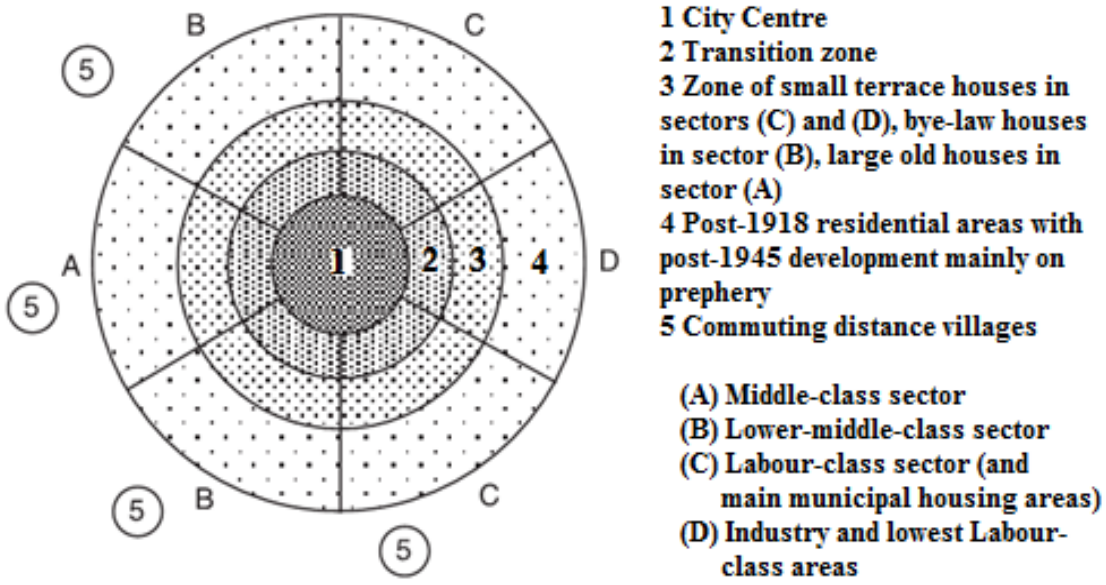


Figure (2-5): Model of classical British town, produced by Mann \(Pacione- 2009\ (P: 145))

2.2.3.2 Kearsley's modification of Burgess model:

Kearsley's model was an attempt to develop Mann's model of urban morphology taking into account contemporary dimensions of urbanisation such as the level of government involvement in urban development in Britain, slum clearance, sub-urbanisation, decentralisation of economic activities, subculture, gentrification and ghettoisation[3]. The proposed model was a result of manipulation of the model's various elements – such as the extension of inner-city blight, minimisation of local and central government housing and expansion of low-density suburbs. (Pacione- 2009\ (P: 145))

[3] A part of a city in which members of a minority group live.

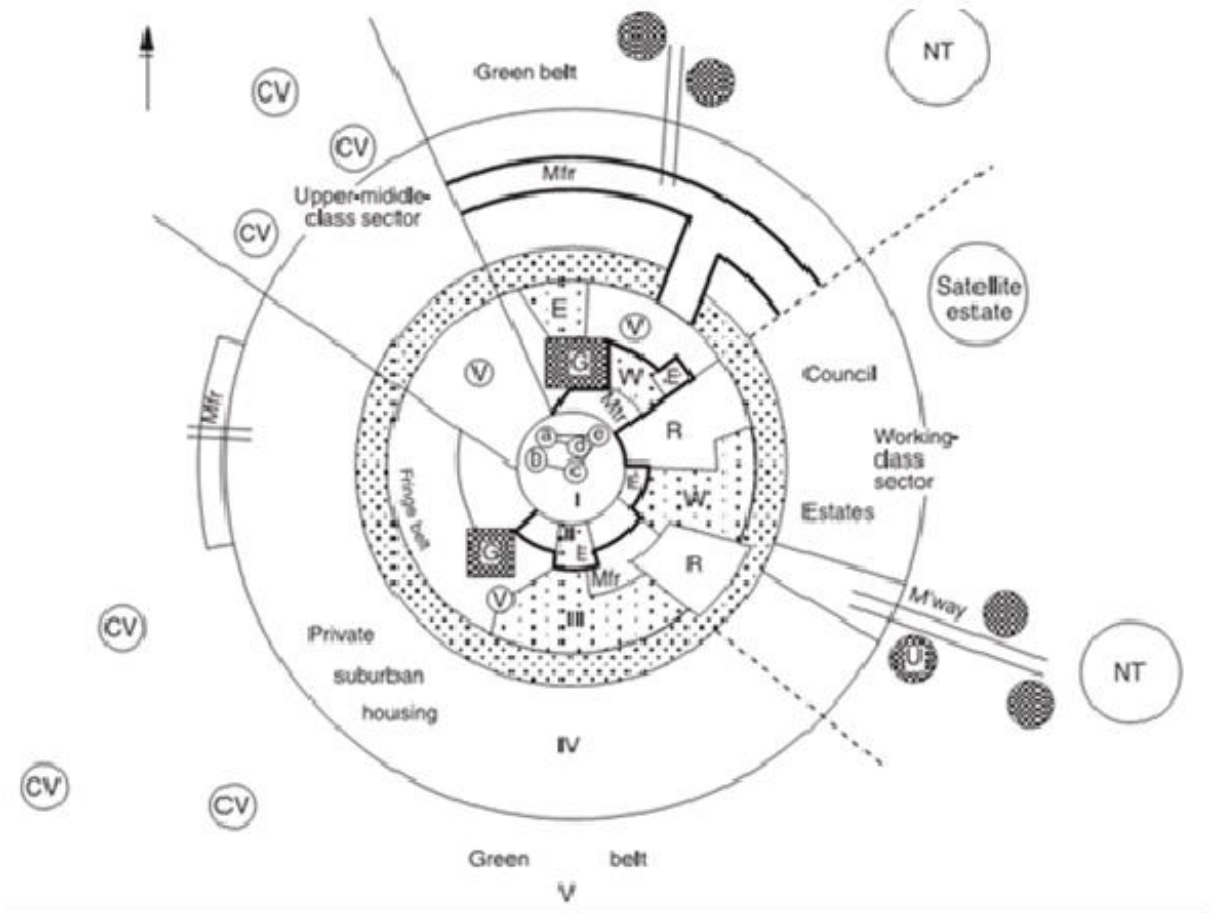


Figure (2-6): Kearsley's modified Burgess Model of urban land uses \(Pacione- 2009\ (P: 146))

2.2.3.3 Vance's urban realms model:

By extending the principles of the multiple-nuclei model, Vance (1964) proposed the urban realms model. The key element of this model is the emergence of large self-sufficient urban areas each focused on a downtown independent of the traditional downtown and central city. The internal structure of each 'urban realm' is shaped by five criteria: The terrain, especially topographical and water barriers, the overall size of the metropolis, the amount of economic activity within each realm, the internal accessibility of each realm in relation to its dominant economic core and inter-accessibility among suburban realms. (Pacione- 2009\ (P: 147)).

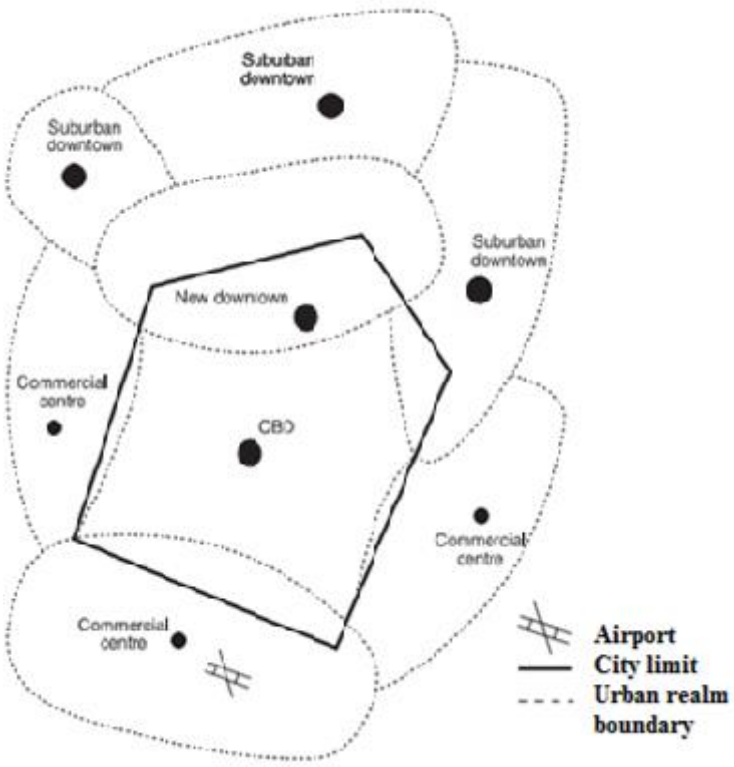


Figure (2-7): Urban realms model, produced by Vance/ (Pacione- 2009/ (P: 147))

2.2.3.4 White's model for the twenty-the first- century city:

White (1987) proposed a revision of Burgess Model that incorporates new contemporary changes, for the twenty-first-century city: These are:

The first: core, the CBD, includes a few large department stores establishments of downtown, but most retailing has moved to the suburbs. The second: zone of stagnation, the CBD expands vertically. Lack of investment in the zone was compounded by the effects of slum clearance, highway construction and the relocation of warehouses and transport activities to suburban areas. The third: pockets of poverty and minorities, these slum areas are found mostly in the inner-city skirting the zone of stagnation, but a few are also located in older suburbs. The fourth: elite enclaves, most live in neighbourhoods on the urban periphery in expensive houses on spacious lots. 'Gilded' neighbourhoods also remain in the central areas of older large metropolises. The fifth: The diffused middle class, nucleation of other social groups are also present, with working-class families living in more modest neighbourhoods, the elderly in garden apartments and retirement communities, singles in apartment complexes and ethnic minorities in their own enclaves. The sixth: industrial anchors and public sector control, industrial parks, universities, residential centres, hospitals, business and office

centres, corporate headquarters and other large institutional property holders. Institutional actors and other members of a local growth coalition pressure city government to modify zoning, lower taxes and construct infrastructure. The seventh: epicentres and corridors, a distinguishing feature of the evolving twenty-first-century metropolis is the emergence of peripheral epicentres located at the convergence of an outer beltway and axial superhighway and providing a range of services to rival those of the CBD. Corridor developments also act as a focus for intensive economic activity. (Pacione- 2009\ (P: 147)).

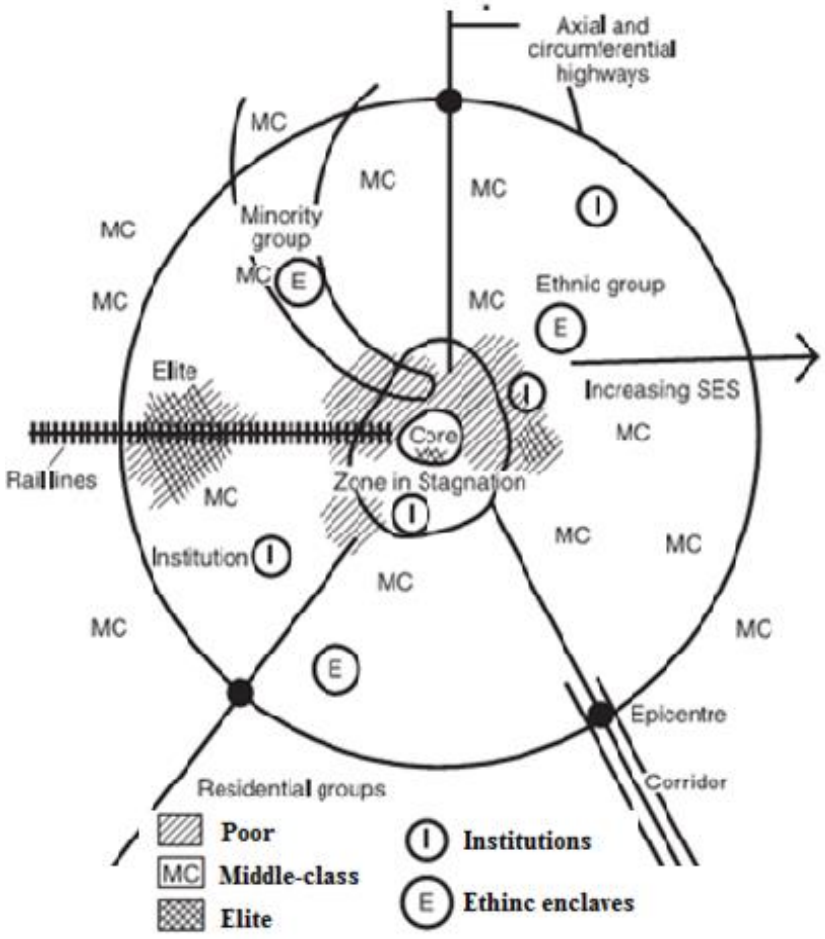


Figure (2-8): The twenty- first- century city model, produced by White \ (Pacinoe- 2009\ (P: 147))

2.2.4 Importance of Urban Models:

- From the previous study of the city ecological models, it is observed that these models are helpful in:
  - Understanding city activities, their land uses and locations related to others and their possibilities of growth and expansion. Also the dependency, interaction and effect relations between them.

- Emphasising the importance of the CBD and working areas, as central places in the city morphology and its relation to other land uses. Its growth relates to the economic transitions change the city composition.
- Emphasising the role of population growth in the arrangement of the city land uses and morphological relations.
- Explaining the role of social and cultural activities in city networks.
- Discussing factors (population growth, industries, automobile... etc.) that affect location and selections of land uses arrangements.
- Discussing issues related to land values and defining ways to predict land estimation (bid-rent) and to guess the needed area for each activity.
- Explaining the travel generations and describing their trips through city.
- Comparing the generated travels, population income, classes and associating their affordable or preference choices in the land rent and location selection.
- Helping in defining the problems or obstacles of city development and preparation of development decisions.
- In spite of the fact that these models were designed for the Western cities, they are taken as general morphological concepts related to the domination of the modern Western civilisation all over the world.

- Modulating city morphology is:
  - Useful in explaining city transition processes;
  - Useful in providing a base for diagrammatically formulating a city concept;
  - Useful as a guide to help in data collection and analysis at starting point of when preparing city diagram;
  - Helpful in establishing criteria for judging changes or interventions in previous city plan;
  - Helpful in linking and concatenating any city component with city transition processing;
  - Helpful in guiding city development policies and procedures;
  - Helpful in creating a method of transition from macro-scale (regional planning) to the micro-scale (urban design) and vice-versa and including actions and sub actions related to that; and,
  - Helpful in projecting city future needs and perspectives.

2.3 Evaluation Factors of City Morphology:

To study and evaluate a city morphology, there are nine factors that are used. These factors are linked together and act as stages in analysing city composition, as causes in making city morphology: land uses and resources levelling, as consequences in making city morphology: detailed zoning, transportation and infrastructure pattern and land values, and as feedback in making city morphology: micro-morphology and micro-spatial growth, macro-morphology and macro-spatial growth. See figure (2-9)

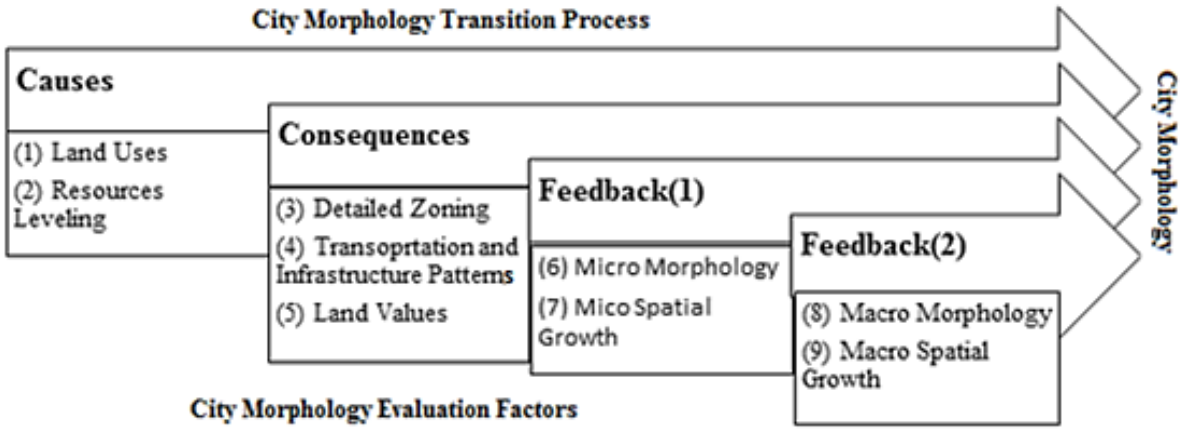


Figure (2-9): City morphology evaluation factors. (Researcher/ Alia- 2018)

2.3.1 Land Uses:

Land uses is an organising process, by which area, and location of certain activities/ land uses are determined and also define the criteria of segregating incompatible uses. In practice, it is used extensively by planners in preparing physical development plans as well as modification of existing ones. The land uses plan is used to prevent new development from interfering with existing situations and to preserve the "character" of a community. Any city is zoned according to activities as functional land uses; this generates the need to travel from one zone to another, as well as socio-economic stratification and avoiding negative environmental impacts. (Wikipedia-2010)

2.3.2 Resources Levelling:

This is about the decisions related to the distribution of available resources - including land- between different uses. It contains portions limits, scheduling and priority ranking in conjunction with short and long period planning. Good decisions mean efficient use of resources, rational uses, with the most benefits. (Wikipedia-2010)

2.3.3 Detailed Zoning:

Urban spatial structure is a developed zoning diagram that specify land uses allocation, connectivity networks and definite shapes and adequate areas for districts. It defines: regulations that guided allocation of lands for activities in definite purposes, the densities at which those activities are performed, heights of buildings, position of a building on the lot (setbacks) and the suitable relation between built up and open spaces, impervious surface, traffic lanes and parking that must be provided.

2.3.4 Transportation and Infrastructure Patterns:

Transportation and infrastructure are the basic physical and organisational structures needed for the operations of society and enterprise. They are the services and facilities necessary for an economy to function. They are important factors for judging a country or region's development. Transportation and infrastructure act as skeleton and tissue of the city, variation in the distribution of land, population, and environment according to zones functions, such as: commercial, industry, housing or mixed. And also according to the land class or land value (Wikipedia-2010).

A city tissue classifies to:

(1) Transportation: roads and streets network. See figure (2-10)

(2) The network of essential services (hard infrastructure) are distributed through the street networks, beginning with the city entrances and ending in its heart “CBD”. This covers supply of: energy, communication, clean water and disposal of rainwater, liquids and solid waste.

(3) The network of public services (soft infrastructure) distribution within the city pattern in hierarchical form related to service diameter which distributes services as national, regional, local, or just for a definite district. That begins from the “CBD” the main city service centre and create other sub services centres for agglomeration benefits and accessibility. The location and area of these centres related to their inner functions and their users socio-economic characteristics, this covers: health, education, government, and all other public services. Figure (2-11): shows the German geographer Walter Christaller’s "Central Place Theory", which is used as a method of organising the distribution of the public services within city in the urban and regional scale. (Pacione - 2009\(P:127))

Figure (2-10): Streets network in the city/ (Abass-2011/ (P: 236))

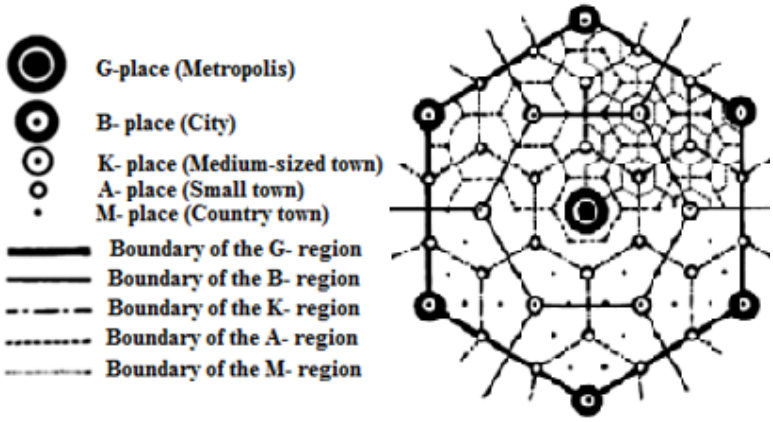


Figure (2-11): Central Place Theory, produced by Christallers in 1933\ (Pacione- 2009\ (P: 127))

2.3.5 Land Values:

Evaluation of land value is based on the radius of service proximity of certain land from inner core of city, further land is the cheapest. Inner-city areas are very densely populated and well served, whilst the suburbs and rural areas are sparsely populated. Other factors are related to people preference and their quality of life. See figure (2-12). (Pacione- 2009\ (P: 144))

2.3.6 Micro-Morphology:

The city micro-morphology is the result of dealing with two factors: the first; city tissue: transportation and infrastructure pattern; and the second; city cells/components: as organisational zones (like: districts, neighbourhoods, cluster, family home…see figure (2-13) and as functional zones (like: open spaces, commercial, industrial,

residential…see figure (2-14). Three major demands are made on the city and its districts which need to be reflected in the micro-structure of the city: accessibility, proximity and functional mix. (Frey -2005\ (P: 56))

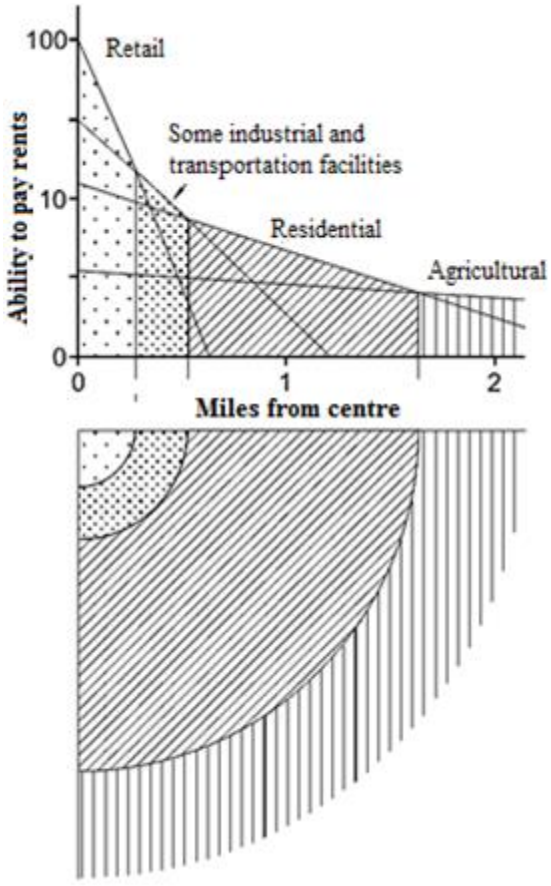


Figure (2-12): The trade-off model of urban land uses\ (Pacione- 2009\ (P: 144))

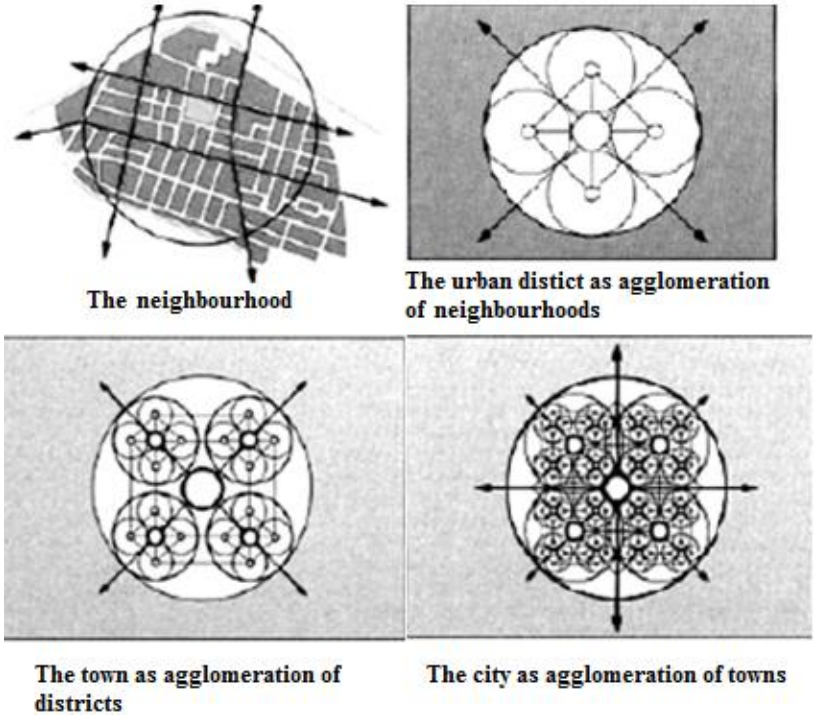


Figure (2-13): The city micro-morphology\ (Frey -2005\P:68)

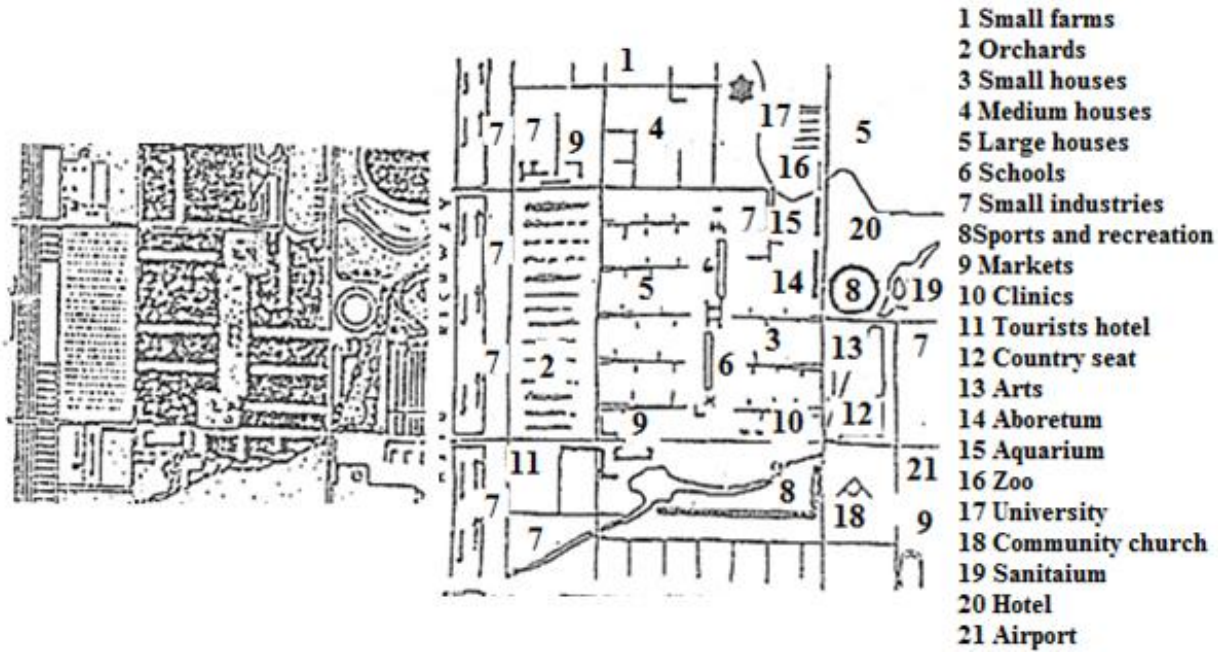


Figure (2-14): Broadacres City, produced by Frank Lioyed Right\ (Abass-2011\ (P: 119))

2.3.7 Micro- Spatial Growth:

City growth is a dynamic process. Figure (2-15), explains the stages of the city dynamic growth related to its centre. Most cities grow outward from a central point. Certain areas of a city are more attractive for various activities, whether by economic opportunity or due to geographical and environmental reasons. As the city grows, these activities flourish and expand outward from the city centre along railroads, highways and other transportation arteries. Residential districts grow by adding new housing units. The districts of low-income housing bordering manufacturing/ industrial areas while districts of middle- and high-income households were located furthest away from these areas. Physical features restrict or direct spatial growth along certain expanding axis; and the growth of a district may affects other districts and change land uses plan. That also may shape by random leapfrog land uses.

Figure (2-15): Stages of the city dynamic growth related to its centre, produced by Doxiadis\ \ (Abass-2011\ (P: 125))

2.3.8 Macro-Morphology:

Macrostructure; is the city and its neighbouring areas, including the system of its total expansion, city with its relations with other urban centres in the region and the country, influencing of the micro environment of urban areas, access to surrounding open spaces and countryside and the potential for a symbiotic relationship between city and surrounding rural areas. (Frey- 2005\ (P: 70)). Figure (2-16), explains city and its shapes of organisation relations with other urban centres.

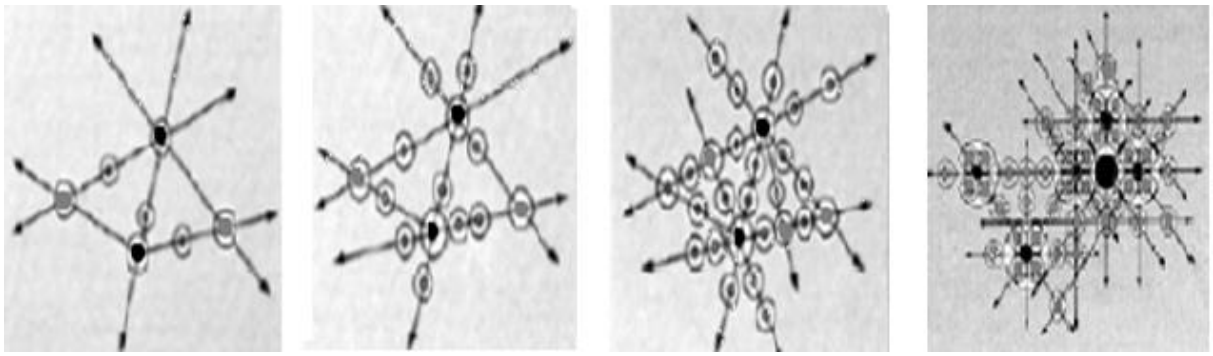


Figure (2-16): City macro-morphology with transport grid, primary and secondary centres\ (Frey- 2005\ (P: 111-112))

2.3.9 City Macro-Spatial Growth:

The world is distributed into countries, countries are distributed in to regions, and regions are separated into urban and rural lands, with multi urban centres. Some central places are in favourable locations and offer more specialised services. These centres tend to grow progressively larger. Such differential spatial growth produces various grades of central places characterised by different population sizes and zones of influence.

To control the expansion of the city lands in surrounding area, the urban growth boundary (UGB) is one form of land-use regulations. The land inside the boundary supports urban development and areas outside the boundary are determined to remain non-urban. It is: exclusively agricultural zoning; nonexclusive agricultural zoning; green belt; and annexation. Urban growth boundary (UGB) defines the limit of urban development and its separation from rural land. City growth extends outside of that boundary, in the lands allocate for that purposes. The existence of urban growth boundary creates as a clear differentiation between land value and development between urban and rural–urban interface areas.

2.4 Using Urban Models to Discuss City Morphology:

According to Giudici in 2002, Models are simplified representation of physical systems, they are the tools to simulate behaviours, setting prediction for future evolution, study dynamics and they give hints for data collection and design of experiments. (Bhatta-2010\ (P: 107)). The main objectives of a model are: to integrate observed information and theories concerning a system, to facilitate understanding system behaviour; to predict the response of a system on future changes; and to allocate certain resources to optimise certain conditions within the system. (Bhatta-2010\ (P: 107))

Urban models are scripted or drafted representations of functions and processes which generate urban spatial structure regarding land-use spatial location and interactions between land-uses and related systems of activities. Usually embodied in computer programmes or a diagram that enables theories to be tested against data and generated predictions of future patterns (Bhatta-2010\ (P: 108)). They also help testing the consequences of planning policies on the future form of cities.

2.4.1 Types of Models:

Urban models are classified as follows:

2.4.2.1 Theoretical models: They attempt to generate theories about urban processes. These models are used to test and establish studies about theoretical hypotheses. They often explain processes in just a one city and only during a certain period of time. (Bhatta-2010\ (P: 109))

2.4.2.2 Aggregate-level urban dynamics models: defined by Batty in 2009: They are representations of changes in urban spatial structure through time which embody a myriad of processes working in cities on different but often interlocking, time scales, and are reflected in city spatial interactions. (Bhatta-2010\ (P: 110))

2.4.2.3 Complexity science-based models: defined by Gilbert et al. in 1996: These models are new, they study how relationships between parts give rise to the collective behaviours of a system and how the system interacts and forms relationships with its environment. These are used to address the complex problems in city planning, that is intangible economic, social and environmental factors. (Bhatta-2010/ (P: 110)). This type of model helps achieving the research hypothesis and process.

2.4.2 Values of Using a Morphological Model:

According to Carmona et al in 2003, the values attained from using models in planning is to compare between cities morphologies and to achieve the followings:

1. Provides a method to monitor and evaluate the transformation of planning process within a city.
2. Provides planners with a mechanism for problem solving and investigation.
3. Enables planners to study, understand and apply diverse sets of multidisciplinary knowledge.
4. Directs planning interventions taking place at different levels of city development frame work.
5. Provides a tool that helps in formulating city policies.

2.4.3 Method of Making a Morphological Model:

Figure (2-17): is formation of a simplified conceptual schema of the process of a model, depending on a work of Giudici in 2002. This is the criteria to build, utilise and evaluate the study proposed model. The process includes the following steps: (1) defining goals of the model; (2) projecting phenomenological laws controlling the model; (3) developing structure of the model; (4) determining and explaining data and information related to the model; (5) defining model calibration and intervening factors; (6) exercising model validation; and last, (7) adapting the model in planning.

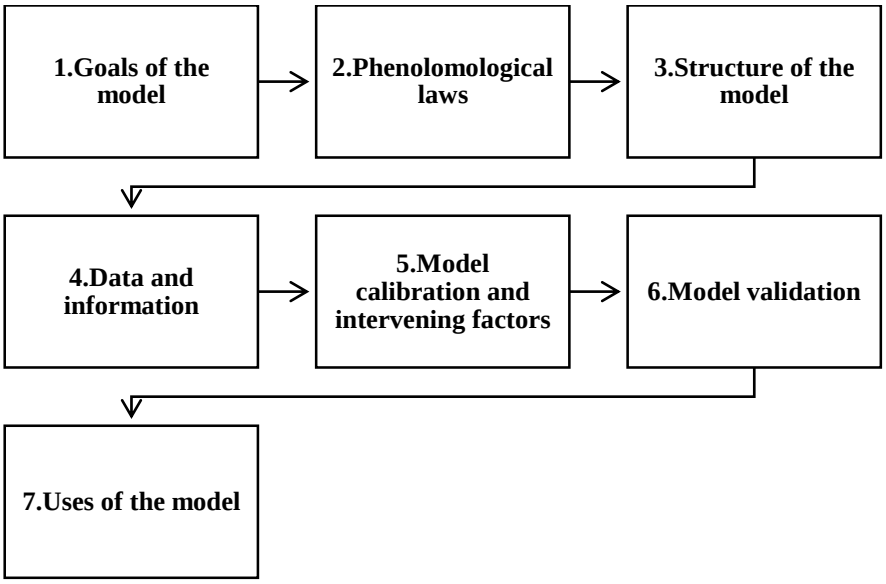


Figure (2-17): A simplified conceptual schema of the process of a model, depending on a work of Giudici in 2002/ (Bhatta-2010/ (P: 108))

2.5 Conclusion:

A city morphology is the city landscape structure. The benefits of a well-developed morphological pattern of a city are: functional efficiency and proper form. To study and evaluate city morphology, there are nine factors available to use: land uses; resources levelling; detailed zoning; transportation and infrastructure patterns; land values; micro-morphology; micro-growth, macro-morphology and macro-spatial growth.

The modulation of city morphology is a useful tool that evaluates and explains city transition process. The complexity science-based model which provides a base for formulating diagrammatically generated concepts, is suitable for this study purposes. It acts as a method of data collecting and analysis when preparing a city diagram; help to establish criteria to evaluate changes/interventions made by population growth and economic activities, link city components with city transition process, help in guiding city development policies and procedures, create a method of transition from macro-scale (regional planning) to the micro-scale (urban design) or vice-versa, include actions and sub actions; and help to project a city future needs and perspectives.

Chapter (3):

CITY MODIFIERS: POPULATION GROWTH AND ECONOMIC ACTIVITIES

3.1 Introduction:

The historical transition stages in the human civilisation make the city transition phases. City characteristics are the direct result of the daily urban living behaviours of population, which provide new ways, needs and techniques for living. A city process of transition or development is affected by some factors which are named as city modifiers; and which exert some control over morphological changes. This chapter, discusses: the city transition process, city modifiers and highlights city population growth and economic activities.

3.2 City Modifiers:

3.2.1 Factors that Cause the Transition of Cities:

Urban ecosystems are the consequences of the intrinsic nature of humans as social beings to live together in towns and cities. "Civilisation" is described as an identity and a system of an organisation of a society governed by constitutions and normative statutes. Each civilisation has its specification descriptions related to: the influence of the natural environment and the geography, human methods to satisfy its needs and wants, political and social organization, territoriality and the changes in the scale of society, and international relations and globalisation.

Civilisation acts as an instrument for better human life on the Earth. Each civilisation established settlements to produce better standards of living for their inhabitants. The people aspiration for better living standards established their thinking in "Utopia". To compare between "civilisation’ ideology" and utopia concepts: the ideology seeks to intervene in the comprehensive human society and to employ its entire means (such as religion, language, ethics, customs, traditions and legends…), but the utopian thinking adopts or changes the main factors that make ideology. (Alansary-2000).

Karl Manheim in 1936 defined utopia as: (representation of future direction and a hope of achieving some of the things that are not achievable in reality, and between the things that ideologies are bent on keeping them) (Alansary-2000(P: 175)).

Main transition stages in city circle of live:

- Human settlements started when humans staked out their territories and marked out boundaries. This was the origin of ancient cities, network of cities, great states, kingdoms and empires. Territories expansion was to find better locations and resources for settlements including cities; this increased the volume of their daily activities and made external relations with other settlements and shaped networks of global mobilisation.
- The dominion of some cities was for economic, transport, religious and political reasons. Colonisation increased the importance of governing capitals and trade ports among the world cities. The international political division of countries increased the number of cities and capitals that differ in urban activities and population welfare.
- Industrialisation increased technological development and modernization of living behaviours. It also made significant impacts on urban forms, increased urban population and affected natural environment. The Industrial revolution increased global connectivity between the world parts by trade lines developed to transport raw materials and final commodities.
- In this century, cities are in need of advances in technologies to access good living standards. The rapid technological changes are associated with new concepts of space, boundaries and global influences which impact on cities. Sustainable development is needed to contain the damages of the environment and ecological systems. Open communities and global migration also increase thinking in diversity and human equitation. And globalisation raises questions about the global-able cities.
- Table (3.1) discusses different city concepts describing the city as: Industrial, Capital, Modern, Mega, Sustainable, Intelligent, Network, and Global city. These descriptions are related to ongoing civilisation circumstances after the industrial revolution in the 19th century. Each one of these concepts affects the city in relation to its: micro-morphology, macro-morphology, and the shape of spatial growth.

Table (3.1): Historical development in the city morphology after industrial revolution in 19th century. (Researcher/ Alia- 2018)			
Cities Concepts	Micro-morphology	Macro-morphology	Spatial growth management
1. Industrial	-City centre defined by large office buildings, factories and warehouses. -Heavy industries stand near railway or sea ports.	-Cities established near possibilities of industry and raw materials. -Industries cause centrality of some countries and cities.	-City grew continuously by expansion, but railway stations and transport constraint that. -Working class lived near their work, upper classes able to live in the countryside.
2. Capital	-Design for memorial capitals to serve 'national identity'. -Automobiles create need to manage traffic and parking spaces.	-The concepts of national, regional, capital and city planning. -Increasing of the number of the capital cities around the world.	-Planning constraint by country and regions area and accessibility determinations. -Growth affects centrality of capitals. City expansion challenged by distribution of services.
3. Modern	-City dimensions are: length, width, rise, and distance, motion, light and sound. -City faces congestions, pollution, uncontrolled densities, loses of open spaces, and a need for reconstruction.	-Differentiation in living ecology between cities in global perspective. -Concentration of services in cities increase their influences towards surrounding rural areas and all region.	-Number of tall buildings continued to grow increasing city density. -Migration from rural areas to the cities/ polarisation.
4. Mega	-Cities face urban poverty, slums, inequity, segregation and shanty areas.	-Metropolitan huge urban areas. -Differentiation between the world 'cities.	- Degradation in CBD and inner city. - Unplanned or scattered city sprawl growth.
5. Sustainable	-New urbanism directed by thoughts of sustainable management to the impacts of human activities. (e.g... green architecture).	-Global environmental problems are identified at an alarming rate. Cooperation between all the world nations in this issues.	-Intelligent decisions, to conserve natural capacity round cities. -Concept of urban growth boundaries.
6. Intelligent	-Technology help solving agglomerations problems in regard to the environment, energy, utilities, and city managing system.	-Technology reinforcing the importance of big cities as centres of services, create competition between them.	-Technology and communications affect cities structure and control concentration of population and spatial distribution of settling.
7. Network	-Communication technology replaces personal contact and change concept of working place. That affects zoning, and network-based urban planning.	-Advancement in communication and transportation effects create "Main port" as node of logistic networks and increased dependency among communities.	-Undirected or uncontrolled urban growth affected by growing of connections between certain sections of most cities and the outside the world.
8. Global	-Cities need to offer market-based legislation and institutions, open private ownership, infrastructure and political stability to participate in global economy.	-Rapid increase in global flows of resources, labour, technology and information in international trade. -Larger developed cities are capable of offering and benefiting most.	-Spatial growth directions affected by integration globally in infrastructure, economic system and social services. That makes the concept of high liveability attracts migration.

3.2.2 Population Growth and Economic Activities as Main City Modifiers:

From the previous discussion of transition of human settlements, the main factors that shape the morphologies of cities are categorised into: the community pattern of organisation; and the economic system.

A community is an organised homogeneous group that shares common values and is attributed with social cohesion. Factors that differentiate various communities include: population count, social classes; art types; language; religious values; science; culture; marriage traditions; family relations; identities; lifestyle; and migration pattern. Social interaction is conditioned by physical distances. Since the advent of the Internet, the concept of community no longer has geographical limitations, as people now virtually gather in an online community and share common interests regardless of their physical location.

Economy is the economic system of a country or an area; it consists of labour, capital, land, agents, productivity, exchange, distribution and consumption of goods and services. All kinds of professions, occupations, economic agents or economic activities contribute to the economy. Consumption, saving and investment are core components in the economy and determine market equilibrium. Economy is distributed into formal economy controlled by the government and informal economy which is taxed but not monitored by a government. All economic systems contain an informal economy in some proportion. Ancient economies were mainly based on substances farming. After the industrial revolution economic activities became diverse, that includes energy, construction and manufacturing industries. Economies of modern societies are based on services, finance and technology.

In this research, cities are considered engines of nation's development and nodes of communication. They are places of concentration of economic activities that play a major role in defining city morphology and shape. By time, dynamic changes take place in a city population size and needs, beside that there are recent high migration rates towards cities. These factors stress cities capacities and affects their morphology and efficiency. As mentioned before, this research assumes two factors that play major roles in city changes; these are population growth and economic activities. Those two factors are taken as main modifiers of city morphology.

3.3 City Population Growth:

3.3.1 Reasons of Urban Growth:

The main factor that causes growth in city volume, as area and densities is population growth[4]. Cities also increase in area if there are new land uses added to it. Urban growth is the increase in urban population or urban area over the total area over time. It is spatial and demographic process and refers to the increased importance of towns and cities as a concentration of population within a particular economy and society. (Bhatta-2010\ (P: 3)) to study city population growth in this research, urban spatial growth is distributed into city micro and macro- growth.

3.3.2 City Micro-Spatial Growth:

Cities expand or contract in size and importance; their dynamic growth and decline is dependent on a variety of factors: historical, economic, political and demographic. The city changes in spatial scale over time. City micro-spatial growth is measured as increase (positive) or decrease (negative) in number of population. One of the results is urban sprawl, which is related only to expansion in the city area, and city shrinking, which is related to decrease in the number of city residences, area, city influence or economic capacity. See Figure (3-1).

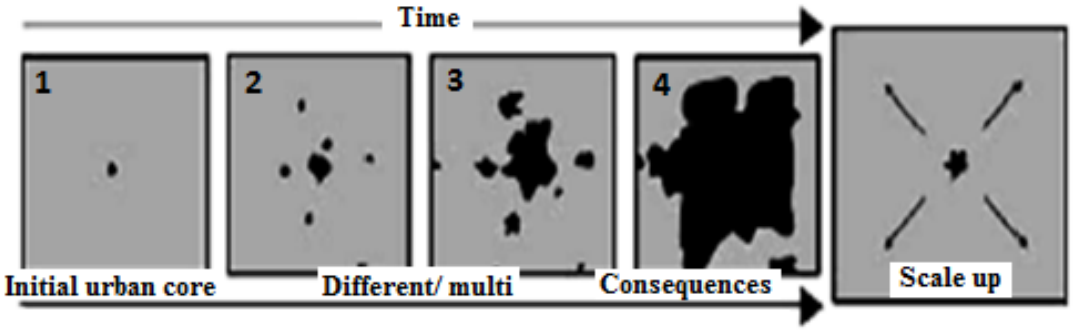


Figure (3-1): Sequential frames of positive urban growth, produced by Herold (Bhatta-2010/ (P:15))

The pattern of city micro-spatial growth is categorized as inner-city boundaries: infill growth or outer-city boundaries: expansion, linear, clustered or isolated growth. This classification is related to the physical shape of communication, the spatial organisation between branches and growth. See figure (3-2)

[4]Rapid growth of urban areas is a result of two population growth factors: natural increase in urban population and migration to urban areas as movement of people from other places in and out the country.

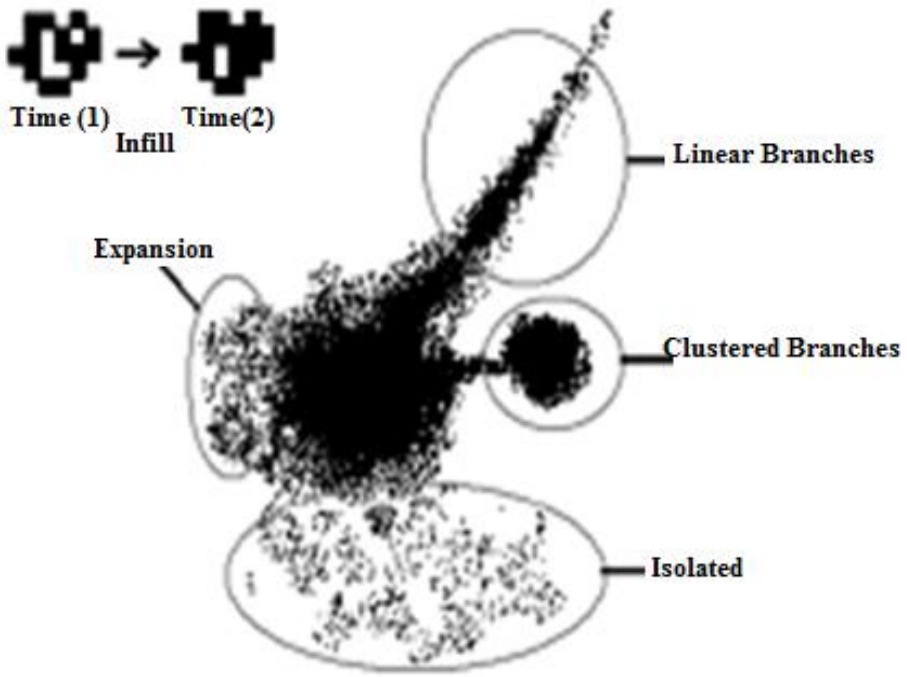


Figure (3-2): Schematic diagram of urban spatial growth pattern/ (Bhatta-2010/ (P:11)

3.3.2.1 Cycle of city growth:

The concept of a cycle of city growth has been employed by Klaassen in 1981 and Van Den Berg in 1982. Cycle of city growth is a diagram that studies growth patterns within individual urban agglomerations, See figure (3-3). It defines stages of city growth as: first: urbanisation, then: sub-urbanisation or ex-urbanisation, and de-urbanisation or counter-urbanisation, and at last again re-urbanisation. (Pacione – 2009/ (P: 80))

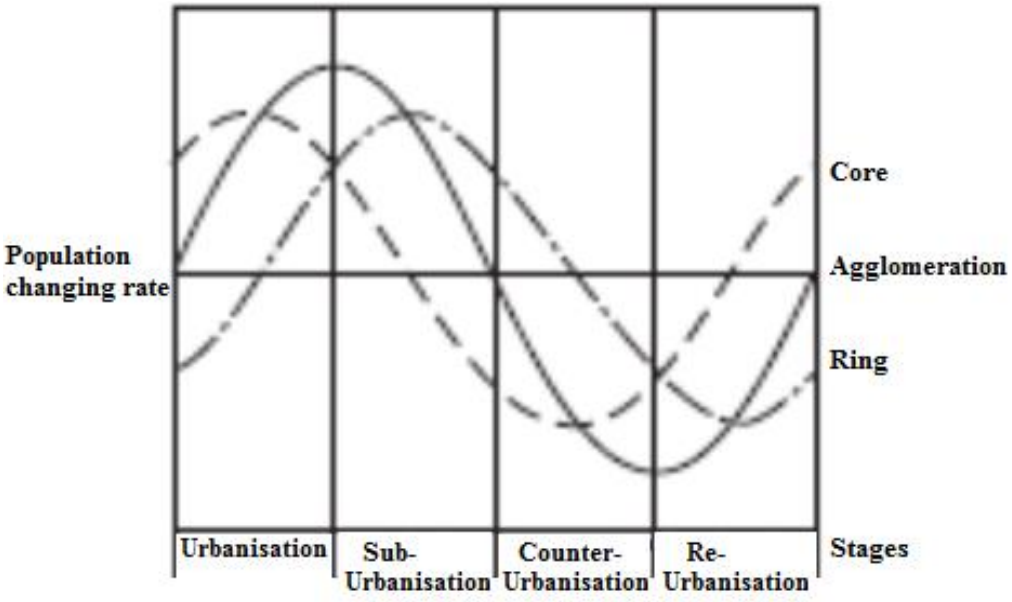


Figure (3-3): The stage of urban development model, produced by Klaassen et al. and Van Den Berg et al.\ (Pacione – 2009/ (P: 80))

The previous four stages of urban development are envisaged as the follow:

1. Urbanisation: when settlements grow at the cost of their surrounding countryside.
2. Sub-urbanisation or ex-urbanisation: when the urban ring (commuter belt) grows at the cost of the urban core (physically built-up city).
3. De-urbanisation or counter-urbanisation: when the population loss of the urban core exceeds the population gain of the ring, resulting in an overall population loss.
4. Re-urbanisation: when the core starts regaining population and the ring starts losing population. (Pacione- 2009\P:80)

3.3.2.2 City sprawl growth:

Urban sprawl is usually defined as the spreading of a city and its suburbs over rural land at the fringe of an urban area. (Bhatta-2010/ (P: 8)). It is caused by uncontrolled, uncoordinated and unplanned growth, driven by multitude of processes and leading to inefficient resource utilisation (Bhatta-2010/ (P: 9)). See figure (3-4). The sprawl induces increase in built-up and paved area. Such outgrowth is seen at the periphery of cities, along highways-ribbon development and along roads connecting a city; these lack basic amenities like sanitation, treated water supply, primary health facilities, etc. The causes of city growth and sprawl is high rate of increase in urban population (Bhatta-2010/ (P: 18)), other factors are:

1. Economic causes, like: economic growth, resulting in an increase of employment opportunities, which creates demand for new housing and other public services.
2. Physical causes, like: lack of suitable land for development within city boundary. Unsuitable physical terrain (such water bodies, etc…) stops continuous development. Also transportation routes cause directed linear branch development.
3. Governmental causes, like: lack of comprehensive visions and lack of, or failure to, properly enforce planning policies and standards. Other reasons: legal disputes, lower development, property tax, lower living standards and property cost.
4. Investment causes, like: landlords desire to invest on land and property development coupled with fluctuation in credit and capital market.
5. Household causes, like: percentage of households that lack affordable housing and the demand for more living space.

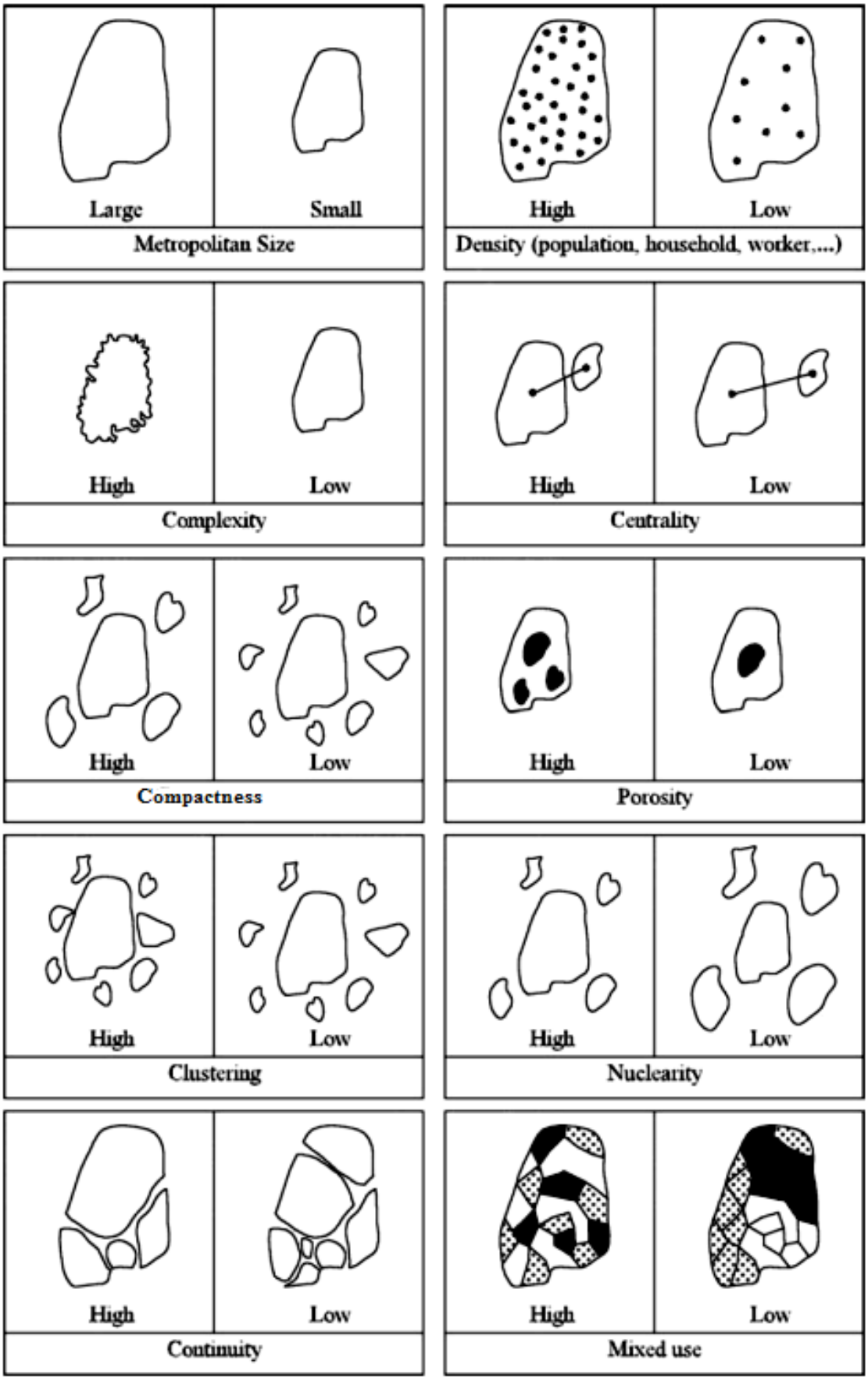


Figure (3-4): Schematic diagram of sprawl quantification and characterisation dimensions\ (Bhatta-2010\ (P:11))

3.3.2.3 Shrinking of cities:

While some cities are growing more rapidly than others, evidence shows that in all regions of the World, many cities are actually shrinking in size.[5] Shrinking cities are often associated with economic and political failure. From a physical perspective, shrinking cities are characterised by abandoned or vacant commercial sites, deserted or unoccupied houses, and wasted infrastructure.

3.3.2.4 City decline:

The reasons that cause cities to decline are:

1. Polycentric development: Many formerly mono-centric cities are becoming increasingly polycentric, developing urban nucleation with their own downtowns, besides housing districts, employment centres and other features of independent cities. These adjacent urban areas expand their population, often at the expense of the original city that experiences a decline in population, accompanied by a decline in economic activities and opportunities.
2. Sub-urbanisation; this process involves systematic and rapid growth of areas on the outskirts of cities, while growth in the inner core slows down and remains stagnant or declines.
3. Improvements in communicating technology, infrastructure and changes in living behaviours that drastically affect the dynamism of cities population.

For Pacione- 2009\ (Ps: 320-323), the reasons that cause part of cities (e.g. inner city) to decline are:

1. The economic decline and unemployment associated with the contracting industrial base due to recession in the economy.
2. Physical dereliction and absence of amenities, that most of the inner areas were built over long time and have not benefited from continued investment and improvement.
3. Social disadvantage, characterises poor and weak classes as a result of the high levels of unemployment and low-wage jobs available.
4. The concentration of ethnic minorities in parts of the inner city, which may lead to discrimination in job and housing markets and insecurity.

[5] Sassen/ Saskia-1996 in “global cities" theory refers to this by the phenomenon of urban "winners" and "losers": the winners being those cities with agglomerated as financial and specialised services and the losers being those with outdated industrial infrastructure and manufacture economies.

3.3.3 City Macro-Spatial Growth:

City macro-growth means an increase in the proportion of the total population that lives in all urban areas relative to the country scale. It could occur either as natural expansion of the existing urban population or as a transformation of peripheral population from rural to urban, incoming migration or a combination of these. In either case, urbanisation has profound effects on the ecology and economy of a region as well as in people's psychology and lifestyles.

The macro- spatial growth includes the city in the regional scale and the relation between urban and rural areas. Living in cities permits individuals and families to take advantage of opportunities related to proximity, diversity and marketplace competition. In rural areas, often on small family farms, it is difficult to improve one's standard of living beyond basic sustenance. On the other hand; farm living in general is dependent on unpredictable environmental conditions and during drought, flood or pestilence, survival becomes extremely problematic.

The problems of city shrinking and declining are taken in the level of macro-spatial growth of cities, in the study urbanisation directions within the regional zone.

3.3.4 Micro and Macro-Spatial Growth on City Morphology:

3.3.4.1 Measuring urban growth:

Concern changes in city micro and macro-growth aspects, occur daily by the changes in human life. It is necessary to study the growth of cities by using the following measurements:

Nominal measurements: Determine phenomena related to population growth, e.g.: micro-spatial growth, macro-spatial growth, sprawl growth, shrinking growth, urbanisation, ex-urbanisation, sub-urbanisation, counter-urbanisation, re-urbanisation, over-urbanisation, inner-city infill growth, outer-city expansion, linear growth, clustered growth, and isolated growth.

1. Ordinal measurements: Determine facts related to urban development affected by population growth, e.g.: natural environment, physical pattern, political and social environment, economic environment, health, housing, transportation; infrastructure, security and safety, recreation, consumption, equity, modernity and technology.

2. Quantitative measurements: Determine quantities related to: causes of growth, e.g.: natural increase, rural- urban migration, movement between cities and the migration for special cases or unexpected situation (e.g. war, natural disasters...); or qualities of growth, e.g. homeless people, unemployment, poverty…
3. Interval/ ratio measurements: Determine quantitative measurements indicating population growth effects on urban development, e.g.: demand for human being urban needs like: education and literacy rates/ work/ income/ luxury needs/ using technology/ family changes/ health conditions, life expectancy and infant mortality, demand for consumption, demand for: transport, infrastructure services and use of natural resources….
4. Quantitative interval measurements: Determine quantitative measurements related to population growth effects on city micro-morphology, e.g. population densities, increase in land value, expansion of urban area and increase in the building pattern…. Also, determine quantitative measurements related to population growth effects on city macro-morphology, e.g. levels of urbanisation, urbanisation rate, speed of urbanisation, limits of urban growth, extent of population concentration in large cities and spatial distribution of the urban areas…
5. Descriptive statistics, either: frequency tables, central tendencies, variability or association and correlation. They study and indicate population growth in definite place or comparison between different places, and phenomena or causes, like effects on urban growth in relations to change in land values.

3.3.4.2 Aspects of urban growth:

The consequences of city micro and macro-spatial growth in city development are classified in this research to the following aspects: concentration of population and spatial scale, employment and productivity, living behaviours, the urban environment, the need for transportation and infrastructure and micro and macro-growth controlling methods. All these aspects have both positive and negative impacts on city morphology. Table (3-2), discusses population growth (positive) aspects in micro and macro-levels of urban areas.

Table (3-2): Population growth aspects in micro and macro-levels of city morphology. (Researcher/ Alia- 2018)		
Aspects	**Micro-level**	**Macro-level**
1) The concentration of population and spatial scale	-Changes in city functional zones area. -City spatial distribution and balance of densities. -Network of infrastructure and transportation	-Cities influences and growth directions -Economic, political and cultural links between cities. -Primate cities effects on economic, administration and transportation context.
2) Employment and productivity	-Opportunities of proximity, diversity and marketplace. -Extension in the service sector. -A neediness of increase in economic producing sectors to secure the per-capita income.	-Businesses generate jobs and capitals, usually located in cities. -Primate cities attract cheap and highly skilled labours and give the opportunity to increase incomes and qualifications. That causes a rapid change in economic activities structure.
3) The urban environment	-Modern cities create their micro-climates. -Problems of air pollution, and garbage and sewage disposals. -Factors create bad impacts on ecosystem and public health.	-Intensive use of natural resources and production of wastes. - Land-use change affects forests and agricultural land. -The environmental repercussions (climate changes).
4) Living behaviours	-Need for extension to keep capabilities of lifestyle. -Factors increase rents, land values and taxes. -Class segregation identifies poor and ethnic suburbs.	- Cities provide better basic recreation, modern luxuries and specialist services. -Urban quality of cities attracts foreign investments.
5) The need for transportation and infrastructure	-Changes in volume of infrastructure needs. -A neediness of growth in transportation. -The standards and consuming cost of infrastructure and transportation directed urban development.	-Macro-networks of transportation and infrastructure are necessary to control urban growth and support middle and small cities. -Macroeconomic policies to clear supplies fragmentation.
6) Micro and macro-growth controlling methods	-Uncontrolled urban growth results in sprawl. - Smart growth policies seek to compact urban areas. -Infill growth prevents peripheral development. - (UGB) Urban growth boundary, supports wildlife. -Cities shrinking affects the local economy and increases the per-capita cost of transportation and infrastructure.	-Over-urbanisation implies that economic growth is unable to keep pace with urban population growth. -The growth of primate cities helps nations concentrate and maximise financial and human resources more efficiently. -When primate cities generate negative externalities, small and intermediate cities are encouraged to grow.

3.4 City Economic Activities:

City economy is the system used to achieve and distribute economic roles, works, needs and wealth. The importance of city economy puts it under the direct interest of the government; this, in shape of planning, investing, monitoring and regulating. The private sector and the international agents are other economic partners. Urbanomics describes city formation phenomenon where economic priorities prevail to facilitate the city propensity to generate and accumulate wealth. Such city formation involves some irreversible spatial investments, massive resource allocations and financial investments recoverable only if anticipated future income transpires. Consequently, it is a pertinent concept in urban planning.

Economic activities are the activities that generate jobs and wealth for individuals or communities. There are five sectors of economic activities: Primary; this involves the extraction of resources directly from the Earth. It includes agriculture, mining and raw materials extractions. Secondary; this group is involved in the processing of products from primary industries. It includes all factories those that refine metals, produce furniture or pack farm products such as meat. Tertiary; this group is involved in the provision of public and privet services. It includes teachers, managers and other service providers. Quaternary; this group is involved in the research of science and technology. And Quandary: which includes the highest levels of decision-making in a society or economy. This sector would include the top executives or officials in such fields as government, science, universities, non-profit organizations, healthcare, culture, religion and the media.

As a country develops people move away from the primary sector to secondary and then to tertiary sector, see figure (3-5). Urban studies divide urban economic activities into three main categories related to land uses diagrams: agriculture, industry and services (as combination of Tertiary, Quaternary and Quandary) sectors:

1. **Urban and pri-urban agriculture:** urban agriculture occurs within the city in most cases high yield market gardens for fruit and vegetable growing; it is likely to include small animals developing aquaculture (fish production) and also the forestry. Pri-urban agriculture is agriculture occurring on the urban-rural fringe or within peripheral low-density suburban areas. (Viljoen, Bohn and Howe- 2005\ (P: XVIII)).

2. **Urban industry:** is the production of an economic good or services within an economy, acts as a key sector of production and labour. It is aided by technological advances and has continued to develop into new types and sectors. Industry developed transportation to reach the world markets and helped companies to develop their size and wealth.
3. **Urban services:** The service sector consists of activities where people offer their knowledge and time to improve productivity, performance, potential and sustainability. Services (also known as "intangible goods").

To study city economic activities in this research, city economy is distributed into City micro and macro-economies. All aspects are studied by micro and macro-economies, which affect each other, such as the level of unemployment in the economy as a whole is affected by the city employment rate.

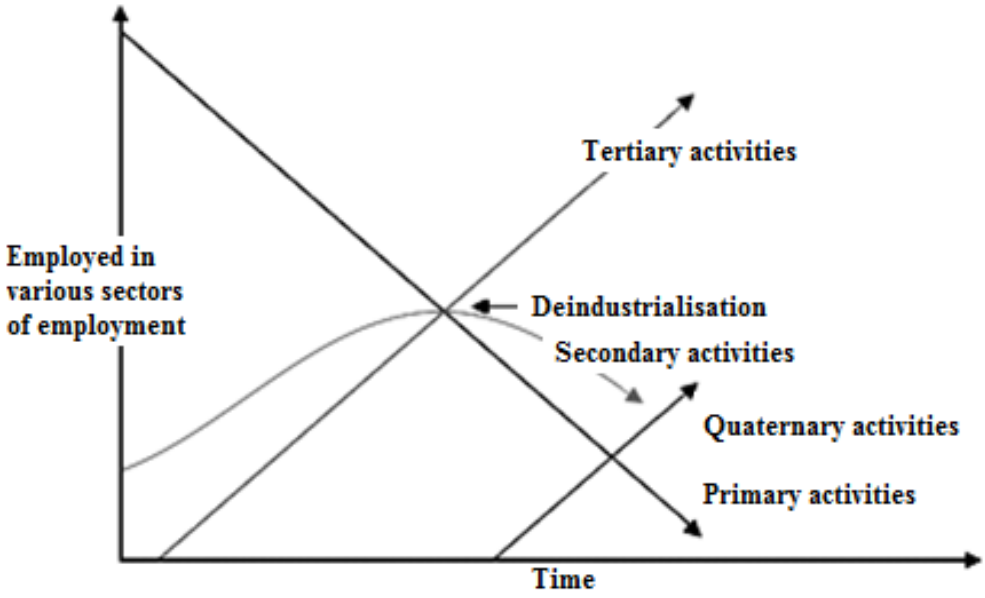


Figure (3-5): Sector Model, produced by Clark in 1950\ (Wikipedia-2010)

3.4.1 City Micro-Economy:

Micro-economics means the local economy of the city, and it deals with the effects of national economic policies (e.g. allocation of resources, changing taxation levels, etc.) on city economy. Also, it studies the behaviour of individual households and firms in making decisions on the allocation of their limited resources, examines how this affects the price, supply and demand for goods and services. The important issues in micro-economy are: modes of operation, opportunity cost and demand and supply. See figure (3-6).

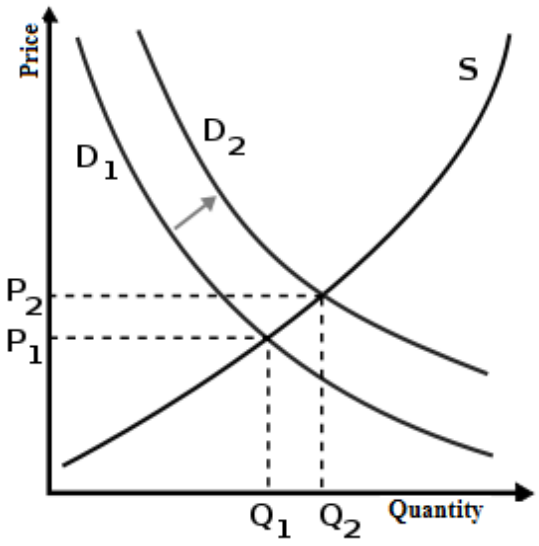


Figure (3-6): Demand and Supply/ (Wikipedia-2010)

Urban economics focus on spatial relationships between individuals and organisations, to understand the economic motivations underlying the morphology: formation, functioning and development of cities. In this research micro-economy analysis evaluate the effect of inner- city working sector in the city morphology. The working sector consist of economic activities within city (services, industries, and agriculture). These activities are located as land uses in city plan in fragments or accumulative shape.

3.4.2 City Macro-Economy:

Macro-economics is a branch of economics dealing with the capitals, performance, structure, behaviour and decision-making of the whole economy. This includes regional, national and global economies. Macroeconomists develop models that explain the relationship between such factors as national income, output, consumption, unemployment, inflation, savings, investment, international trade and international finance.

Macro-economy subjects, in spatial consideration study as geographical location, economic sector, economic capabilities and categories of industry, in analysis of a country's regional and global economy as a whole. While macro-economics is a broad field of study, there are two areas of research that are emblematic of the discipline: the attempt to understand the causes and consequences of short-run fluctuations in national income (the business cycle) and the attempt to understand the determinants of long-run economic growth (increase in national income).

3.4.3 Micro and Macro-Economies on City Morphology:

3.4.3.1 Micro and macro-economies measurements:

Concern changes in city micro and macro-economic aspects, occur daily by the change in human life. It is possible to study city economic activities effects in urban areas by the following measurements:

1. Nominal Measurements: Determine phenomena related to economic activities, using resources, capitals, economic forces, urban and rural industries, poverty, deprivation, etc.
2. Ordinal Measurements: Determine facts related to urban development affected by economic activities, e.g. expenditure in investment, infrastructure and transportation, supply and demand of housing; migration and depopulation land uses per activities, determines the various prices of land across space, the location choices of households in conjunction with the market effects of housing policies, urban economics analyses to city morphology.
3. Quantitative Measurements: Determine quantitative measurements related to economic growth, e.g. employment, working force per activities, expenditure, profits, city local income, GPD, per capita income, taxes, inflation, currency, consumptions, demands, supplies, etc.
4. Interval/ Ratio measurements: Determine quantitative measurements indicating economic activities effects on urban development, e.g. general-equilibrium, welfare analysis, the per-capita income, economic activity in relation to other activities, spread of employment in cities zones, study the economic forces, economic urban problems such as poverty or crime…
5. Quantitative Interval Measurements: Determine quantitative measurements related to economic activities: volume, number of workers, revenues, profitability, government expenditure and taxes, finance…
6. Descriptive Statistics: either, frequency tables, central tendencies, variability or association and correlation: Study and indicate economic activities in definite place or comparison between different places: economic activity relates to other activities, urban economy in the national development planning, and city economic concentration in relation to city influences…

3.4.3.2 Aspects of economic activities upon city morphology:

Analysis of economic activities effects in city micro and macro-morphologies is discussed by the following items: land-use economics return, allocation of (capitals, investments and resources), the environmental effects, economic returns by urban quality, need for transportation and infrastructure for certain economic activity, and activity necessities and city macro-morphology. The micro and macro-economy analysis' directions toward socioeconomic benefits are similar, so the discussion of the micro and macro-economic aspects on city development focuses on the differentiation between the capacities of economic activities. See table (3-3).

3.5 Conclusion:

Transitions of human civilisation are the main factor that contributed to the transition in the human settlements. In a city transition circle, there are two important factors that play major roles in inducing changes in settlement system of development, these are; community shape and economic system.

Growth of urban population in general has significant causes and consequences that affect city morphology and efficiency. Changes in population densities or spatial scale of a city witness increase or decrease over time. Aspects of city micro and macro population growth related to city morphology include: concentration of population and spatial scale, employment and productivity, the urban environment, living behaviours, the need for transportation and infrastructure and urban spatial growth controlling methods.

Economic systems controlled development directions and are directly reflected in city composition. It is important, therefore, to put it under direct formal/government interests. Scale wise, city economy is divided into two categories: micro-economics, which deals with the local market mechanism, and macro-economics, which deals with the economy as a whole, i.e. at all national, regional and global levels. Aspects of city micro and macro-economies related to city morphology include: land-use economics return, allocation of capitals, investments and resources, environmental effects, economic returns by urban quality, need for transportation and infrastructure for certain economic activity and activity necessities and city macro-morphology.

Table (3-3): Economic activities aspects upon city morphology. (Researcher/ Alia- 2018)			
Aspects	**Agriculture**	**Industries**	**Services**
1) Land-use economics return	-Creates new jobs and enterprises; -Saves environmental degradation.	-Create new jobs and enterprises; -Uses natural resources. -Produces to satisfy demand.	-Creates new jobs and enterprises; -Functional links between services, firms in all planning levels.
2) Allocation of capitals, investments and resources	-Volume of labouring -Economic returns -Cost of starting new projects -Available natural resources -Demands of products	-Volume of labouring -Economic returns -Cost of starting new projects -Available natural resources -Demands of products	-Volume of labouring -Economic returns -Cost of starting new projects -Available natural resources -Demands of service
3) The environmental effects	-Ecological Intensification. -Improve soil condition. -Links city with nature.	-Natural resources are essential for industries -Cause pollution.	-The concentration of population exhausts the environment. -Cause pollution.
4) Economic returns by urban quality	-Land development. -Increases the portions of open space (parks). -Enjoyable roads networks.	-Located near resources and transportation routes. -Waste affects the environment. -A need to study labour's commuting cost and time.	-Strategic location increases land values and decrease infrastructure cost. -Investment increase urban quality -Increase land value.
5) Need for transportation and infrastructure for certain economic activity	-A productive urban landscape acts as landscape with direct connections to public transport -Paths develop to lead from suburban to the city centre. -Suburban dwellers gain a pleasant walk to work.	-Industries heavy roads affect the environment and urban pattern. -Need to regulate and manage transportation and infrastructure to increase productivity. -Some industries better be located out of the city.	-Firms' buildings make a new addition in the city appearance, with various styles and elements. -Some urban services improve living behaviours in general. -Services pressure city networks of transportation and infrastructure.
6) Activity necessities and city macro-morphology	-Mixed-use development. -The environmental sustainability. -City engages with the environment. -Accommodate ecological principles.	-Cause slums and blight areas. -Demand for affordable housing. -Need for extension in transportation and infrastructure	-Entering a new urban activity creates change in services structure. -Shopping streets affect city pattern. -Need to services extension.

Chapter (4):

MORPHOLOGICAL DEVELOPMENT AND CITY MODIFIERS

4.1 Introduction:

This chapter discusses the relationship between the development of a city and its modifiers (population growth and economic activities). The study reconsiders limited economy cities, which suffer from two related problems: intensive urbanisation and stressed economic situations.

4.2 Development of City Morphology:

Currently, almost all segments of the World population are completely dominated by urban values and living behaviours. The city became a major social, cultural, economic and intellectual stimulus in modern urban society. That increases the importance of city development process (Bhatta-2010\ (P: 3)). Development of all kinds is an outcome with two major aspects: population and the environment that involves social, economic and strategic interests. Urban development management to extend at these effects is a dynamic process concerned with urban settlements and areas. The major guides of urban development in general are attributed to four elements, these are: sustainable urban development; human welfare; efficient spatial distribution; and efficient economic performance.

4.2.1 Sustainable Urban Development:

Efforts towards planning for sustainable urban development are required to adopt a long-term prospective role. In essence there are two broad approaches to sustainable urban development: an environmental protection approach with a focus on reducing the consumption of resources and minimizing the environmental impact of development, and a holistic approach including an ecological component (stressing the importance of environmentally sound policies), economic aspects (development activities and fiscal issues) and social-equity issues (a fair distribution for resources and impact of policies). (Pacione – 2009/ (P: 186))

4.2.2 Human Welfare:

Issues related to human welfare include human needs and requirements, public choice and services. Human needs and requirements: physiological, safety, affiliation, self-esteem, self-actualisation and aesthetic needs[6]. Public choice and services theory refers to a set of decisions made in concern with people' advantages by provision and allocation of services in cities. Investors seek to achieve maximum profit, but politicians seek to gain votes by providing favourable tax and expenditure options to the public. Human welfare is about increasing social justice and the quality of human life offered. Human development, according to the United Nations (UN), takes place in three directions, these are: health, education and income. There is no measurement defined to achieve the adequate limits in human welfare. It is a dynamic matter changed by transition in human civilisation and influenced by scientific, technological, environmental, economic and social changes.

4.2.3 Efficient Spatial Distribution:

Controlling population densities is the most important factor in urban development. The main causes of micro and macro population growth of urban areas are: increasing in the rate of development, creating of new job opportunities, new-structuring of economic activities, developing of industrialisation and increasing capabilities of transport and communication networks. Rapid change in the patterns of settlements creates a need to balance different living qualities between regions, urban and rural sectors, country' cities of different sizes and social groups within a city.

4.2.4 Efficient Economic Performance:

Urban economy controls the whole economy of the country, as well as economic decisions made by institutions, investors and markets. Agriculture is an activity linked with rural areas as producers and urban areas as a market. Industrialisation is always regarded as a major gainful economic activity in urban areas with a high percentage of

[6]Maslow (1954) identified this hierarchy of human needs: first, issues related to human physiological needs (breathing, food, water, sleep, homeostasis, and excretion). Second, issues related to human safety (security, employment, resources, mortality, health, and property), issues related to human love and belonging (friendship, family, sexual intimacy), issues related to esteem (self-esteem, confidence, achievement, respect of others, and respect by others) and last issues related to human self-actualization (morality, creativity, spontaneity, problem solving, lack of prejudice, and acceptance of facts).

labour. The service sector, which is available normally in the urban areas due to population concentration. The strategic visions about economic performance affects urban development programmes in many ways that include: sector allocation of resources, location of industries and major activities to match the available resources in the country and at a regional scales, distribution of land uses in urban areas and procedures of dealing with urban poverty and unemployment issues.

4.3 Planning for Urban Morphological Development:

4.3.1 Micro and Macro-Levels of Urban Development:

Every development plan is conducted by a comprehensive national development plan, which includes sub plans in different levels of detailing related to the national administration system of the country or the spatial distribution of the inner-country territories. Planning transition means how development plans start in shape of strategy, policies and act until they reach implementation stage.

The micro level of urban development includes: urban area within a city related to daily commuting zone, and the macro level of urban development includes: the urban subsystem related to regional, provincial or state limits and the expansion of this urban subsystem toward national and international\ Global zones.

At macro levels of development, central governments decide on policies with clear spatial implications to implement institutional reforms, mobilise resources, and support transportation and infrastructure development. On the other hand, at the macro level of urban development authorities design local development strategies or refashion policies and put programmes and projects to link up with the macro initiatives that harmonize development at the larger scales. Table (4-1) explains policy measures in urban development from micro to macro-levels.

4.3.2 Aspects of Urban Morphological Development:

The urban morphological development aspects in micro and macro-levels are discussed in general as spatial policies, resource management, conservation of natural environment, urban quality, transportation and infrastructure pattern and micro/macro-influences and growth, as is illustrated in table (4-2).

Table (4-1): Policy measures for urban development policies. (Renaud – 1981\(P:134))		
Operation	**Nature of policy measures**	**Aspects**
Micro-level: Urban\ city level, (daily commuting zone)	Local land- use policies; regulation of industrial location and services sector; extensive use of land control as part of urban transport policies; the environmental; choice of site for satellite cities and policies toward low- income neighbourhoods; management of local taxation system and locally owned public utilities; enforcement of codes for building design and construction; location of major traffic generators; location of hospitals and health clinics.	• Internal efficiency of cities. • Sources of growth of the city.
Macro-level: Regional, provincial or state (urban subsystem and rural services centres)	Economic development policies; public investment policies and diversification of activities; formulation of policies by broad areas; public transport policies; industrial estates policies and other employment location decision; allocation of health and social services; regional land policies; education; regulation of urban and none urban land uses; and regulation of utilities.	• Control over local activity within cities and rural centres. • Concentration of investment in selected urban centres.
Macro-level: National	Population policy; public sector investment allocation; intergovernmental fiscal relations, fiscal transfers and taxation; transport policies; communication policies; national growth policy, sector priorities; treatment of rural sector; labour policy; banking and finance policies; education policies; and regulation of public utilities.	• Guides of population, sectorial priorities and the rural sector.
Macro-level: International\ Global	Growth strategy and export orientation, foreign exchange policies, tariffs and trade protection, regulation of foreign investments, international transport policies and immigration and emigration policies.	• Accentuate investment concentration in the largest cities.

Table (4-2): Urban development micro and macro aspects upon city morphology. (Researcher/ Alia- 2018)		
Aspects	**Micro-level**	**Macro-level**
1) Spatial policies:	-Location of economic activities is central to understanding the organisation of other land uses in space beside, morphology and growth of a city.	-Macro-spatial policies need to be comprehensive; that makes any planning part of a national strategy and must be based on needs and resources constraints.
2) Resource management:	-Resources for development: economy, the environment, transportation, infrastructure and population. -Management of resources focuses on: enhancing living behaviours, generating fortune and decreasing poverty.	-Location of economic activities affects the efficiency of the national economies and inner migration. -Issues related to lagging or depressed regions by resources and investments directions.
3) Conservation of natural environment:	Cities attempt to: -Conserve their natural environment. -Decrease bad effects on micro-climate. -Decrease consumption level of natural resources.	-Having high standards of living without hurting the available resources for future generation, by achieving rational use of renewable and un-renewable resources and secure wild life. -Avoid risk to health and safety.
4) Urban quality:	-Keep heritage, enhance atheistic composition and accommodate the modern style of living. -Achieve equity between populations, diminish segregation between classes and routes, create safe and moral community and improve welfare programmes.	-Make pretty, comfortable and distinctive urban centres that to attract global tourists, with adequate transportation, infrastructure and employment opportunities. -Achieve strong national urban system with formal and informal networks linked between cities.
5) Transportation and infrastructure pattern:	- Good urban transportation through inner and to outer city. -The development and expansion of urban infrastructure systems have been driving urban development, to cover the essential needs of population and industries.	-Cities tended to grow at locations savings transport costs. -Emphasise intermediate and small cities in macro-pattern. -Providing essential infrastructure, that includes: finding sources, disposing places, producing and managing.
6) Micro/macro-influences and growth:	-City size is dependent on its position in the hierarchy of cities in an urban system. It is evaluated by its location and its function, defined as relations between city and its hinterland-zone of influence.	-Simulate growth of regional centres and raise their quality through economic development, quality of life, transportation and infrastructure. -Support cities to have global influence.

4.4 Development of City Morphology and City Modifiers:

City modifiers, population growth and economic activities are linked to city morphological development. To deduce the role of each one of them in a transition process of city morphological development. The following discussion considers this triplex relationships between them: population growth and economic activities; city development and population growth; and city development and economic activities. Table (4-3) illustrates the relations between city morphological development aspects and city modifiers aspects.

4.4.1 Population Growth and Economic Activities:

Throughout the World, there are regional differences in the rates of urbanisation which provide clear evidence of the relationship between urbanisation and economic progress. Increase in the per-capita income and increase of industry value in the national income, are always followed by an increase in urban population number. Also the development of services sector such as banking and financial systems including different forms of trade are among the most important contributors to city growth. They increase transportation and infrastructure investments, facilitate for more robust labour markets, increase more employment opportunities and lead to higher wages in cities.

Some cities have lost or are losing significant numbers of people as a result of economic degradation. The loss of employment opportunities leads both high- and low-income residents, to leave the city. Economic decline in one city also leads to prosperity in another that is because capital and infrastructure investments move between regions and cities. The economic consequences of a city shrinking include a reduction in the transportation and infrastructure demands, but they must still be provided to the rest of city citizens over the city geographic distance. That raises the services provision per-capita cost and creates uncertainty in the planning process.

Economic policies and investments are primarily set by national government. Urbanisation is an important factor in determining strategies for economic development and allocation of resources; from the other side, economic development and allocation of resources acts as major causes for increased urbanisation.

Numerous factors have fundamental roles in measuring the relationship between population growth and economic activities. These are: Awareness and recognition of

population needs which are highlighted because they formulate the value of social services; Population growth as it affects availability of labour and hence planning for the provision of employment opportunities, as well as their distribution among various regions and economic activities within the country. Population growth as it affects: the per-capita income distribution, relation between urban and rural economy; and the importance of each of them; and ability to contact, and take advantage of other economic development experiences and programmes throughout the World, and between public and private organisations concerned with population problems.

4.4.2 City Development and Population Growth:

Countries make strategies and policies to satisfy the right of all citizens to live in suitable environments and to develop their countries to be one of the vanguards in the World. Human demographic dynamics, such as: population, growth, spatial distribution, age, employment, essential needs and luxuries consumption levels, social movement and migration; all of which lead to an urban change.

Urbanisation is directly attributed to spatial growth of towns and cities or physical growth of urban areas. People want to encourage that growth while at the same time protect the environment. The procedures toward making smart growth development of cities is to attain the goals of sustainability. The primary causes of urban areas contraction in relation to urban development are: political decisions involving change of city status, management and reduction of investments.

According to that, there are two types of urban development: The first: controlling urban quantity by directing population growth. The second: improving urban quality by improving population welfare and the environment sustainability. There are significant relationships between the two types of urban development defined as; the quantity of urban development affects the quality, and the quality of urban development causes the growth of quantity. Improving the quality of urban settlements usually attracts new comers and that increases the scale of urban development. Urbanisation involves changes in urban density and volume, which affects the regional environmental, economic, social and political structures. Also the growth of cities strains their capacity to provide some services such as energy, education, health care, transportation, sanitation and physical security

4.4.3 City Development and Economic Activities:

Economic development includes strategies made to improve the economic system and the national income, by determining the allocation and the use of resources. Normally this is translated into spatial policies which define where people live and where they work and their projected incomes, expenditures and quality of life. Generally: aspects of urban development are all primarily directed by economic provisions, also urban quality is considered as a major factor in attracting investments, global firms exist only in urban areas with environments that support global economy supplies.

The relationships between a city development and its economic activities established by the location of industries, which is affected by a myriad of economic and non-economic factors, such as the nature of material inputs, the factors of production, the market and transportation costs, and rapid growth and the spread of the city within its hinterland. Decentralisation of population within the city is related to the movement of a large part of firms premises away from the traditional city centres; other important relationships include: economic agglomeration relations within the city are according to its external economies (regional, national, international, or global). City policies assist distribution of citizens according to their preference, and city regulations of land and buildings co-ordinate business investments.

Diversified spatial distribution of natural resources, diversified allocation of development capitals including finance, labours, and technologies, and diversified economic experiences to make economic profit, create a mosaic of inequality, at all geographic scales, from global to local. The main economic aspects in settlements, to balance development planning, are based on studying: economic development, economic activities, environmental impacts, employment opportunities, income levels, human poverty, transportation and infrastructure, and the provision of public needs.

There is strong economic interaction between urban and rural development. Farms preferred to be located in proximity to urban large markets to buy their yielding cash crops, and cover city daily consumption needs, they also benefit from being closer to urban public services. As well, linking rural areas with urban transportation creates possibilities to increase agricultural productivity and decrease rural migration to urban areas.

Table (4-3): The relations between city morphological development aspects and city modifiers aspects. (Researcher/ Alia- 2018)		
Morphological development aspects	**City modifiers aspects**	
	Population Growth aspects	**Economic Activities aspects**
1) Spatial policies	**The concentration of population and spatial scale :** -Volume of population basic needs -Increases total used area and built up density	**Land-use economics returns:** -Supply and demands in basic services -Industries location affect city diagram
2) Resources management	**Employment and productivity:** -Growth increases jobs opportunities -Growth increases number of labours -Growth affects the per-capita income -Development of human capabilities	**Allocation of capitals, investments and resources:** -Importance of economic activities to generate income -Economic activities polarise population growth -Degradation in economy cause outer migration -Resources and investments expenditure
3) Conservation of natural environment	**The urban environment:** -The urban environment is important for human welfare -Urban ecology affects natural environment	**Economic activities environmental effects :** -Natural resources create economic activities -Economic activities affect natural environment
4) Urban quality	**Living behaviours:** -Development or deterioration in living behaviours -Following new technologies -Preventing divisions between routes and classes -Effects on identity, aesthetic, safety and health secure	**Economic returns by urban quality:** -Land values -Economic planning and social justice -Economic decline causes urban quality decline -Investments in urban quality
5) Transportation and infrastructure networks	**Need for transportation and infrastructure:** -Volume of population basic needs (clean water, electricity, drain, sanitation, communication, internet) -Movement needs of population -Number of population affect infrastructure production and consumption cost	**Need for transportation and infrastructure for certain economic activity:** -Industrialisation process -Labours needs for Infrastructure and working trip -Interaction between industries -Transportations of raw materials and final products
6) Micro/macro-influences and growth	**Micro and macro growth controlling methods:** -Growth follows urban development -Controlling spread of cities within hinterlands -Create city smart growth -Support shrinking cities	**Economic activities and city morphology:** -Relation between urban and rural economises -Relation between production areas and markets -Economic decline of any urban areas affects the regional and national urban systems

4.5 Cities in Limited Economy (LECs):

There are variations between cities around the World in the limits of development. This research considers city population growth and economic activities as independent variables and city morphological development as a dependent variable, so the study of cities morphologies and growth in limited economy case is essential.

4.5.1 A Global Variation in Cities Development:

According to economic development, there are three classifications for nations. These are: developing, in transition, and advanced. There is another subcategory of least developed nation. (UN-Habitat-2005)

Developing Countries in general are countries which have not achieved a significant degree of economic growth compared to their population and which have in most cases a medium to low standard of living. On the other hand, developed countries have economic systems that are based on continuous self-sustaining growth in the tertiary and quaternary sectors and high standards of living. However, there are notable exceptions; some of these, countries are considered to have advanced economic systems and a significant component of primary industries in their national economies. The USA and Western Europe have very important agricultural sectors. The natural resource extraction is a very profitable industry (high value added) e.g. oil extraction.

Limitation in economy:

To define countries with limitation in economy, the word limitation, when it refers to an amount it only means a small amount, when it refers to needs it means covering a small part of needs, and when it refers to choices it means providing few alternatives. Limitation in economy, when it relates to a country's development, means a low level of wealth, capitals and organisation system. It also relates to the mount of fulfilment policies and strategies. This study discusses two sub-definitions: Limited Economy Region (LER) and Limited Economy City (LEC).

There are some factors that create an obstacle for the development processes in (LERs). Some of them are internal and others are external but the majority of them are difficult to control unless fundamental changes in economic and institutional systems are made and a level of flexibility is achieved in the international economic system (Taha -2007). Those development obstacles are:

4.3.2.1. Historical colonisation consequences: These include civil wars and local conflicts which negatively affect the use of available resources, development of appropriate local administration system, natural growth and habitation context of population in their countries' total areas. (Taha -2007)

4.3.2.2. Social development: In such economies, illiteracy and unemployment rates are very high as a direct result of low productivity. The increase in migration to urban areas increases unemployment rate there. There is a relationship between per-capita income and mortality rate in these countries. The low per-capita incomes are attributed to bad nutrition and bad health guidance, supplies and services. (Taha -2007)

4.3.2.3. Governing system: In (LERs), political situations are unstable and governmental institutions are weak and submissive to foreign dominators. Shortage in capitals decreases their development role. By corruption, countries lose resources; and the limited application of law and regulations constraints any development programmes and plans. (Taha -2007)

4.3.2.4. Economic development: Debt problem is a real obstacle to developing countries' efforts and renders their economies depend on outside resources. Budget planning leads to misallocation of resources. There is a massive expenditure on essential needs compared to expenditure on productive sectors. Expansion of (LERs) trade is reduced by difficulties in the rules of global free trade and their commodities weak qualities.

4.3.2.5. International relationships: Trade policies which are imposed on (LERs) negatively affect their small industries and prevent their growth. All the developmental programmes in the (LERs) depend basically on loans and external aid from rich countries and this hinders taking independent decisions and settling conditions there. The international economic crisis affected most the developing world brittle inner situations. (Taha -2007)

4.3.2.6. Technological development: Technology is expensive, beside that it helps in increasing the effective use of resources. (LERs) are considered as consumers not producers of technologies so there are difficulties to follow new inventions and adopt high technologies to support living behaviours. (Taha -2007)

4.3.2.7. The environment: degradation of the environment is a general global problem. Natural disasters like floods and droughts have hit many countries, and decreased their capacity to implement development programmes and sustain their essential capabilities and natural resources. (Taha -2007)

4.5.2 Limited Economy Cities (LECs):

A morphological development is a part of a total city development. Cities in the case of limitation in economy have special characteristics in their managing systems and morphological compositions.

4.5.2.1. Challenges facing (LEC) management:

1. **Accelerated problems:** Urban systems in (LECs) suffer from degradation of urban environment and shortage of housing, working opportunities, basic services, infrastructure and transportation. Besides that, (LECs) urban areas suffer from high rates of rural migration as a direct result of countries' poverty. That causes a decrease in city capabilities and an increase in the volume of urban needs.
2. **Rationality and strength of provided solutions:** At the built environment, there is instability of plans as a result of inappropriate planning decisions. Also problems in activating laws and regulations to protect the natural environment, living behaviours, traditional and historical heritage, city images and components.
3. **Forced priorities for economic development:** (LERs) countries' have to focus on applying economic development reforms to improve the quality of life. There are limitations in major economic activities causing unemployment or under employment, lack of equity of services and resources to different income levels. Poverty causes: persecution, segregation, increase in crimes, weakness in morals, and also directs all development resources and efforts to resist these ills.
4. **Capabilities of development makers:** Many cities, particularly in the (LERs), do not have adequate financial and human resources to conceive and implement medium- and long-term development strategies. There is inefficient intervention of government efforts, planning committees, research institutions and regulation authorities. That is because of shortage in institutionalisation systems, experiences, qualifications and capitals. The private sector role is weak, relative to its capabilities and the country's internal situation.

4.5.2.2. Challenges facing (LECs) morphology:

1. **Quality of urban areas:** (LECs) are characterised by low liveability, shortage of public services, inefficient transportation systems, lack of access to energy and clean water, inadequate sanitation, inefficient waste disposal, lack of green areas, and lack of entertaining facilities. There are city operation problems, caused by un-studied population densities. Most of the (LECs) are located in hot climates with difficult environments, but their buildings are: in endurable materials, not complying with surrounding environments, built with inefficient technology and un-satisfactory shapes and solutions.
2. **Plight areas within city**: There are extreme-poverty neighbourhoods' inside cities in such miserable conditions. There are massive clearance and redevelopment programmes, undertaken by the local authorities, combined in some areas with modernisation and new buildings aided by housing associations and private developers. Demolition of these areas creates spatial changes and redistribution of housing tenure. Besides that poor housing still rise in inner-ring suburbs of many metropolitan areas.
3. **Informal housing areas:** Neither the public sector nor the private sector produce adequate and sufficient low-income housing, thus urban poor are forced to turn to the informal sector for their accommodation. Informal settlements are situated outside the formal city and beyond the regulatory reach of the authorities, on land along railway tracks, riverbanks, swamps, flood-prone areas, landfill sites or places with heavy pollution. Most authorities refuse to install infrastructure in those illegal settlements that forces their residents to rely on the (often informal) private sector.
4. **Slums housing area:** A result of poverty, slum household is defined as a group of individuals living under the same roof lacking one or more of the following services: access to improved water, access to improved sanitation facilities, sufficient living area, stable structure to improve quality and durability of dwellings and security of tenure. Slums and squatter settlements have the reputation of being areas of crime, drugs and prostitution, thereby stigmatising their residents. In many cases, the poor have to pay many times more for a service than people in the formal city and this increases their poverty.

4.5.3 Constraints of Urban Development in (LERs):

4.5.3.1 Concept of constraints:

Any development effort is planned to execute defined goals. Goals to implement are confronted by obstacles which stop them or slow their progress. Such obstacles are considered as constraints. A constraint acts as a limitation of possibilities. In mathematics: the constraint is a restriction of the feasible solutions in an optimisation problem. In the theory of constraints (TOC)[7]: it is any factor that limits the performance of a system and hinders achieving defined goals. There is at least one constraint in any given system. (Alia -2007)

Constraints are not stable but they change due to the change in place and time. From the vision of the ability of human being; constraints are classified into two types: out of human being abilities and within human abilities. Generally, all science is made to develop the ability of the human being to satisfy his changing needs. But, there are always some factors that are beyond the human being's control (e.g. natural constraints like climatic conditions and geographical elements). The constraints mentioned here are constraints that affect the formal interventions of authorities and are related to the underdevelopment phenomenon. (Alia -2007)

4.5.3.2 Categories of urban development constraints:

There are three categories of constraints that are known to form the basis of any urban development programme: the first: physical capacity constraints: that include the characteristics of the city land and the total area available for city expansion. They are important dimensions of the national urbanisation policy. They define population densities and concentration, transportation and infrastructure, expenditure and services supplies by the per-capita population, economic integration and political capacity. This category of constraints is most linked with urban spatial growth. (Alia -2007)

The second: economic capacity constraints: that include the level of (GNP), the per-capita income and the structure of economic activities. They are essential factors in urban and regional development. The rate of growth of an economy is very important, because without growth there is no need or ability to decentralise economic activities.

[7](TOC) is an overall management philosophy introduced by Rd. Eliyahu M. Goldratt in his 1984 book titled: "The Goal"

The gap between the incomes of rich and poor regions directs formal economic investments to achieve economic balance. In this research, this category of constraints is most linked with economic activities. (Taha -2007)

The third: political and institutional capacity constraints: that include the selection of an appropriate strategy, the dissemination of information about it, its acceptance throughout the country, implementation methods and situations, and the strength to sustain the strategy over time. There is nothing more harmful to urban development strategies than shifting objectives and erratic implementation because they often lead to major irreversible issues. Indicators of the institutional ability to carry out policies are: the degree of ethnic fragmentation, the efficient structure of government, the share of central government expenditures into total public expenditures and the relative balance between public and private sectors investment. There are great differences between the planning concerns and criteria of centrally planned economies and those market economies. In this research this category of constraints is most linked with city morphological development. (Taha -2007)

4.5.3.3 Urban development constraints in (LERs):

The urban development constraints in (LERs) are classified into; physical capacity constraints: "Challenges and Opportunities", economic capacity constraints: "Poverty and Resources" and political and institutional capacity constraints: "Institutionalisation and Partnerships". Table (4-4): explains urban development constraints in the (LERs), All the constraints are linked together and every change (increase or decrease) in the role of each one causes change (increase or decrease) in the other's roles. Table (4-5): discusses the negative effects of the constraints in the urban development of the (LEC)-

Table (4-4): Urban development constraints in the (LERs). (Researcher/ Alia- 2018)			
Scaling of urban development constraints		**Developing Countries urban development constraints**	
Physical constraints	• Net population density based on arable land; • Transportation and infrastructure expenditure and services supplies in the habitation area the per-capita.	**Challenges and Opportunities**	a) Basic necessities: 1. Suitable urban housing; 2. Basic services for urban areas solution; 3. Urban transport programme. b) Dynamic effectiveness: 1. Sustainability: sustainability of urban areas and role of cities in sustainable development; 2. Flexibility.
Economic capacity	• Level of GNP the per-capita income; • Rate of growth of the economy ; • Inequities; • Unemployment.	**Poverty and Resources**	a) Urban poverty; b) Capitals: 1. Finance; 2. Labour; 3. Technologies.
Political and institutional capacity	• Degree of ethnic fragmentation; • Efficient structure of government; • Influences and rationality of decisions; • Public expenditures; • Relative balance between public and private sectors investments.	**Institutionalisation and Partnerships**	a) De\centralisation; b) Institutionalisation; c) Monitoring and evaluation mechanisms; d) Partnerships: 1. Local governance "The right to the city"; 2. Public participation; 3. Private sectors contribution; 4. City-to-city cooperation; 5. International non-governmental organisation; 6. Global campaign. 7. Rural urban interactions.

Table (4-5): The negative effects of development constraints in the (LECs). (Researcher/ Alia- 2018)			
The constraints	**Causes**	**Horizontal effects(quantity)**	**Vertical effects(quality)**
1.Challenges and Opportunities			
e) Basic necessities	• Inequitable or shortage in distribution of the basic necessities.	• Unbalanced polarisation causes inefficient spatial distribution. • Inefficient economic performance.	• Human poor quality of life. • Decreasing in available capabilities.
f) Dynamic Effectiveness	• Development without ability of dynamicity.		
2.Poverty and Resources			
g) Urban Poverty	• Insufficient individual or public resources for development.	• Increasing the role of the government and partnerships relations in the development. • Inefficient urban development programmes.	• Human poor quality of life. • Decreasing in available capabilities.
h) Capitals			
3.Institutionalisation and Partnerships			
i) De\centralisation	• Weak governing performance in making development.	• Inefficient urban development programmes. • Waste of resources.	• Decreasing in available capabilities.
j) Institutionalisation			
k) Monitoring and evaluation mechanisms:			
l) Partnerships			

4.6 Conclusion:

The major guides of urban development are: sustainable urban development, human welfare, efficient spatial distribution, and efficient economic performance. Planning for urban development is a long-term central comprehensive planning activity of a nations that is facilitation intervenes all levels of planning. The main aspects related to micro and macro-levels of urban development in a national urban policy include: spatial policies, resource management, conservation of natural environment, urban quality, transportation and infrastructure pattern and micro/macro influences and growth. There is a clear relation between development and city modifiers: population growth and economic activities.

Urban development constraints in (LERs) are classified as; physical capacity constraints: "Challenges and Opportunities", economic capacity constraints: "Poverty and Resources" and the political and institutional capacity constraints: "Institutionalisation and Partnerships". The negative effects of development constraints in the (LECs) are distributed to first, horizontal effects related to city development quantity include: unbalance polarisation causes inefficient spatial distribution, Inefficient economic performance, increasing the role of the government and partnerships relation in the development, inefficient urban development programmes, and waste of resources. Second, vertical effects related to city development quality include: poor quality of human life, and decrease in available capabilities.

Chapter (5):

GENERATING A CITY MORPHOLOGICAL MODEL (CMM)

5.1 Introduction:

Urban morphology is viewed as a system that integrates many subsystems. Population growth and economic activities are phenomena that take place upon a city morphology. To proper understanding them needs a study of their effects within a city morphology, in the form of rational relationships or a model.

The process of designing a city morphological model (CMM), includes the previous steps mentioned in chapter (2). This includes defining goals of the model, projecting phenomenological laws controlling the model, developing the structure of the model, determining and explaining data and information related to the model, defining model calibration and intervening factors, exercising model validation; and last, the methodology to adapt the model in city morphology planning.

5.2 Defining Goals of (CMM):

The goals of designing this (CMM) include:

4.2.1. Enables studies of the effects of population growth and economic activities upon a city morphology as in terms of spatial composition and a managing system. This is done by making a simple form of relationship, with a high rate of flexibility and coherent internal relations, which are linked in reasonable sequence of relations. That internal phenomena of the model are easy to understand, clear to follow up by time in investigating actions and reactions, and is able to feedback.

4.2.2. Considers the characteristics of a real time city[8], as a utopian case, which is capable of being updated, due to dynamic changes that happen in a city morphology and its modifiers by changes in daily life and transition of

[8] The real time city terminology mentioned by Stephen Graham in a book (Imagining Cities, scripts, signs, memory) -page 31- as the city after telecommunication- (Westwood and Williams – 2005)-

civilisation. Thus, such model enables evaluating efficiencies of different cities, as well as studying situations of cities in different economic positions.

4.2.3. Helps to provide a strategy frame that keeps a city efficiency under all development situations. That defines the effects of any intervention on a city morphological development, to increase the rationality of decisions-making process in city morphological development especially in issues related to the modifiers set by the study. This strategy, considers that planning for urban morphological development is in a shape of policies and procedures, is comprehensive issue works in macro levels (global, national, regional) or micro level (local, city, districts). It must also be mentioned, sustainable planning is a long-run activity, in need of continuous monitoring and a correlating mechanism which considers the volume of city resources and capabilities in relation to city constraints and modifiers.

4.2.4. Enables focus on *Khartoum* city, the capital of *Sudan,* which is regarded as a developing country, facing problems of high rate of urban growth, and ineffective spatial distribution of population.

5.3 Phenomenological Laws Controlling (CMM):

5.3.1 Phenomenological Law Controlling Evolution of a City Morphology:

To study city morphology there are main factors that must be considered for their major contribution in directing the functional morphology of cities. They are regarded in this study as functional causes and consequences. Causes include: city activities, city interactions, city micro-influences/internal networks and city macro-influences/external networks, while the consequences of that include: city morphology and city images. See figure (5-1).

a) City activities: these are generally categorise by ownerships, users, frequency, areas, technology and environment. They are functionally categorise as residence, job, and recreation activities.

b) City interactions: These are relationships between two or more activities expressed in terms of functions or movement associated pattern: e.g. agglomeration, trips generations...etc.

c) **City micro influences/internal networks:** These include the city structural composition, its hierarchal networks, and centrality. They are represented as interactions between activities in the form of channels between land uses, and system of services distribution.

d) **City macro-influences/ external networks:** The relationships between a city and its surrounding environment or settlements that identifies in shape of external expansion of the city interaction processes.

e) **City morphology:** This is express the position of the spatial zone of each activity in a accordance to its resources and surrounding environment, as well as, regarding its interactions, networks and influence relations among activities. This represents the city identified land uses distributed on internal networks (micro-scale) and external networks (macro-scale).

f) **City image:** This is the sensuous reflection of functional, identical and aesthetical composition of a city morphology. Expressed by urban design efforts using city components such as: streets, masses, facades, squares, nodes, landmarks, and edges.

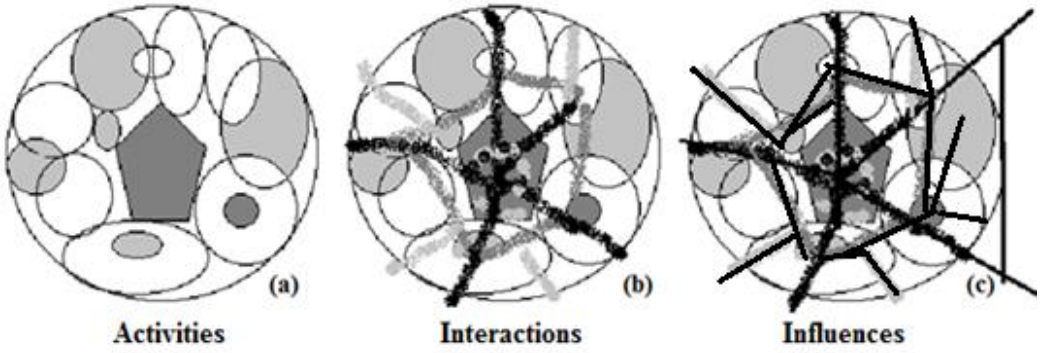


Figure (5-1): The research approach in modulating the morphological context of the city. (Researcher/ Alia- 2018)

There are other factors that contribute city morphology, but they are not considered in this study because of their limited focus on identifying a single city, while this model is expected to be applicable to all cities. They include:

1. Physical constraints within city form: (this is related to the natural characteristics of the place such as site geography, topography, climate…)
2. City status: (this related to the size of city population), and
3. City ideology: (which is represented the thoughts of its community, in term of: religion, ethnicity, culture…etc.).

5.3.2 Characterising a City Morphology:

To characterise a morphology of a city, one needs to define its activities, interaction, networks and influences.

5.3.2.1. City activities: These are functions carried out by individuals at different places to fulfil physiological and institutional needs, as well as personal obligations and preferences. Every activity has a space (land use) and activities cluster together for service provision. Most cities accommodate a combination of functions, when one of them is dominant, a city is categorised by it (e.g. Administration, industrial, services …). The activity generators factors include:

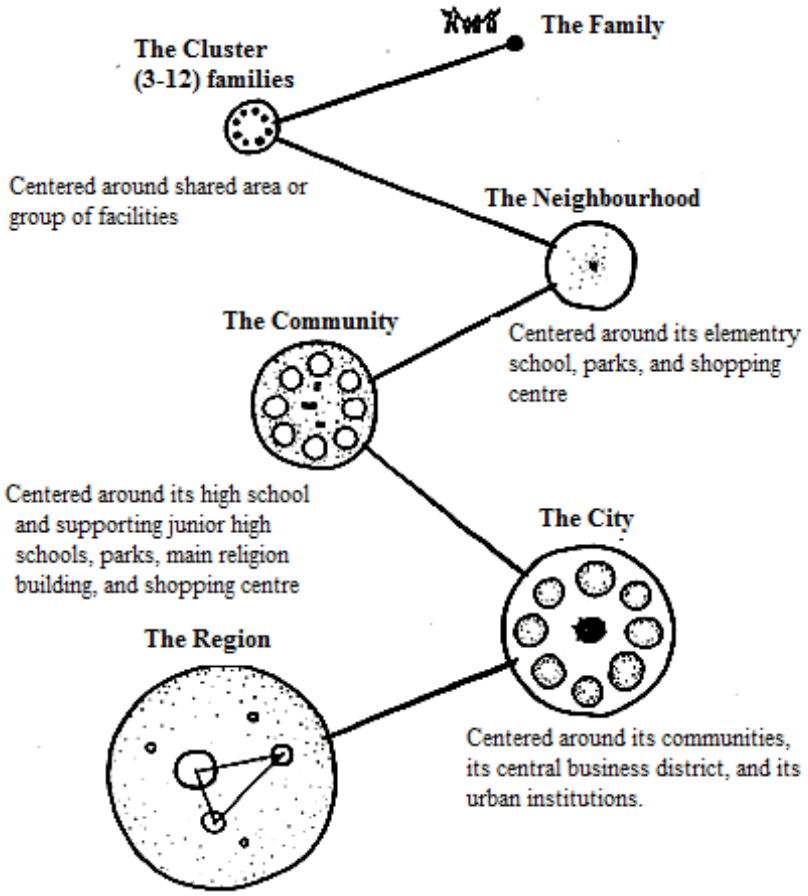
a) **Land, population, and environment:** these are factors that affect the spatial distribution of human activities on a site. It involves the management and modification of the natural environment into built environment, according to the needs of population and conservation of natural resources.

b) **Allocation of resources:** Resource allocation is a plan that specifies the uses of available resources -including land- to achieve future goals. Also it is the process of allocating resources among land, people, various projects or business units.

5.3.2.2. City interaction: Interaction is an action that occurs as two or more objects affect each other. All city systems are related and are interdependent and every action has a consequence. All cities are planned to avoid anarchy, congestion, inefficiency, or unwanted generated actions or interactions. The major categories of interactions are: existence or inexistence of elements (ecological or physical components), travel as moving things (humans, animals, vehicles) and the transition of: authority, work, social relation or services as (information, clean water, energy, sanitations, drainage …). The impacts of city interaction on a city morphology are categorised to:

a) **The environmental endurance:** This considers the relation and interaction between a city and the environment as a natural ecology, and between the city residences and its natural and physical resources through time.

b) **Interrelations in a city morphology:** City social interrelationships consist of the family as the basic social units, cluster, neighbourhood, community and any identity shape. See figure (5-2). There are other functional interrelations between city main functional elements (working, living and public services) and between semi categories of functional units of each element (administration firms in working component). Also interaction exists within each firm, there are relationships between its industrial and services components. These relationships arrange city land uses and generate trips between them.



c) Figure (5-2): City social interrelationships. (Simonds and Starke -2006\ (P: 335))

d) **Interaction between Job and residential location:** Every city has a one core or multi cores of businesses affecting the decentralisation of the population. Industries such as finance, insurance and real estate benefit most from agglomeration of economic activities. There are direct relations between the place of work and the place of residence represented in the everyday travel to work. In reality, residential areas are located close to firms to minimise commuting cost and time. The resident movement to special areas creates new jobs, especially in services. The substitutes such as: city characteristics, city

policies, capital and noncapital cities, number of state or non-state workers, hours of work per week, private firms, and individuals' preferences in choosing their residential locations, all produce the unique city interaction networks.

5.3.2.3. City influences and networks: City micro influences/ internal networks are the communication channels within a city. These networks are in various forms, nature, and importance. They include: first: physical connections to and from places (such as road traffic, canals…etc.) and the supplying and disposing connections of materials (like: clean water, electricity…etc.). Second: immaterial connections (such as shared class, cultural links...etc.). Third: services networks: these are hierarchies and levels of providing public services according to number of people, distances to supply and the particular way of living in a city. City macro-influences/external networks are attraction forces of the city centre and its ability to serve and control surrounding lands and territories which include other cities, towns, rural areas, and countries. Scheduled flights, global finance and trade, migration are regarded as macro networks of cities. The capital city controls all the surrounding region and acts as country gate. The concentration of the traffic is usually in the city centre, see figure (5-3)

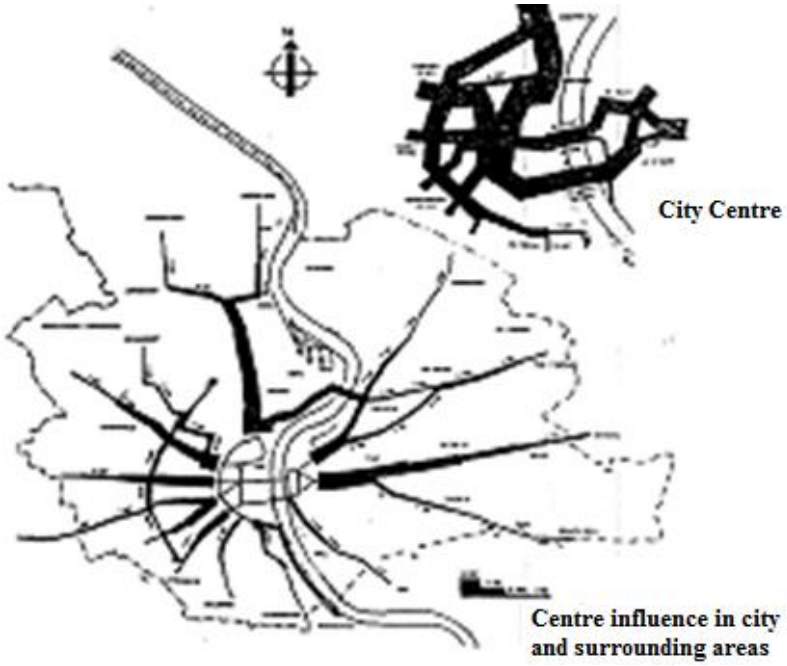


Figure (5-3): City influences rate related to traffic volume from the city centre\ (Abass-2011\ (P: 231)) the thickness of the black colour indicate the concentration of traffic.

There are four factors shapes city networks:

a) **Nodes:** central areas in the city that serves the surrounding, or areas in the crossing points in a city micro and macro networks. The city itself is regarded as a node where different regional networks run together. The concentration of governmental bodies, public services, trade, markets, and transportation, are the major factors defining nodes.
b) **Gravity:** is the power of an activity to attract users or other activities in the spatial distribution. In population growth considerations it causes urbanisation, and in economic activities considerations it causes increase in supply and demand of population needs.
c) **Domination:** some activities, land uses or networks are more powerful than others. That increases the gravity of their nodes in the city micro and macro networks.
d) **Agglomeration:** it's a relationship between activities, which acts as a spatial distributer of activities, stimulating them to be in close proximity to each other.

Figure (5-4): Explains the pattern of the relation between the previous four factors: The nodes and their network relations, their hierarchy defines dominance power, movement between them explains gravity relations and their surface measures their influence.

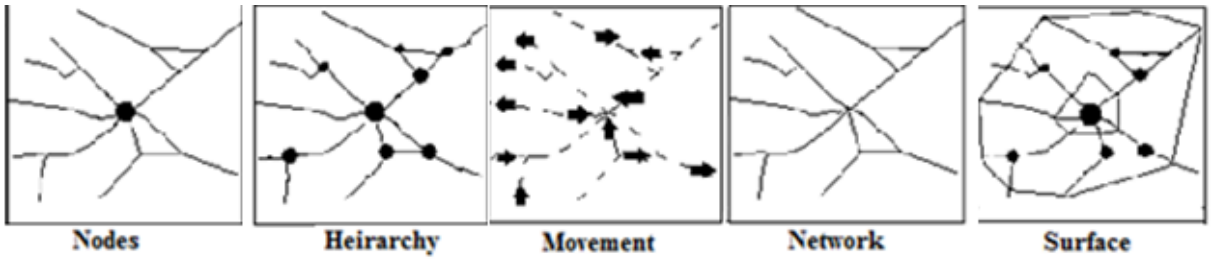


Figure (5-4): Spatial components for the city and the regional systems\ (Khawgeli-2007\ (P: 9))

5.3.3 Intervening Aspects:

The interventions are made to develop city morphology are mainly focus on the following aspects:

5.3.3.1. Intervening activities on the city morphology:

a) **Working activities:** functional categories of jobs in the cities are: urban agriculture, industries and services. Services include education, health, government, commercial, cultural services, entertainment…etc. All working activities are categorised as: global or local, private or public, high tech- or low tech-, energy intensive materials or less intensive materials, polluting or less polluting, highly expensive or not, labour intensive, and skilled workers.

b) **Living activities:** The supply of dwellings has various choices related to the dwellers characteristics like religion, income, culture, race and preferences. Preference of dwellings in the city changed from the detached house to the attached row house, town house, crescent or atrium house to the urban tenement, the apartment block and the high-rise tower.

c) **Social activities:** Social spaces in cities are: institutions work in services include: religion, health, education, cultural, sport, governmental, community services, post offices, courthouses, libraries services or open spaces like streets, piazzas, markets and parks. These were the places for spontaneous interaction or a distinct realm, maintained by the public. There are differences among the social activities in the city related to their specialisation, users' characteristics as number, age, religion, income, race…and so on. The public spaces are generally related to government but there are public private domains. Other public services, that are essential to the city, include transportation, clean water, energy, waste disposal drain, and sanitation supplies.

5.3.3.2. Intervening interaction on city morphology:

a) **Working zones characteristics:** Working zones link with transportations nodes and supply with better transportation and infrastructure. Firms and state institutions, especially, in the capital city concentrate in the CBD. Institutional with a public direct relation exist in highly populated areas. Workshops with limited pollution locate themselves near residential zone. Industries are located in the suburbs far from residents' area because of their environmental effects, to be near a regional transportation node or a source of raw materials.

b) **Living zones characteristics:** The most healthy and attractive sites in the city are for housing: locations with natural amenities, dramatic open spaces, distant views, the water's edge, and adjacency to great parks and open spaces.

c) **Public zones characteristics:** Public spaces are preferably: being connected to different parts of the city, extending to the public streets, transportation stations, parking areas, pedestrian circulation accesses, squares, urban institutions, parks, gardens and playgrounds of the city. Also they present city images by exterior and interior architectural facades. The largest and high level of those public spaces and facilities are located in such way to serve a highly concentrated number of people in inner and central parts of the city.

d) **Transportation and infrastructure networks characteristics:** The provision of transportation and infrastructure must connect to each cell in a city and follow a city streets. It is likely to be higher in the central area, which is the place of population concentration and the main node of streets network in most cities. The performance of the networks of transportation and infrastructure is the main factor controlling interventions in this field; the others factors include their cost related to living behaviours, sustainability and the environment pollution.

5.3.3.3. Intervening networks on city morphology:

a) **Centres:** Within a city, the historical urban core (city centre) approximates the geographical point of gravity of the city stock of dwellings. In urban areas, land values are often higher in central areas, thus making up an incitement for more intensive utilisation of building sites. For many types of businesses, a location in the largest city of the region offers agglomeration benefits. Large cities are also often nodes in national and international public transport networks (express buses, railway lines, flights, naval transport...). The city centre is in need to be well designed as an area that host recreational and entertainment activities, ethnic and multicultural services.

b) **Spatial determination of the functional districts:** Basically, urban functional zones fall into one of five major categories: residential, mixed residential-commercial, commercial, industrial and special (e. g. military, power plants, sports complexes, airports, shopping malls etc.). Each category has a

number of sub-categories. In the heavy industries the supply of the raw materials determines the location of the industry in the regional zone but it must consider the social and community characteristics of the population. In the light industries zone, the market and transit system determine the location of the industry. The housing area is distributed into smaller zones or districts through the city. Climate, topography and land geology have their effects on the orientation of site locations and units areas. The distribution of houses reflects the society differentiation of residences, living behaviours and national unity.

c) **Guides to land uses planning:** The human living conditions are used as a guide in land uses planning, all decisions are, therefore, focused on making sustainable, comfortable and enjoyable life. The location of the industrial district is also used as a guide in land uses planning, the main concern in this is the economic procedures towards big profits in the industrialisation process with sustainability consideration.

5.3.3.4. Intervening influences on city morphology:

a) **Centre and margins:** The city contains more than one centre around which activities revolve, some activities are attracted to particular nodes while others try to avoid them. Figure (5-5), explains categories of positioning of the main city centre or other sub-centres and their relation to their ambiance elements and surfaces, also the city shape of spatial growth. At the national urban system level, cities are part of a complex system of interrelated urban places and are key elements in the economic, social and political organisation of regions and nations.

b) **Guides to regional and transnational planning:** There are three levels of urban systems identified as follows: a national system dominated by metropolitan cities. Nested within the national system are regional sub-systems of metropolitan partial cities, and mid-tyre cities in the region. Also contained within regional sub-systems, local sub-systems or daily urban systems representing the life space of city residents. National urban systems vary with regard to their degree of closure or openness to outside influences and global relations, the larger cities usually expand and develop their economic and social systems beyond country boundaries. See figure (5-6) and figure (5-7).

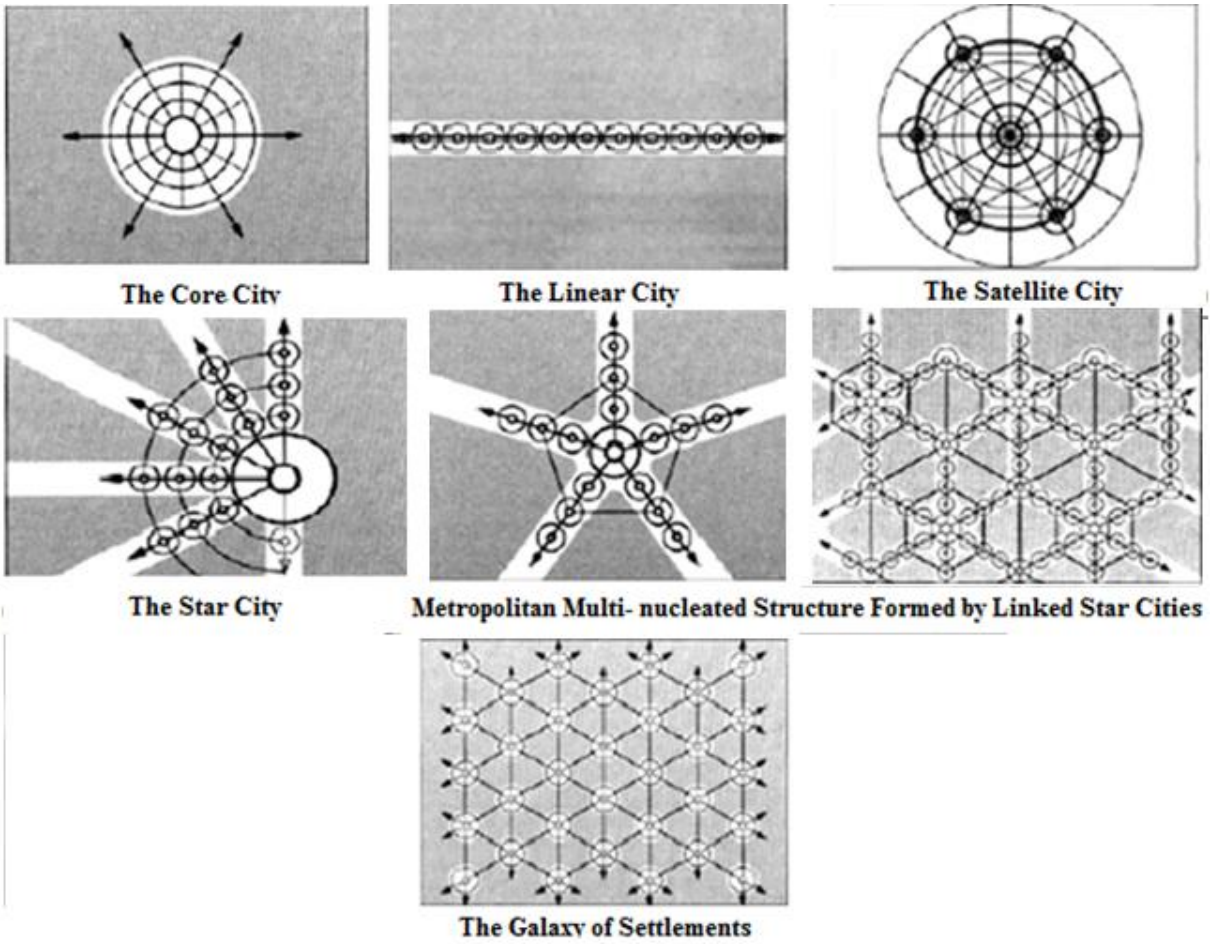


Figure (5-5): Alternatives city spatial growth forms. (Frey-2005\ (P: 75-92))

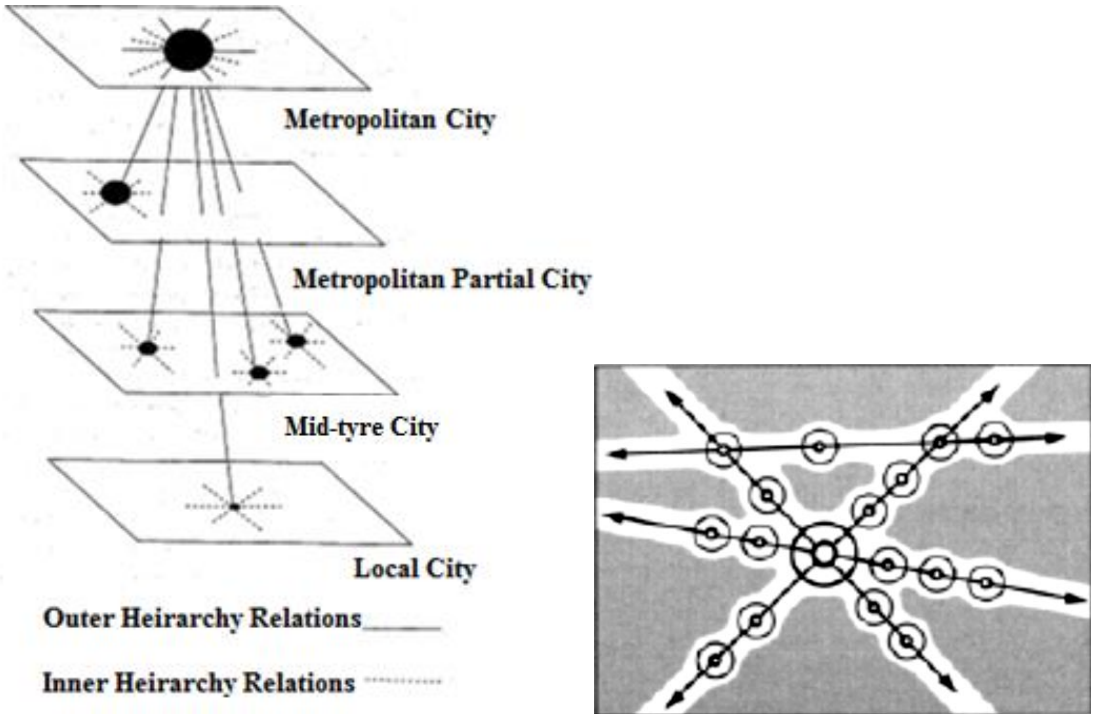


Figure (5-6): Hierarchical structure of centres in the metropolitan city\ (Khawgeli-2007\ (P: 196))

Figure (5-7): The polycentric net or regional city, produced by Lynch in1985\ (Frey-2005\ (P: 75-85))

5.4 Developing Structure of (CMM):

5.4.1 A Proposed Model for City Morphology:

Making a conceptual/ functional model to city morphology is a necessity, to understand the factors that contribute in making city morphology, the process of making such morphology, evaluate and fix that morphology. That model can also enable us to observe and conclude the effects of the population growth and economic activities in the city morphology and translate that to spatial and functional relations.

Data follow diagram or DFD is one of the most simple and effective tools to understand, perfect and implement new processes or systems. DFD, is a visual representation of any process or systems flow of information. The logical form of DFDs diagrams displays the theoretical process of moving information through a system. DFDs, shapes and labels to represent the four main elements: Process, data store, data flow and external entity. (Beginner's Guide to Data Flow Diagrams- 2018)

The basic factors have to be studied in making DFD form are:

5.4.1.1. ''Process'', which illustrates the actions which happened through the model and their transformation from input to output. It is a procedure that manipulates the data and it follows by taking incoming data. A process use logic source of data and control its follow of direction. It always starts and finishes the model.

5.4.1.2. ''Store'', the result of such actions which lay the logic of a city morphology and resources levelling. Data store hold information for using data input flow through a process and then through data store, while data outputs follow out of a data store and then through a process.

5.4.1.3. ''Flow'', which is represented by functional channels and movement in the process. Data flow is the path the system information from external entities through process of data stores.

5.4.1.4. ''External Entity'', which includes external factors interacts with the model out its existence body. It is either the source or destinations of information, so it usually placed in the edge of the model. (Beginner's Guide to Data Flow Diagrams- 2018)

The city morphological model depends on the relations between these four factors in modulating the process of making and modifying city morphological context. The result of this process measures by the nine evaluation factors of city morphology.

5.4.2 (CMM) Internal Relations:

5.4.2.1 (CMM) vertical relations:

Columns in the (CMM) describe city transformation elements, these are: characteristics, interventions and results as observations. They include problems and challenges facing planning efforts.

1. The main elements of the model are: "city activities", "city interactions", "city micro-influences/internal networks", and "city macro- influences/ external networks".
2. The above elements transform by city processes, in this way: a certain city information about “land, population, and environment" and "allocation of resources, stores on city morphology as "the environmental endurance", "interrelations in the city morphology" and "interaction between Job and residential location". According to that, there are two produced relations flows and external entity structure city morphology as "nodes", "gravity", “domination" and "agglomeration" relations.
3. The intervention of these acts are: defining a certain city "working, living and social activities". That stores as "working, living, public zones and transportation and infrastructure networks characteristics". These relations produce three flows "centres", "spatial determination to the functional districts” and “guides to land uses planning". Their external entities are defined as: "centre and margins" and "guides to regional and transnational planning" relations.
4. The results of these interventions, categorise according to: the processes of "land uses" and "resources levelling". That stores as "detailed zoning", "land values" and” transportation and infrastructure patterns". The internal entity relations flow are: "micro-morphology" and "micro- spatial growth". The external entity relations flow are: "macro-morphology" and "macro- spatial growth ".

5.4.2.2 (CMM) horizontal relations:

Rows in the (CMM) include the following elements: process (activities), store (interactions), flow (networks) and external entity (influences). Each of these factors is studied in the following form:

1. Processes: this illustrates transformation of information in the model from input to output. The input in this system starts by "city activities" as relations between "land, population, and environment" and the "allocation of the resources". These act as

daily human behaviour, which reflects on city interventions in the forms of "working; living; and social activities". The results of such interventions in the city morphology control its "land uses" and “resources levelling".

2. Stores: this defines the input of information concerning about city activities in "city interactions"; which include "the environmental endurance", "interrelations in the city morphology"; and "interaction between Job and residential location". Interventions of those factors appear as "working; living; public zones; and transportation and infrastructure networks characteristics". Their results in the city morphology are in the form of: the "detailed zoning"; the "land values", "transportation and infrastructure patterns".
3. Flows: this defines the store of interaction relations in the city process in shape of "city micro-influences internal networks"; which is formed of: "nodes"; "gravity” as well as; "domination" and "agglomeration” relations. These relations are intervene city in defining its "centres"; "spatial determine to the functional districts" and "guides to land uses planning". The Results of these are: the "micro-spatial morphology" and "micro-spatial growth" of a city morphology.
4. External Entities: this defines the external effects to the (CMM) system, and interacts with it. That acts in the shape of "city macro- influences/ external networks"; which also contains the previous networks in the shape of relations: "nodes"; "gravity”; "domination”; and "agglomeration”. But here these factors intervene as "centre and margins" and "guides to regional and transnational planning". The results are: the "macro-morphology" and "macro- spatial growth".

5.4.3 (CMM) Structure:

Representing a city morphology requires simulating city activities, their internal relations and interactions between them with determination of relevant networks and influences relations. This representation is used as a tool to express the existing system and also it predicts its future evolution. The model must discuss the dynamic transformation of city morphology and act as a method of data collection and analysis that helps in decision-making. The proposed model is a functional one based on a matrix form of four columns and four rows, with vertical and horizontal relations arrangements. That depends on DFD methodology of data treatment. See table (5-1).

5.4.4 Diagramming the Proposed (CMM):

City planning categorises to: planning of a new city or a re-planning of an existing one. The city planning or the re-planning in this research model moves through three stages, see figure (5-8):

1. Determine city system processes: in the form of city land uses and resources levelling; as imaginary decisions or available data.
2. Stores the previous information by determining: detailed zoning, land value, transportation and infrastructure patterns; as decisions or available constraints.
3. Determine flows and external entities: these are represented by micro and macro morphologies. As planning, re-planning or any other development decisions. That is directed by the micro and macro-spatial growth projections.

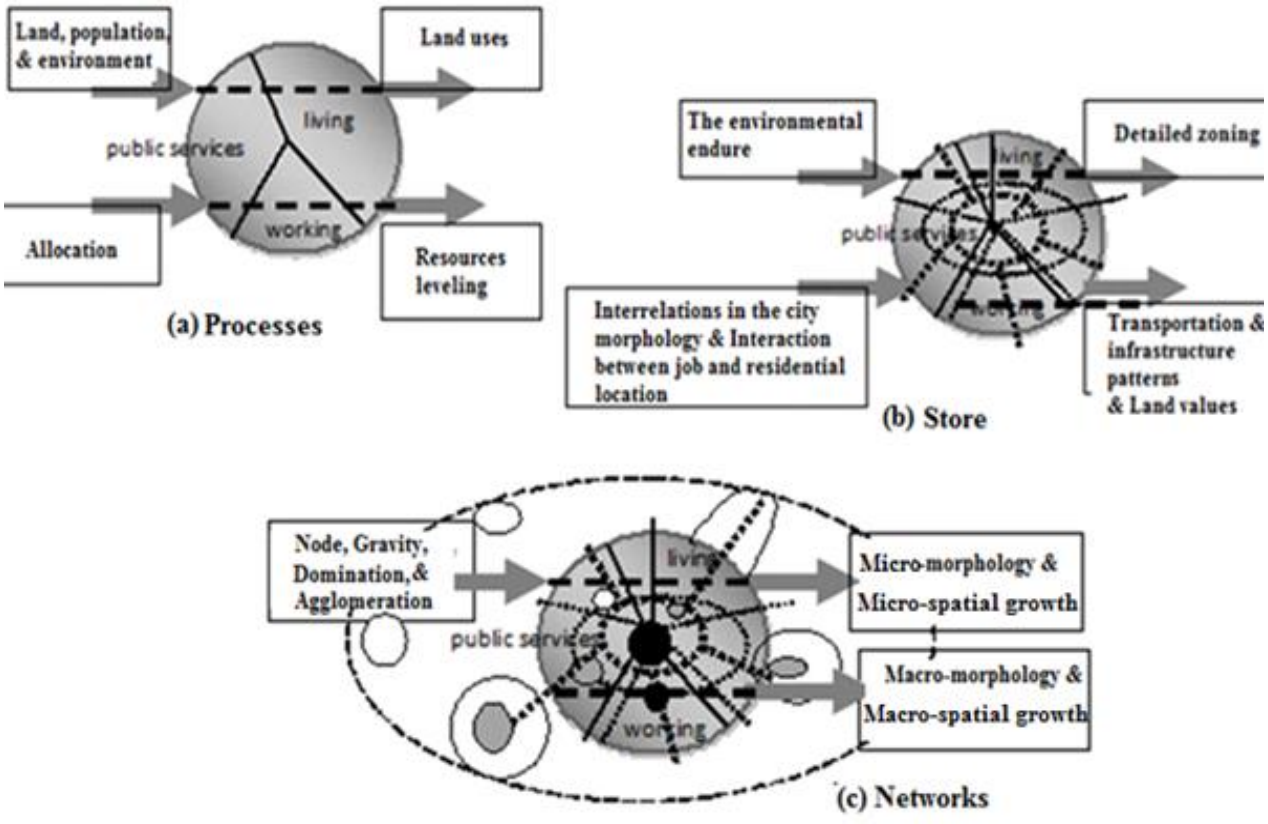


Figure (5-8): The research model of city morphology. (Researcher/ Alia- 2018)

Vertical relations

Table (5-1): Proposed (CMM) city morphological model. (Researcher/ Alia- 2018)				
(a)Elements		**(b)Acts**	**(c)Interventions**	**(d)Results**
Processes	**City activities**	1. Land, population, and environment 2. Allocation of resources	1. Working activities 2. Living activities 3. Social activities	1. Land uses 2. Resources Levelling
Stores	**City interactions**	3. The environmental endurance 4. Interrelations in the city morphology 5. Interaction between Job and residential location	4. Working zones characteristics 5. Living zones characteristics 6. Public zones characteristics 7. Transportation and infrastructure networks characteristics	3. Detailed zoning 4. Land values 5. Transportation and infrastructure patterns
Flows	**City micro-influences/ internal networks**	6. Nodes 7. Gravity 8. Domination 9. Agglomeration	8. Centres 9. Spatial determination to the functional districts 10. Guides to land uses planning	6. Micro-morphology 7. Micro-spatial growth
External Entities	**City macro-influences/ external networks**		11. Centre and margins 12. Guides to regional and transnational planning	8. Macro-morphology 9. Macro-spatial growth

Horizontal relations

5.4.5 City Morphological Development and City Modifiers Aspects in (CMM):

The purpose of this model is to study the effects of city modifiers, population growth and economic activities, upon city micro and macro-morphologies. The internal relationships in this model must represent the process of making and intervening city morphology and relate that to the aspects of urban development and city modifiers. Table (5-2) explains how this relation is represented in this model.

5.5 Determining and Explaining Data and Information Related to (CMM):

The model uses qualitative data analysis in the shape of scenario writing that explains two sequences of data treatment: first acts, interventions, and results; And second processes, stores, flows and external entities. That is to discuss certain morphology for a city by understanding the causes of morphological transition and the effects of such transition in the city efficient performance.

Each elements of the previous, translates to a quantitative research via statistical, mathematical or computational techniques. The use of quantitative data is to support understanding. That is because the qualitative analysis defines and approves a phenomena but does not give calculation which is necessary in formulating strategies priorities and portions, in making-decisions and in discovering risks. For population growth and economic activities, their measurements are explained in chapter (3).

5.6 Defining (CMM) Calibration and Intervening Factors:

The methodology of evaluation the (CMM) is based on cause and effects relationships, it enables evaluation of city physical performance and rationality of development decisions. That also enables discussing and measuring the interruption of city modifiers, population growth and economic activities in city micro and macro-morphologies. To compare between different cities or to judge the morphological development situation of a city, the efficiency concept is used in (CMM) as a measuring tool. The evaluation process is a systematic analysis, of performance and impacts of the city efficiency concerns, guided by urban morphology development aspects.

Table (5- 2): City morphological development and city modifiers aspects in (CMM). (Researcher/ Alia- 2018)					
Morphological development aspects	**City modifiers aspects**		**(CMM) aspects**		
	Population Growth	**Economic Activities**	**Acts**	**Interventions**	**Results**
1) **Spatial policies**	-The concentration of population and spatial scale	-Land-use economics returns	-Land, population, and environment -Allocation of resources	-Working activities -Living activities -Social activities	-Land uses -Resources Levelling
2) **Resources management**	-Employment and productivity	-Allocation of capitals, investments and resources			
3) **Conservation of natural environment**	-The urban environment	-Economic activities environmental effects	-The environmental endurance -Interrelations in the city morphology -Interaction between Job and residential location	-Working zones characteristics -Living zones characteristics -Public zones characteristics -Transportation and infrastructure networks characteristics	-Detailed zoning -Land values -Transportation and infrastructure patterns
4) **Urban quality**	-Living behaviours	-Economic returns by urban quality			
5) **Transportation and infrastructure pattern**	-Need for transportation and infrastructure	-Need for transportation and infrastructure for certain economic activity			
7) Micro/macro-influences and growth	-Micro and macro-growth controlling methods	-Economic activities and city morphology	-Nodes -Gravity - Domination -Agglomeration	-Centres -Spatial determination to the functional districts -Guides to land uses planning	-Micro-morphology -Micro-spatial growth
				-Centre and margins -Guides to regional and transnational planning	-Macro-morphology -Macro-spatial growth

5.6.1 A City Efficiency:

City efficiency refers to: the performance of the city and its possibilities to satisfy its citizens' needs and wants, that in the form of (CMM) aspects. Efficiency is measured by five criteria:

5.6.1.1. Goals (e.g. the input and the output, cost and revenues);

5.6.1.2. Determine factor (e.g. social, economic or technological efficiency);

5.6.1.3. The advantages and disadvantages: (e.g. human welfare);

5.6.1.4. Related regional consideration (e.g. other places in the region) ; and

5.6.1.5. Justice (fair standard).

The research uses the goals approach by taking real time cities as an efficient utopian city model, the determined factors approach to investigate the effects of population growth and economic activities, and the limited economy city model is concluded by comparing its special characteristics with the efficient model of the city.

5.6.2 Measuring Efficiency:

To achieve accurate measuring of efficiency, this study uses determine fundamental efficiency factors, related to the research purpose.

1. **Needs of cities:** In 1996 (HABITAT) Agenda, recommended the needs of the cities by determining improvement aspects in the city' programme areas which included: providing adequate jobs and shelter for all; promoting sustainable energy and transport systems in human settlements; promoting the integrated provision of the environmental infrastructure: water, sanitation, drainage and solid waste management; promoting human settlements planning and management in disaster-prone areas; promoting sustainable construction industry activities; improving human settlements management; promoting sustainable land-use planning and management; and promoting human resource development and capacity-building for human settlements development.

2. **Characters of urban zones:** Include, increasing city productivity; diversity in the sources of public treasure; good employment opportunities as working methods, hours and income; decreasing cities capacity in consuming natural resources and production of pollution and waste; suitable environment; adding and protecting the

factors that improve human health; providing adequate transportation; achieving good infrastructure system; availability of public and social services; conserving ecology; improvement in industry and commerce; development in the physical planning system by new types of building; growth in the land value; and growth in the building pattern.

3. **City design considerations:** Include, degree of containment of development in the city structural and morphological form; access to services and facilities with the minimum exertion; access to green open spaces for all citizens; adjustment of population density relative to land needed for social, environmental, human health and economic aspects; enhancement of environmental conditions to conserve human health; potentiality for social mix through a variety of housing to insure social and economic opportunities equity; potentiality of local autonomy for poor and weak classes, minorities and also combinations; potentiality of self-sufficiency by mixing and generating different production and economic activities; viability of mixed uses to decrease travel generation and needs for transportation; viability of public transport which is comfort, accessibility, reasonable cost and safety; dispersal of vehicular traffic for public and private transit; degree of adaptability for all natural and built up environment; image-ability of the city (the physical entity) as a whole with modernity, heritage and aesthetical aspects; Image-ability of parts of the city (neighbourhoods, districts, towns) with identical and distinguishable characteristics; and sense of place and centrality insuring unity and networking between morphology and community cells.
4. **City accentuation:** That means, city has an efficient and a central role in the region and country development. It has rural and urban successful association in movement, services and production aspects; and the city has global strong networks of communication as well as presence and glory for both its citizen and nation.

5.6.3 Measuring Efficiency in (CMM):

Table (5-3) defines efficiency in the city model performance and determines methods to judge, and measure a city efficiency and how to compare it with other cities.

5.7 Exercising (CMM) Validation:

The validation of (CMM) is measured by the rate of uncertainties. Uncertainty refers to a lack of data or an incomplete understanding of the context of a decision. It is either qualitative or quantitative. Uncertainty reduces or eliminates with more or better data. The (CMM) deals with cause\ consequences method, it is designed to treat any matters that interrupt the city morphological development process. (U.S.EPA-2017)

5.7.1 The Powers of Changes in the Proposed Model:

Modification of the city is a dynamic process. City changes continuously in area, number of residence, land uses, built up densities, open spaces, activities, interaction between activities, and quality of living. That is planned (intended) or is observed as a pattern of activity (emergent) related to daily life in the city. The discussion of city modification process include:

5.7.1.1 Power: refers to the capacity of a thing to direct or influence other things. It causes changes in a city morphology that is categorised as internal\external city entity and under\out-city control and with organised\random acts. The forces that make and take urban decisions are considered as a part of this power.

5.7.1.2 Roles: the distribution of the power in the system in accidentally, expected or reasonable form. Every place and community has its special characteristics and organisation system controlling the relationships between its elements, the act of power in the city morphology is determine by that.

5.7.1.3 Limit of power: refers to the limits which control the capacity of the power like space, time, saturation\ diminution, abilities and choices. This also refers to the limits of an act and its containments acts. Acts are sort of actions done by powers, but limits describe and measure the effects of those acts.

5.7.1.4 Feedback\ consequences: feedback which is considered as the reflection of the previous elements in a city, that is in a shape of relative consequently results. The feedback process of any new changes interrupting a city morphology, is a tool to make new, correct or support, decisions.

Table (5-4), defining powers which intervene the model, and their roles, limits and feedbacks in planning.

Table (5-3): City efficiency in the (CMM). (Researcher/ Alia- 2018)				
Elements	**Efficiency element**	**characteristics**	**Interventions**	**Results: Problems\ Planning**
Processes: City activities	**1) City needs** (quantitative measuring system / judging rationality)	1. Social activities 2. Land, population, and environment 3. Allocation of resources	1. Working activities 2. Living activities 3. Social activities	1. Land uses 2. Resources levelling
Stores: City interactions	**2) Characters of urban zones** (quantitative measuring system / judging rationality)	4. The environmental endurance 5. Interrelations in the city morphology 6. Interaction between Job and residential location	4. Working zones characteristics 5. Living zones characteristics 6. Public zones characteristics 7. Transportation and infrastructure networks characteristics	3. Detailed zoning 4. Land values 5. Transportation and infrastructure patterns
Flows: City micro-influences/ internal networks	**3) City design considerations** (qualitative measuring system / cause and effects)	7. Nodes 8. Gravity 9. Domination 10. Agglomeration	8. Centres 9. Spatial determination of the functional districts 10. Guides to land uses planning	6. Micro-morphology 7. Micro-spatial growth
External Entities: City macro-influences/ external networks	**4) City accentuation** (qualitative measuring system / cause and effects)		11. Centre and margins 12. Guides to regional and transnational planning	8. Macro-morphology 9. Macro-spatial growth

Table (5-4): Aspects intervening (CMM). (Researcher/ Alia- 2018)			
Power	**Role of power**	**Limit of power**	**Feedback\ consequences of power**
(1)Current formal frames	-Intended acts -Land uses and distribution of public services -Networks of transportation and infrastructure -Current laws and regulations -Spending priorities	-Planning functions -Sectorial or comprehensive planning -Planning vs. implementation -Interests conflicts.	-Determine and formulate all planning tasks.
(2)Urban governance	-Intended acts -Managing resources and treasury -Powers of appointment and intervention -Prepare and agree on budget -Initiate legislation -Provide and specify the level and quality of service. -Check the tax, expenditure and provide grants	-Structure of local government -Spatial fragmentation -Agencies conflicts -Local stability -Policy guidance: Ideology -National urban policy and planning, local economic and social conditions and public choice	-Institutionalised city planning -Preparing and agreeing on plans -Monitoring and judging -Supporting and securing -Allocation of resources -Impact on land values
(3)Public	-Unintended acts -Force of public to express their demands -Goals of urban social movements -Citizen participation in decision-making -Disadvantages and harmful groups resistances	-Intensification of social and economic change -Local government policy and action response -Information and transparency.	-Demands of the public people are the basis of all powers roles. -Facilitate changes -Quality of life - disadvantaged groups interests
(4)Interest groups	- Both intended and unintended -Reform efforts -Participate in advocacy planning	-Diversity of attitudes	-Pressure to resolve of interest conflicts
(5)Private investors	-Intended acts -Participation in making economic development -Private capitals support country resources	-Dynamic development in marketing and production -Government controlling of private contributions	-Controlling the important and big share of resources and capitals
(6)Globalisation	- Both intended and unintended -Increase in the role of multinational corporations -Increase independent relations between governments.	-Differentiation between countries capabilities and governing systems obstacles globalisation applications -Domination of some countries	-Pressure from global interests conflicts -Global effects on local firms -Pressure from local government to facilitate globalisation

5.7.2 Uncertainty in (CMM):

There are two basic kinds of uncertainties: Systematic uncertainties, due to faults in the measuring instruments or the techniques used, and random uncertainties, associated with unpredictable conditions under which the measured quantity performed or due to a deficiency in measuring. (Notes on Data Analysis and Experimental-2009).

Causes of uncertainty in urban development are the following:

5.7.2.1 The institutional system: this happens if the powers making planning decisions have limited knowledge about uncertainty avoidance, limited capabilities, limited experience, limited regulations, and when a decision-making process under high stress or crisis. Globalisation also is a complicated process which is not ignored or controlled in decision making process.

5.7.2.2 Un-expected or uncontrolled constraints: like environment changes, disasters, political unrest, and wars.

5.7.3 Relation between Factors Intervening the Model and the Urban Development Constraints:

Table (5-5): explains the direct relation between urban development constraints in the limited economy city which is discussed in chapter (4) and the types of power intervening (CMM).

5.8 Adapting (CMM) in Planning:

Urban development is strategic planning that involves setting goals, determining actions to achieve the goals and mobilising resources to execute the actions. (CMM) is designed to describe how the ends (goals) will be achieved by the means or resources in a definite process. (CMM) acts as an urban development scenario. The exercise of identifying alternative future include collecting quantitative and qualitative data about the possibility, probability and desirability of change. The (CMM) is a tool for analysing data, evaluating phenomena, identifying alternatives, forecasting problems, and making decisions. It is a strategy frame, and is capable of back feeding.

5.8.1. (CMM) in strategy formulation: The (CMM) helps in providing data to create strategy elements: vision, missions, objectives, policies, and tactical choices. The (CMM) strategy frame, gives organised information and acts as the base of strategic scenario planning. It identifies external opportunities and threats, determines internal strengths and weaknesses, establishes long-term objectives, generates alternative strategies and chooses particular strategies to pursue.

5.8.2. (CMM) in strategy implementation: (CMM) is a process of putting strategies and policies into actions through its generated and monitored programs, budgets and procedures. (CMM) acts as a base for using computer data basis or electronic problem solving programme. The main advantage of (CMM) is its ability to update. That is very necessary in the recent rhythm of life. The multiple analysing perspectives which exist in it, increase the accuracy of introduced policies.

5.8.3. (CMM) in strategy evaluation and management: (CMM) is a method to evaluate, review the causes of current strategies, measure performance and take corrective actions. It also helps in identifying weaknesses in current formal frames and their performance. (CMM) is able to extend or decrease, it's easy to enter either qualitative or quantitative data to be assessment. The table shape and the matrix distribution helps to add any new aspect. But this is necessarily guided by the relationships between the aspects of the three variables.

5.8.4. (CMM) in rational decision-making: Decision-making is regarded as the cognitive process resulting in the selection of a final choice which is identified between alternatives based on the values, preferences and beliefs of the decision-maker. That is regarded as a problem-solving activity. The sequences of data analysis process in (CMM) is much identified that rejects any odd data that may interrupt it. (CMM) is focused on building future models for city morphological development, which help harmonise all governmental policies, building national capacities, establishing international partnership, and making research reports related to these policies. (CMM) is also applied when studying and dealing with potential risks to society. It can study any strategically special interests depend on hypothetical future events and measure their potentiality to change or damage human living quality like: climate change, artificial intelligence, etc.

Table (5-5): Relation between factors intervening (CMM) and urban development constraints. (Researcher/ Alia- 2018)			
Power	Urban development constraints		
	Challenges and Opportunities	Poverty and Resources	Institutionalisation and Partnerships
(1) Urban governance	-Problem solver and decisions maker	-Control resources and assists, problem solver and decisions maker	-Actors and conductors
(2)Current formal frames	-Frame for decisions and regulations	-Frame for decisions and regulations	-Frame for decisions and regulations
(3)Public powers	-Actors, goal and partners	-Actors, goal and partners	-Goal and partners
(4)Interest groups	-Partners	-Partners	-Partners
(5)Private investors	-Actors and partners	-Actors, goal and partners	-Actors and partners
(6)Globalisation	-Affect decisions	-Affect decisions	-Affect decisions

5.9 Conclusion:

Building a functional model of a city morphology is necessary to study the effects of the city modifiers. The city morphology model (CMM) has been discussed employing six aspects categorised as causes and consequences, as follows: the causes: city activities, city interactions; city micro- influences/internal networks and city macro-influences/external networks. The other factors have been referred to as consequences of causes: city morphology and city image.

The (CMM) is a functional model on a matrix form of four columns and four rows, with vertical and horizontal arrangements. The columns describes city transformation elements: characteristics, interventions and results as problems and planning interventions. The rows describe city model phenomenological laws elements: processes (activities), store (interactions), flow (networks) and external entities (influences). Exercising (CMM) in a city requires introducing the data related to each topic in the table cells and analysing it with relation to the mentioned purpose. For more abbreviation and accurateness and to focus on explaining city morphology, the horizontal relation is used for explaining, and the vertical relation suffices as a method of defending and supporting model.

(CMM) is used as tool to express the efficiency of existing systems and predicts future trends. It’s a discussion of the dynamic transformation of city morphology. The model acts as a guide to help in data collection and analysis that helps in the decision-making process. To define the methodology of using (CMM), discusses the powers intervening it, its uncertainties limits, and its constraints. Also discusses the ability of (CMM) to associate in formulating urban development strategies and decision-making process especially in the topics related to urban morphology development and city modifiers.

Chapter (6):

EFFECTS OF POPULATION GROWTH AND ECONOMIC ACTIVITIES UPON THE (CMM)

6.1 Introduction:

This chapter includes: making a utopian morphological model to a real time city, countervailing ongoing circumstances on (CMM) to study the differ situations of the world cities, and studying city modification process in the case of a limited economy city. Then deduce the effects of city modifiers.

6.2 Utopian Morphological Model for Real Time City:

6.2.1 Recent Situations of World Cities:

To discuss the ongoing circumstances of recent cities, the global perspective of urban development must be studied. This emphasises the differentiation of limited economy regions (LERs). This study- when necessary- is done in a quantitative analysis of facts and statistics, with qualitative explanations, comments and comparisons.

6.2.1.1 Global Perspective for Urban Growth:

a) **Natural growth of the world population:** the world population is projected to grow from 7billion to 9billion by 2044. See figure (6-1), although population growth rates remain above 2% in some countries of (LDR), some countries experience negative population growth for different reasons. (U.S Census Bureau-2015)

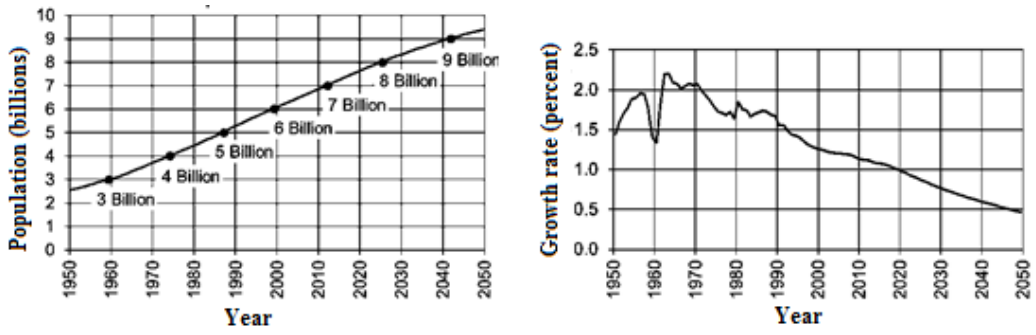


Figure (6-1): The World total population and population growth rates (1950-2050). (The world Health Organisation- 2012)

b) Growth of urban population: The world rural population is now close to 3.4 billion and is expected to decline to 3.2 billion by 2050. This trend has influenced not just the physical location of population but also the organisation and conduction of economic and social life of both urban and rural dwellers[9]. See figure (6-2). In the More Developed Region (MDR) the pace of urbanisation has slackened and has in some instances gone into reverse. By contrast, the Less Developed Region (LDR) characterises by rapid urbanisation that expects to continue for decades. Continuing population growth and urbanisation are projected to add 2.5 billion people to the world's urban population by 2050, with nearly 90 per cent of the increase concentrate in (LDR) (United Nations-2014\ (P: 1)). See figure (6-3).

c) Population growth variation between the world cities: The world's urban population distributes among settlements of differing sizes along a continuum from small towns with several thousand people, to giant cities, with population of tens of millions. Most of the world cities are with fewer than 500,000 inhabitants and function as links between town and country where agricultural surpluses exchange for manufactured goods and services in accordance with the precepts of the central place theory.

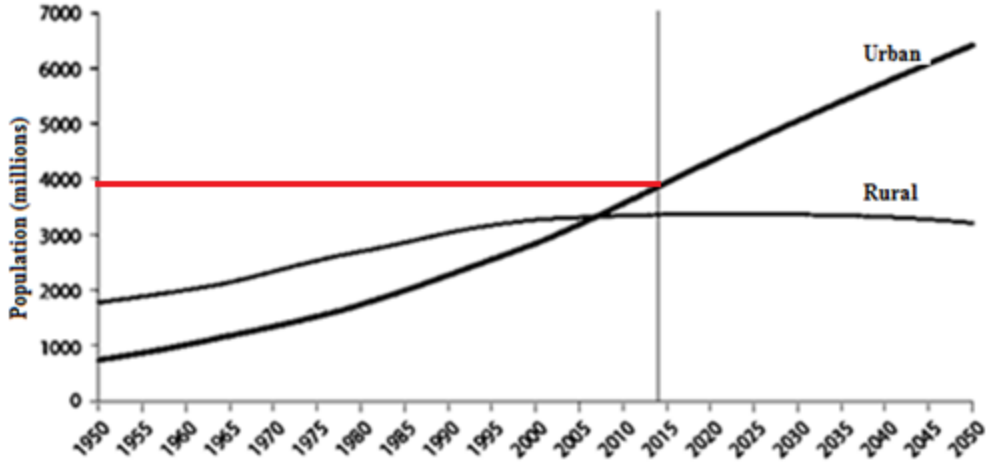


Figure (6-2): The World urban and rural population, (1950-2050). (United Nations-2014\ (P: 10))

d) Directions of migration: While some cities increase in population other cities declines. The (LDR) countries are currently passing through the process of industrialisation which is followed with high rate of urbanisation. The other causes

[9]According to the (UN) State of the world Population 2007 report; this is referred to as the arrival of the "Urban Millennium" or the 'tipping point'

of this are: the highest rate of natural population growth and the poverty, and slim level of services and the unsettled situations of the rural areas. In (MDR) countries, the future growth of urban population will be comparatively modest. That is because of 80% of their population already live in urban areas and they have low population growth rates. It is important to note that there are large migration flows from (LDR) countries to (MDR) countries.

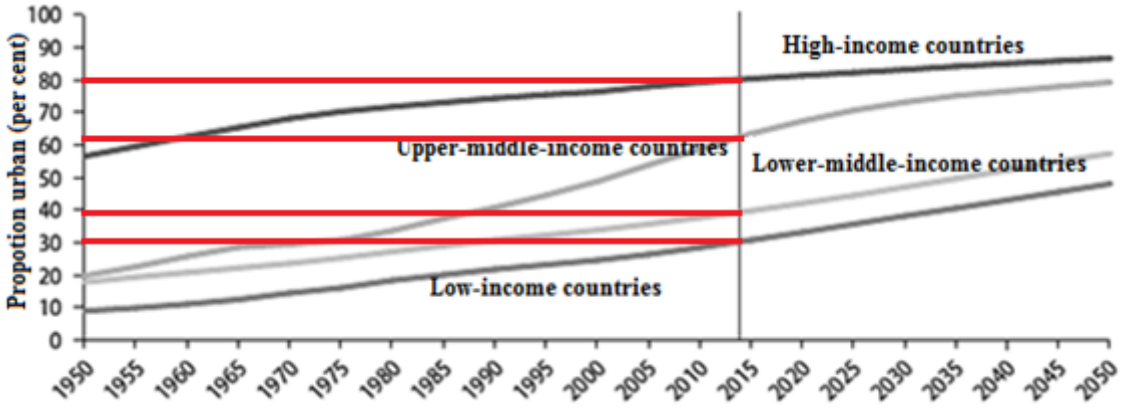
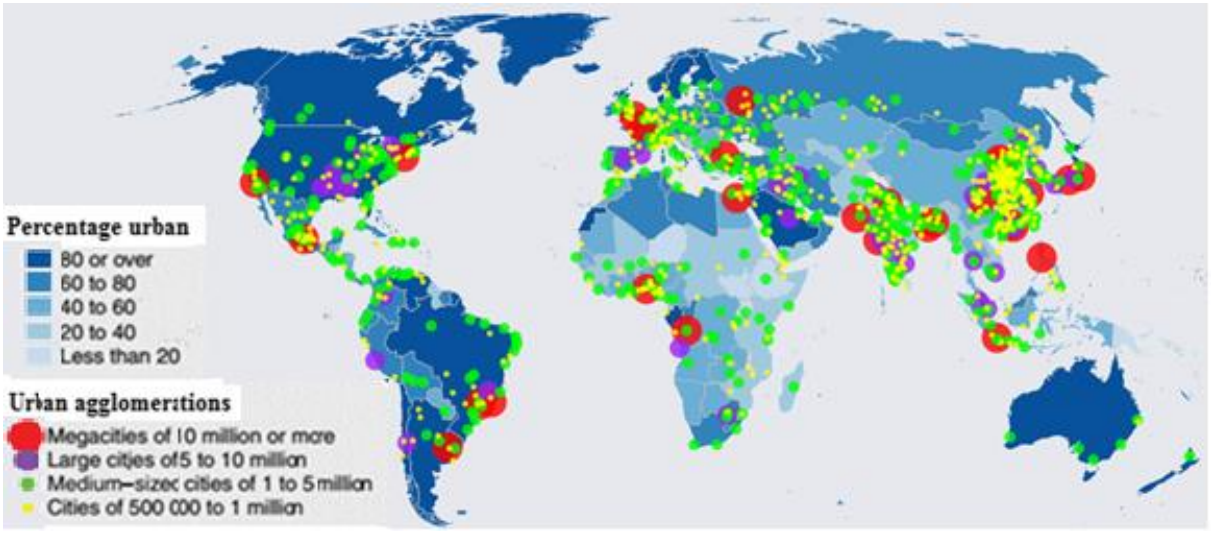


Figure (6-3): The World proportion urban by income groups, (1950–2050)/ (United Nations-2014\ (P: 10). Note: Country classification by income level is based on 2012 GNI the per-capita from the World Bank and it is kept unchanged throughout the estimates and projections

e) Mega cities: There is a World-growth of the number of hyper cities- city with more than 10 million residences-. Those cities dominate the global urban and economic systems. The exact nature of these super cities varies from country to country or even within a country. See map (6-1)

f) New scale of urban morphology: This huge growth in urban population forces causes uncontrolled urban spatial growth resulting in sprawl. The rapid growth of cities strains their capacity to provide public services, transportation, and infrastructure. Since governments have less revenue to spend on that, cities have serious environmental problems that affect the sustainability of planet.

g) Needs for new urban planning instruments: 'Ebenezer Howard' designed his "Garden Cities for Tomorrow" in 1898, for a population of 30,000; today, cities are designed to contain millions. In cities today buildings are over 300 stories, private cars numbers are over millions, Institutions like university owns thousands of hectares. Mega-cities, have created an entirely new scale of development that has generically changed their nature and character.



Map (6-1): The world percentage of urban and location of urban agglomerations with at least 500,000 inhabitants, 2014/ (United Nations-2014/ (P: 9)

h) (LDR) cities:

- **Micro-morphology in (LDR) cities:** Quality of urban areas varies considerably between (MDRs) and (LDRs), almost all liveable urban areas are found in the (MDRs). Cities there have their importance based on their number of population, geographical positions, history and culture or even climatically or for natural environmental reasons. There are very important and pretty cities in the (LDR) that act as important places. According to (UN-HABITAT), currently two-thirds of Africa's urban population live in informal settlements without adequate sanitation, water, transport or health services, most condemned to slums and shanties towns.

- **Macro-morphology in (LDR) cities:** There is a huge diversity between big and small cities (up and down tiers), many national urban systems in the (LDR) are characterised by the absence of the middle tier cities. Formal and informal networks do exist between cities, but it is usual for small towns to exist in a state of social and cultural isolation from other communities. Up tiers cities of (LDR) have received a disproportionate amount of national resources, this greater degree of territorial injustice needs to be addressed by national economic and urban development policies. The largest cities of (LDR) have a spatial functional structure very similar to that of major cities in (MDR).

6.2.1.2 Global Perspective for Economic Activities:

Globalisation is the most discriminatory characteristic of the real time economic situations. It influences the city composition and affects cities morphologies, management and accentuation among others.

a) **Economic globalisation:** The driving force behind economic globalisation is: the growth of multinational and transnational corporations (TNCs); the expansion of trade and foreign direct investment (FDI); the emergence of a new international division of labour (NIDL); the enhanced mobility of money capital across international boundaries; the globalisation of markets for consumer goods; and the intensification of international economic competition with the rise of newly industrialising countries (NICs). Globalisation in economy is measured in four different ways: exports plus imports, labour inward or outward migration flows, inward or outward direct investment, and last, combine of technology, international research and development flows.

b) **Globalisation economy upon city micro-morphology:** economic globalisation manifests on the rise of global cities, the expansion of the service sector of the economy, the deindustrialisation, and decline of older industrial cities. As local context, in many cities a new economic core of banking and service activities emerges to replace an older core based on manufacturing that contains the logistic services provided to firms. The flexible production systems of economy and the technological innovation create new industrial spaces variously referred to as technology parks, science cities or techno-poles in inner or beside city boundaries.

c) **Globalisation economy upon city macro-morphology:** As regional context, process of urban territorialisation led to the emergence of a number of ‘urban service corridors’ between cities round the world. Critics argue that globalisation economy results in: global inequality and poverty levels between and within nations, regions and cities. The poorer countries suffering disadvantages while the larger countries controlling the market prices in the global free trade. Also, globalisation allowed corporations to move manufacturing and service jobs from high cost locations to locations with the lowest wages and worker benefits. This led to a negative effect in (MDR) countries, it causes loss of jobs among both middle and lower classes of population.

d) **City management in the global world:** Cities are varying greatly in their capacity to meet the challenge posed by globalisation. Globalisation of economies is forcing countries to remove both open and hidden trade barriers and open their markets to competition from other countries; but local firms cannot compete the global ones. Today, investment decisions in Multinational (MNCs) and Transnational Corporations (TNCs) which have headquarters in one of the 'command cities' of the global economic system, have direct effect on many national governments. To confront such forces, cities must seek to position themselves and, increasingly, compete in global society.

e) **Globalisation and its impact on urban poverty:** Globalisation of economies is forcing Developing Countries to restructure their economies to make them more competitive in the global market by "right-sizing government" and reducing or eliminating subsidies and by privatising government-owned firms and enterprises. E-commerce and related telecommunications sectors are the fastest growing segments of the world economy. Large companies are increasingly positioning themselves to compete in the new knowledge-based global economy. Since the poor do not have resources and are often unable to access information, they are likely to be further impoverished and marginalised. Globalisation of information also means greater exposure to consumerism and higher expectations among urban population that remain unachievable becomes cause for social, ethnic and religious violence.

6.2.2 Research Approach to Modelling a Utopian City in the Real Time:

There are global differences between global nations in their economy and community shape. These differences create variability between world cities, in volume, entrepreneur, liveability, and communication relationships. The concept of the city efficiency changes daily by the transitions in human civilisation.

With refine to cities, utopianism is now a measured by abilities to: increase living standards, political transparency, democracy process and economic productivity, adapt new ways in which a society should relate to nature and does not destroy the planet and compromise the rights of the future generation in having good life condition, adapt cultures and identities in accordance with the principles of participation in one's society,

adapt technological development in management and organisation of daily activities, production of daily life consumption committees, modern and comfortable living behaviours, and adapt possible interactions with different world-communities.

The (CMM) acts as an abstract relations for the modification process of the city morphology. That is, to convey changes which are intervening continuously in the current transition of human civilisation, showing different results in different cities. To produce a model of a utopian city in the real time, the information which relates to its ongoing situations is inserted in the research city morphology model. The factors affecting the real time city, are considered as areas of city improvement.

The process of modelling a real time city is by inserting a functional model. The factors affecting the real time city according to the model are divisions of data and relations. See table (6-1). The element column of the model is replaced by certain state of city in real time in the following criteria:

1. (Activities): ‘‘Mega or Metropolis’’ for the new scale of city development, or the concentration of economic activities; ‘‘Public or capitalist’’ for its governing system; and ‘‘Compact’’ or not for population concentration.
2. (Interactions):‘‘Harmonized’’ related to the population social characteristics; ‘‘Sustainable’’ according to the relation to ecology system; and ‘‘Intelligent’’ if it follows high technologies.
3. (Networks): ‘‘Network’’ if it has developed communication, transportation and infrastructure systems.
4. And (Influences): ‘‘Capital or noncapital’’ as a description for its state federal-political spatial organisation role; and ‘‘Global’’ if it has developed contact and effective position with the world.

For each city state the processes column fills with the city state descriptions, the acts column fills with its characteristics and the interventions column fills with spatial aspects. The results column discusses its consequences in city planning. The assumed (CMM) of the real time city, has all these city states, in a different rate of impacts that shapes cities and defines the variation between cities in the world scale. The utopian city is an efficient and influencing city which has all these city states in a positive way which can measured by city efficiency limit.

6.2.3 Diagramming Utopian Real Time (CMM):

To diagram a real time city in a more clear vision, this is done in two sections. The first one is the micro-morphology, while the second is the macro-morphology. The nodes, domination, gravity, and agglomeration relations in the real time system of living, are the factors that shape these morphologies:

6.2.3.1 Real time city micro-morphology:

Figure (6-4) is represent real time circumstances. City micro-morphology characteristics are described as the following:

(a) Nodes: The properties of areas to be highly accessible site with strategic importance. Advances of communication technology does not require public services as a prerequisite- necessary be in the geographical centre of land uses. Rather, modern technologies strengths and influences the centres of services by developing the intelligence of facilities, transportation, and infrastructure systems.

(b) Domination: Some parts of the city dominate others by affecting its functions and structural form. Some city zones are linked with global communities more than the neighbouring local communities. Intelligent communication creates imaginary centres, decreases the need for travel and actual presence. All that changes the old arrangement of the city land uses.

(c) Gravity: The global increase in migration within and between countries makes cities, especially the prime ones, disorderly and diverse in form of heritages, socio-economic classes and multi living styles. Such differences in communities affect the nature of determination services needed at different city areas. Developing cities face problems of evolution of decayed inner-city zones. Also there is increase in decentralisation by people who prefer working or living in high-tech and sustainable new communities.

(d) Agglomeration: The legitimising identity of a city faces a fragmented spatial growth into various communities and functions which compete over spaces. Local centres can no longer keep structural relations held together. The working zones and industrial areas still control the land arrangement and land values. Environment protection is the most important planning goal for many cities across the World, to minimise the overall effects on the local and global environment.

Table (6-1): Real time (CMM). (Researcher/ Alia- 2018)					
(a)Elements	**City concepts**	**Powers of interventions**	**(b)Acts**	**(c)Interventions**	**(d)Results**
Processes: City activities	**– Urban scale**	-Deal mainly with: Urban governance, Current formal frames, Interest groups, and Private investors.	1. Land, population, and environment 2. Allocation of resources	1. Working activities 2. Living activities 3. Social activities	1. Land uses 2. Resources levelling
	–Governing system	-Deals mainly with: Urban governance, Current formal frames, Public, Interest groups, Private investors and Globalisation.			
	–City compaction	-Deals mainly with: Urban governance, Current formal frames and Private investors.			
Stores: City interactions	**–Harmonized city**	-Deals mainly with: Urban governance, Current formal frames, Public, and Interest groups.	3. The environmental endurance 4. Interrelations in the city morphology 5. Interaction between job and residential location	4. Working zones characteristics 5. Living zones characteristics 6. Public zones characteristics 7. Transportation and infrastructure networks characteristics	1. Detailed zoning 2. Land values 3. Transportation and infrastructure patterns
	–Sustainable city	-Deals mainly with: Urban governance, Current formal frames, Public, Interest groups, and Globalisation.			
	-Intelligent city	-Deals mainly with: Urban governance, Current formal frames, Public, Interest groups, Private investors and Globalisation.			
Flows: City micro-influences/ internal networks	**–Network city**	- Deals mainly with: Urban governance, Current formal frames, Public, Interest groups, Private investors, and Globalisation.	1. Nodes 2. Gravity 3. Domination 4. Agglomeration	1. Centres 2. Spatial determination to the functional districts 3. Guides to land uses planning	1. Micro-morphology 2. Micro-spatial growth
External Entities: City macro-influences/ external networks	**–City as a capital city**	-Deals mainly with: Urban governance, Current formal frames, Public, Interest groups, Private investors, and Globalisation.		1. Centre and margins 2. Guides to regional and transnational planning	1. Macro-morphology 2. Macro-spatial growth
	–City as a global city	- Deals mainly with: Urban governance, Current formal frames, Private investors, and Globalisation.			

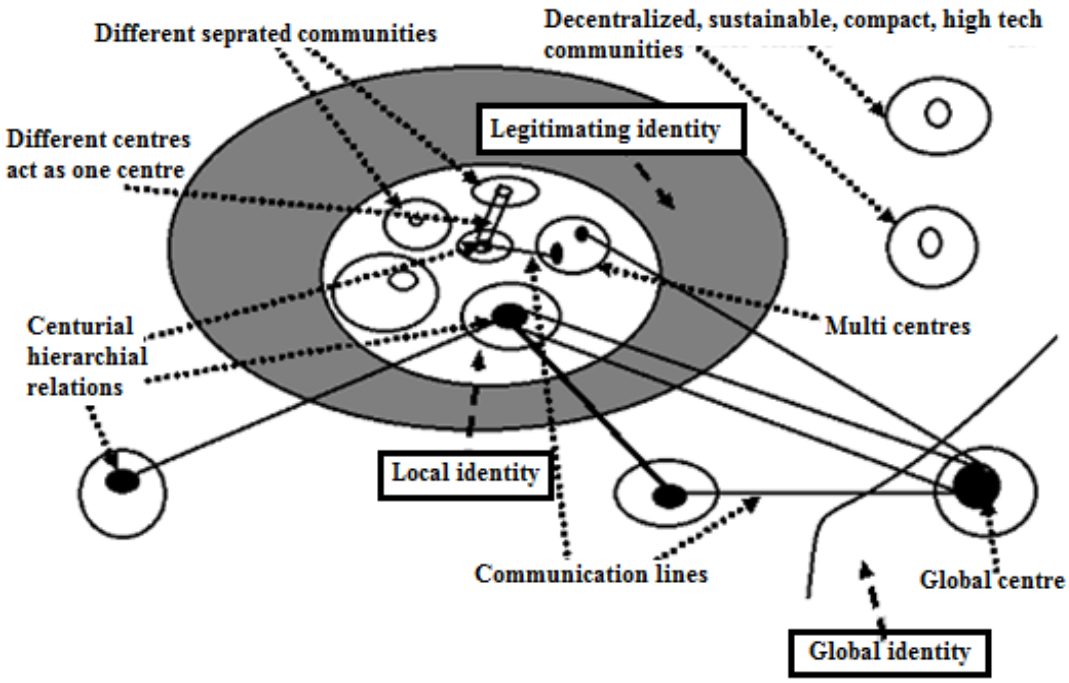


Figure (6-4): Real time city micro-morphology. (Researcher/ Alia- 2018)

6.2.3.2 Real time city macro-morphology:

Figure (6-5), present a real time circumstances, a city macro-morphology characteristics are described as the following:

(a) Nodes: Global cities compete with each other for global business. They are sites of transnational production processes, with functional relations related to global financial and business. The global hierarchy of cities depends on strength of linkages between individual cities within the global urban system. Prime categories of links that bind cities across national borders are: the multinational networks of providing production services and firms of manufacturing; the global financial market affected by telecommunication technology; and the growing number of cities twin relations with linkages between their urban governments.

(b) Domination: Some 'global cities' have become key command and control points for the global economic system. Such centres are distinguished, not by their population size (as in the case of megacities) or their status as capital cities of large countries, but by the strength of their economic power. Each is defined as a major financial, manufacturing, or transport centre, acts as a location for the headquarters of (MNCs and TNCs), and is defined by the number of international institutions included, the rate of growth of business services, population size, or IS characterised by distinct social and cultural attributes.

(c) Gravity: The urban primacy in the metropolitan centres is still going on and when some areas grow others decline in the regional context. There is internationally growth of urban residence in comparison to rural residence, reflecting the huge scale of urbanisation. The possibility of a transnational urban system with multi different centres, affect national urban systems, to disconnect from their local regions. This leads to growing inequality between cities that are integrated into the global urban hierarchy and those outside the system, which become more peripheral. Competitive metropolitan areas must offer an attractive quality of life and responsive public and private organisations that enhance human resource development.

(d) Agglomeration: Globalisation, increases international trade and investments. The mobility of factors of production and advances in information and transportation technology are fundamentally and pervasively changing the economic bases of metropolitan areas. Cities try to attract global economic activities.

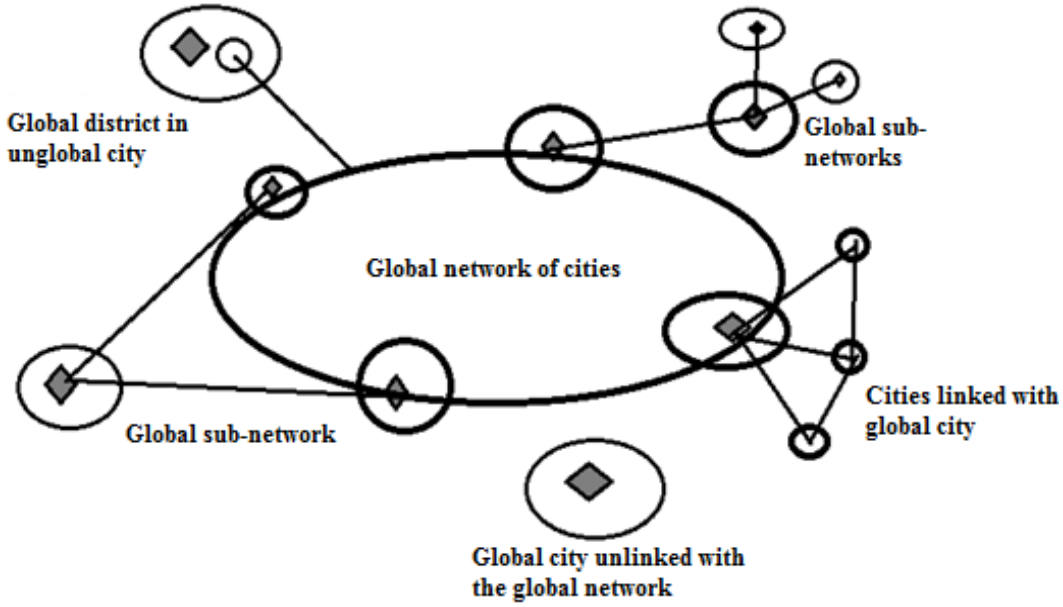


Figure (6-5): Real time city macro-morphology. (Researcher/ Alia- 2018)

6.3 Modification Process in (LECs):

To study the modification process in Limited Economy Cities (LECs), the relationship between a city modifiers must be discussed. This section also defines urban development constraints in the (LECs) and relationships between urban development constraints and (CMM) efficiency aspects. Finally, it explains (LECs) micro and macro morphologies and diagram the limited economy city\ (LEC).

6.3.1 Real time Cities Situations in (LERs):

a) Relation between population growth and economic activities in (LERs):

Economic situations cause city declines. Figure (6-6), shows that in (LERs) there is a high rate of cities experiencing slow and negative growth rates. The domestic economy there is characterised largely by low technology endowments, and limited trade and services in the absence of significant natural resource assets. Also, problems of low economic growth, low savings and investments, foreign debts, current account deficits, and inflation rising. The (LER) country's traditional economy depends on agriculture and a low level of industrial development due to lack of qualified human resources and technological infrastructure. Most of the economy has relied on the agricultural sector for job creation. Besides that, urban-based economic activities represent more than 50 per cent of (GDP) of all (LER) countries; that is because: cities gain from economies of urban scale and agglomeration, in addition to demand for consumers and intermediate goods. That creates employment opportunities and has been the main driving force for the massive rural-to-urban migration. However, lack of appropriate city planning, redistributive mechanisms and protective labour laws have increased the vulnerability of the poorest groups in the city and led to increasing social divisions. (LERs) efforts on economic development are not accompanied by concomitant policies to improve the quality of rural life. This leads to a widening rural-urban divide in employment, schooling and medical services, which fuels further migration to cities.

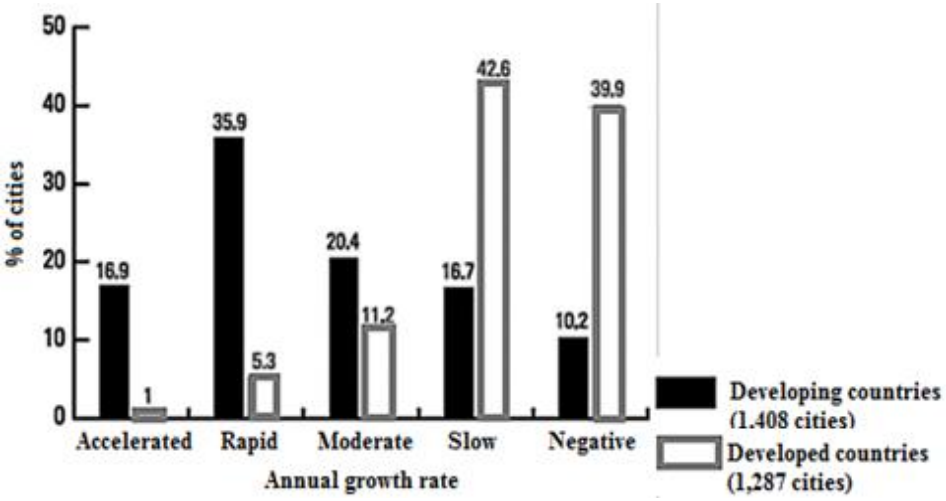


Figure (6-6): The World proportion of cities experiencing accelerated, rapid, moderate, slow and negative growth rates in the developing and developed regions in the1990s\(UN -2014)

b) **Relation between city development and population growth in (LERs):** The process of urbanisation in (LERs) involves changes in the social structure of the population, living standards, way of living, and economic conditions. Internal or external country urban-to-urban migration is also becoming more common. A common historic pattern observed in all (LERs) is urban primacy, the demographic domination of primate cities over all other cities within an urban system that concentrates people, resources and investments. Cities particularly in the small and intermediate ranks do not have adequate financial and human resources to conceive and implement medium- and long-term development strategies. City declines as residents seek opportunities in other cities that offer a higher quality of life. Suffering from deterioration of living conditions and urban decay also contributes to population loss. Many rural migrants find temporary work in cities and return to their villages or small towns in time for the harvesting season. In these cases, urban population numbers, in both cities and villages, grow or contract, depending on the time of year and the season. It is also possible that some cities lose population as a result of war, disasters or civil conflicts.

c) **Relation between city development and economic activities in (LERs):** Highly performing and dynamic cities and towns with healthy living environment are essential components in the country's development process and are vital sources of revenues not only for themselves but also for rural development programmes. The rapid economic growth in (LERs) is concentrated in the larger cities, stimulated by increased incomes for some groups in society and a limited expansion in urban economic activities. To develop the economic climate in (LERs), appropriate policies and investments should meet these challenges: economic development and planning levels, poor transportation and infrastructure; qualitative and quantitative housing inadequacies; and environmental degradation. Urban primacy in (LERs) is bad for business – it distorts the economy, creates imbalances in the distribution of population and resources and gives rise to different forms of socio-economic anarchy. While (LERs) are using macro and micro-economic policies to jump-start economic development, they often lack the regulatory competence and strategic focus to promote comprehensive balance, not only between regions or cities, but also within cities.

6.3.2 Modulating Spatial Growth in (LEC):

6.3.2.1 Acts modulating spatial growth in (LEC):

(a) Nodes:

- In (LERs); there are high rates of centralisation of population in few urban points and this means there are low rates of spreading in the total countries area. There are big gaps: in volume, liveability and importance, between those primate cities and other cities in (LERs) countries. Capitals get their importance from governing institutions and this helps in the concentration of services and industries. Globally, the world is going to be centralised, mainly depending on the information technology; so (LERs) cities must develop their capabilities to participate. The capabilities of urban centres do not help supporting their nodes roles in city morphological networks.

(b) Gravity:

- Globally, differences in economic opportunities between lagging and leading world-regions often provide the main motivation for migration. In the (LERs) performance of economy causes internal polarisation that means concentration in limited country urban centres with unbalanced distribution, limited use of resources and external polarisation out of the country which means losing high skills and qualified labours.
- In (LERs), the rate of growth of the urban population is very fast, this means urban problems are increasing. In economically lagging regions there is lack of adequate public services, such as piped water, electricity... Some cities lose their population to more dynamic cities that offer more opportunities and attract more residents. Shrinking of cities in (LERs) could be explained by a variety of factors: sub-urbanisation and the growth of nucleation; the decline of processing industries; the loss of political importance; difficulties in generating adequate infrastructure and public amenities, congestion of the highway, and uncontrolled economic activities.

(c) Domination:

- Prime cities dominated national urban systems in the (LERs). In each country there are one or few points controlling population movement and economic activities. The economically shrinking and declining city is associated with appearance of satellite cities emerging around it, linked with the national urban system.

- The (LECs) face the problem of conserving the "territorial identities' related to real time situations. The tension between the global net and the local net, changing by the recent redefining of technology, culture, relationships, power and experience, that make the global behemoth of firms, groups, territories and population are interconnected and interdependent. This tension increases in case of weakness in the role of the local nodes of limited economy. Open markets attract alternative global organisations; and this creates a need for developed new institutional systems and regulations to govern on (LERs).

(d) Agglomeration:

- Due to globalisation, the concentration of investments in cities attracts large number of migrants looking for employment, thereby creating a large surplus labour force, which keeps wages low. This situation is attractive to foreign investment companies from developed countries that produce goods, for far less than if the goods were produced where wages are higher. This makes urban poverty serves a distinct function for the benefit of global capitals.
- Nevertheless, cities provide poor people more opportunities and greater access to resources to transform their situation. In many megacities of the Developing World, urban sprawl is a common problem. A substantial amount of city dwellers live in slums within the city or in the urban periphery in poverty and in a degraded environment.

6.3.2.2 The results of the acts modulating spatial growth in (LEC):

(a) Micro-morphology:

1. **Unsteady:** The (LEC), is in the stage of designing and redesigning its micro structure for economic aspects. There are continuous changes happening in the city structure such as land uses and interaction relations between those land uses.
2. **Un-Homogeneous:** There are differences and variations between city' districts, and within each one, in the quality of living and city operation process.
3. **Zones in danger:** Unstudied urbanisation causes emergence of poor areas characterised by: slum dwellers; urban decay; traffic congestions; environmental pollution; uncontrolled land uses and densities; limitations on infrastructure, services and open spaces; need for reconstruction; and decrease in the city image.

(b) Macro-morphology:

1. **New scale of urban development:** All the world population growth in the largest urban agglomerations is expected to occur in the (LERs). This creates an entirely new scale of development, a scale that has generically changed the nature and character of infrastructure and services. The metropolitan cities serve in difficulties the surrounding rural areas and small towns.
2. **Un-connected:** In (LERs), formal and informal networks do exist between and inner cities, but cities and towns in such areas are still more isolated without having the advantages of modern forms of technology and organisation. The transportation and communication networks are inefficient.
3. **Un-controlled urbanisation:** The most significant characteristics of macro-urban development are: rapid and unplanned urbanisation accompanied by problems of urban congestion, environmental degradation, regional imbalances, and increase in the numbers of under-employed and unemployed population and sprawling slums and squatter settlements.
4. **Not-global:** Today there is a growing interconnectedness of and internationalisation of the connections between certain sections of most cities and the outside-world, impacting on all quarters of the city. The capabilities of the (LEC) constraints them in assimilating the global urban system. That aggravates poverty problems and causes isolation from the global community.
5. **Un-accompanied zones:** There is an increase of private ownership control over economic activities and their benefits, manifest at all levels of economy: local, regional, national and international. The abilities of the private sectors enable them to make efficient contact with global economy and (TNCs). The public and government sectors are less able to make such contact. The environment of such firms and their agglomeration zones differ from the surrounding urban fabric. That creates contradicts in the city morphology.

6.3.3 Diagramming (LEC):

Figure (6-7), explains the micro and macro-morphologies of (LECs), (LERs) according to their (CMMs). Emphasis is placed on nodes, domination, gravity and agglomeration lines.

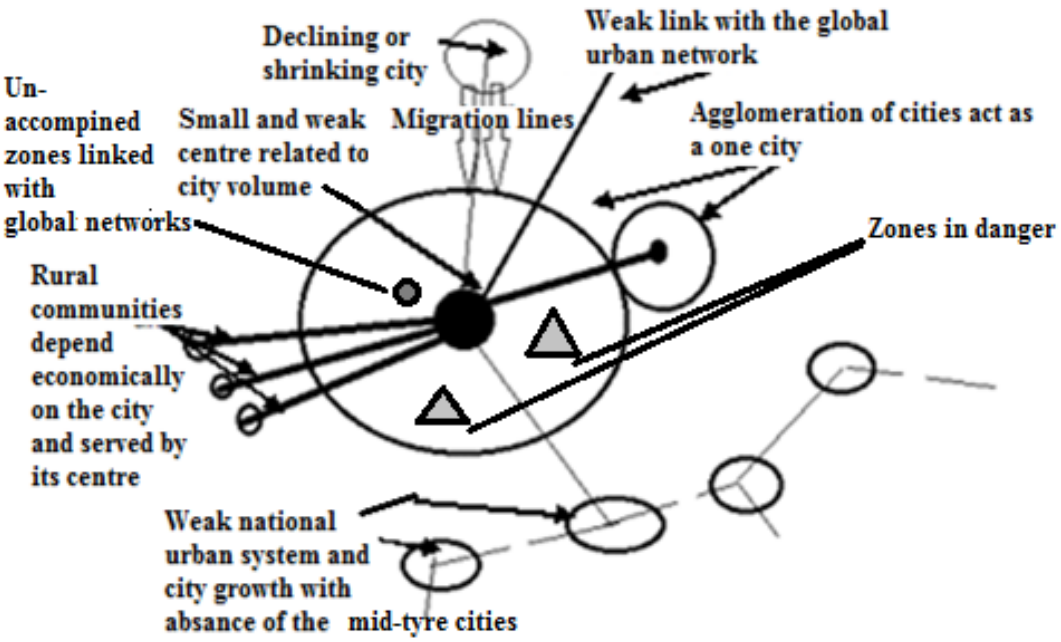


Figure (6-7): Micro and macro-morphologies model in the (LECs) and (LERs). (Researcher/ Alia-2018)

6.4 Effects of Population Growth and Economic Activities upon the (CMM):

To explain the effects of population growth and economic activities within the produced city morphological model, this needs to be discussed individually in shape of comparisons, enabling a detailed and multi-dimensional study. See figure (6-8) and tables (6-2a), (6-2b), (6-2c), and (6-2d).

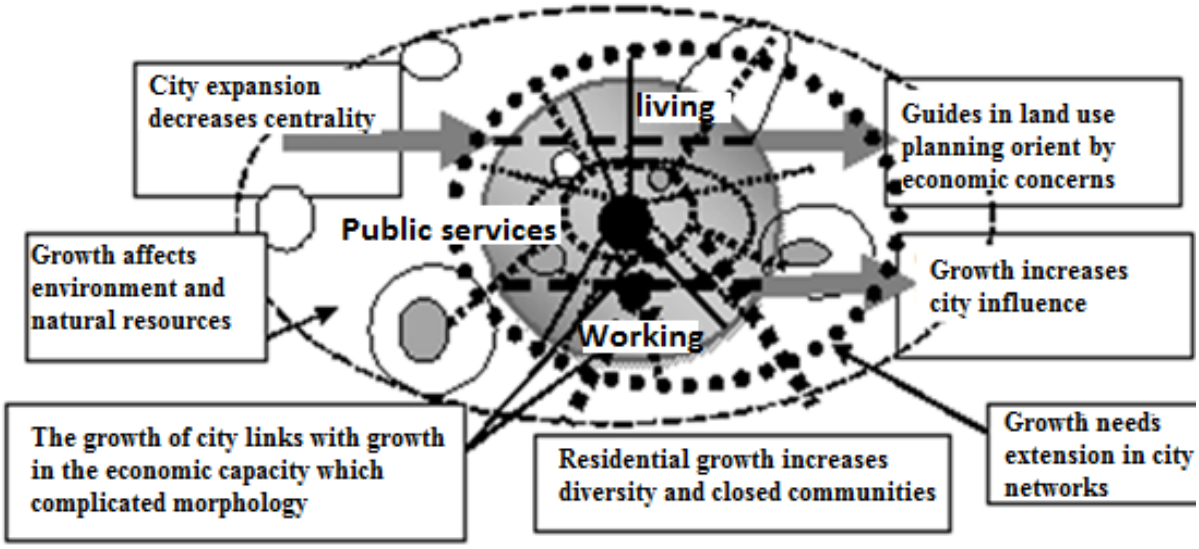


Figure (6-8): The effects of population growth and economic activities upon a city morphology. (Researcher/ Alia- 2018)

Table(6-2a): The effects of population growth and economic activities upon the (CMM)-Element (Activities) (Researcher/ Alia- 2018)			
		Population Growth	**Economic Activities**
Acts	**Land, population, and environment**	-The increase in population number determines where and how people live, what and how much they need, that affects uses of the capacity of natural resources in the planet; including land.	-Economy defines: the used volume of natural resources including strategic conservation efforts, also the effects of industrial production processes in the environment.
	Allocation	-Increase of population creates a need to generate income and extend economic system, increase jobs, services, and infrastructure. The Concerns of a large number of population groups or classes dominate economic policies.	-Economy determines the resources to expense, the relation between public and private sectors and what to investment in or encourage. Investment in human development, services and infrastructure are fundamental to economic growth.
Interventions	**Working activities**	-Population growth increases the importance of economic system, increases its capacity and activities, and increases the need for employment and urban poverty level.	-Economic activities determine: employment structure and categories of jobs; firms capacities and organisations, work equipment and needed services, location and used area; and city movement networks.
	Living activities	-Increase in city population increases population needs, housing demand, densities; building pattern and land value; expansion of the urban total area; and creation of poor urban zones and neighbourhoods within and at the boundaries of the city.	-Economy determines: supply and demand of housing, the polarisation zones of the population growth; rural migrants, productive workers; the per-capita income; the residence cost related to jobs location, also the family expense and consumption attitudes.
	Social activities	-In cities, the availability of better services and infrastructure causes urbanisation; the increase in residences creates a need for extension and redistribution of services and infrastructure.	-Economy determines: The services categories, cost, quality, quantity and organisation structure; and the relation between private sector and the public sector investments.
Results	**Land uses**:	• -The shapes of city spatial growth are: infill or expansion; (isolated; linear; and clustered), sprawl regards as low density unplanned pattern, and shrinking characterises as decease in the city volume and residences. • -City growth affects city functional diagram as areas and spatial relations, also the capacity and structure of services, transportation, and infrastructure distribution.	• -Cities existence depends on availability of strategic resources (water source, fertile lands, transportation roots, trading location, tourism features…). • -Economic activities affect urban zoning, dominate the landscape of populated areas, define economic districts, inner-city spatial relations, and the relations with surrounding rural areas and other urban centres.
	Resources levelling	• -Over urbanisation implies that economic growth is unable to keep pace with urban population growth, shrinking of cities is also bad in economic concerns considered as wasting for the existing capabilities. • -To achieve "Equity" in distribution of the gains of economic development, this means equal access for the public, between regions, cities and within cities.	• -Economy determines private property and ownership, taxes, profits, revenues, relation between the national income and the per-capita income, classifies businesses that participates in the economic sector and divides the economy into functions related to markets or industries. • -To achieve economic profitability this means more production with less capitals.

Table(6-2b): The effects of population growth and economic activities upon the (CMM)-Element (Interactions) (Researcher/ Alia- 2018)			
		Population Growth	**Economic Activities**
Acts	**The environment endurance**	-Urban areas create their own microclimates. Increase of population increases uses of natural resources, pollution, and waste.	-Economic activities cause environmental pressures. State and local governments regulate economic activities with sustainability consideration.
	Interrelations in the city morphology	-City growth changes city spatial relation, creates weakness in the functional relation between city zones; and lack of basic amenities and transportation.	-The relations between economic activities in the production or marketing process is underlying the relations in city morphology.
	Interaction between job and residential location	-Living in cities is to improve opportunities for: jobs, services and transportation. City expansion growth extends working trip and infill spatial growth increases congestion.	-Housing and associated services are essential for both production and human welfare. Where people live depends on their workplace. The change in income means change in residence needs.
Interventions	**Working zones characteristics**	-City growth: increases jobs categories and professions; extends volume and branches of enterprises; and increases importance of working trip time. Communication technologies increase of number of people who prefer working at home.	-Factors that control working characteristics are: state governments institutionalisation system; the integration of authorities into a whole working sector; private ownership; the centrality of planning; the available capitals; and the needs of economic activities.
	Living zones characteristics	-Urban growth increases the cost of living and basic supplies. Sprawl growth provides more single family residences and decreases crowding and aggression, but causes social disparity; and decreases social coherence.	-Housing tenure includes multi private and state categories. That depends on: land and housing unit value, cost of services and human necessities and distance to work. Also that differs by individuals' incomes, local environment and luxury needs.
	Public zones characteristics	-The urban growth increases importance of public spaces with needs to continuous extension and maintenance. Sprawl causes inadequate or inefficient distribution of public facilities with high taxes and inequity of services.	-Public spaces determine by public and private ownerships. The invisibility of information technology and globalisation combined to change the old architectural values permanence and transformed all social and productive relationships and space demands in the city.
	City transportation and infrastructure networks characteristics	-Growth affects city inner social networks as administrators, politician, voluntaries, and friends and relatives networks. Urban densification and sprawl creates needs to active transportation networks, controlling inflated infrastructure and service costs, and deceasing energy inefficiency.	-Government control services access and transport without and within the state. Investments in transport increase the overall productivity of nations' and regions' economies, and also contribute to the maintenance of balanced regional development and the reduction of socio-economic disparities across space and people.
Results	**Detailed zoning**	• -Planned urban growth pattern is based on strategic reasons and adds to city ecology, like: redevelopment for an activity; economic purposes; functional roads; land of special purposes; landscape infrastructure; revitalising an area; greater liveability; and controlling urban expansion.	• -The economic system provides: patterns of distribution of economic and social capitals, patterns of land values and patterns of human behaviours. Cities must follow the change in technology and communication systems which affect all human doings.

	Land values	• - Still more likely is to live and work in the capital and central areas. Cities growth causes increase in rents, and public services cost. Urbanisation causes underinvestment in infrastructure, increases commuting trip; and creates need to low-cost residence. Sprawl gives probability of lower land prices, but affects the value of exurban lands.	• - The increase in liveability[10] of an area increases its land value. The central area is most accessible zone has very high land rent value. Economic activities increase or decrease land values according to their effects. Increases in land values also encourage further development and increase rent prices and tax revenue from local government.
	Transportation and infrastructure patterns	• -Three levels of urban systems are identified: a national system dominated by metropolitan centres, regional sub-systems of cities, and local sub-systems inside one city. Growth in these urban systems needs to be supported with strong channels of interaction between their components.	• -Cities are key elements in the spatial organisation of regions and nations. The networks of services, production, transportation and infrastructure must consider the catchment area; frequency choice according to class, income, and technological changes in the firms system.

[10] Liveability use indicators to rate cities such as: air quality, affordability, public transport, economic viability, crime rates, highly developed infrastructure and recreational facilities.

Table(6-2c): The effects of population growth and economic activities upon the (CMM)-Element (Micro-influences/ internal networks) (Researcher/ Alia- 2018)			
		Population Growth	**Economic Activities**
Acts	**Nodes**	-The city main centre growth is a result of city expansion. Large cities need sub centres to distribute services, some services have short serving diameter. Sub centres have inverse dependency relation with city diameter.	- City main centre and sub centres act as nodes in the movement of customers and commodities that include governmental and private firms and transportation. To serve in a global level that need improved environment, good services, infrastructure, and quality of life.
	Gravity	-Many immigrants prefer to settle in impoverished city cores. High rate of rural migrants settle in shanty towns and experience extreme poverty. City decline causes: abandonment of residential and industrial areas, wastage of infrastructure and deterioration of inner-city.	-Improvement in the economic capacity and city liveability are the major gravity factors for cities. The new set of industries, arrayed around aerospace production and including special industries, populated by a set of insurgent firms, has led to an extraordinary shift in the nation's industrial centre of gravity away from the heartland.
	Domination	- Forces, such as availability of resources, decision-making machines, historical and ideological values increase city domination. Urbanisation resulted by city primacy.	- The concentration of governmental institutions, jobs, services, and products in cities increase their domination in surrounding regions, and motivated inner migration.
	Agglomeration	-Cities growth patterns should be based on efficient urban spatial management structures. City zonal growth is due to proximity to: geographic features, political entities, services centre, important urban agglomerations, markets, infrastructure and transport lines, natural resources; and transnational borders.	-The economic considerations zone city as interest purposes land-uses. The inner interactions in between all economic sectors, with other land uses affect city spatial distribution. The use of advanced information and telecommunication is a movement toward fragmentation of places and more individualised choices of identity.
Interventions	**Centres**	-There is one (or more) centres that dominated large cities. These multi-centres vary in their included functions. The government manages the hierarchy relations between those centres. The locations of sub centres inner-city are closely connected with the concentration of population as the most accessible locations.	-Cities differ in their economic makeup, their social and demographic characteristics and their roles within the national system. Cities developed as goods and service centres for the surrounding hinterlands. Inner-city is still the most strategic location that is reached most easily by the highest number of people.
	Spatial determination of the functional districts	-Some central places in favourable locations attract more people and offer more specialised services. Such differential growth produces various grades of central places characterised by different population concentration and influence. The expansion of city reorganises city functional districts distribution.	- The economic production is linked with the use of available resources, also capitals include labour and infrastructure has location considerations. The agglomeration relations and proximity affect the location of firms. The globalisation and informationalisation makes a shift towards information-based and knowledge-intensive goods.

	Guides to land uses planning	-The distribution of services must consider catchment areas for services and facilities according to number, class and income. -New global services in recreation, education ... this changes the hierarchy of services within the regions. -Spatial growth creates various forms of 'decentralised concentration', based around single services centres or groups. -All economic decisions affect urban growth: changes in economic system and growth, administrative and legal status; the nature of economic activities; jobs opportunities; economic enterprises; land ownership; the public spending; the share of private sector; relation between urban and rural economies; liveability of the urban area; and economic inequality.	-At the national or regional level, the central government decides on policies which support infrastructure development. Local authorities design local development strategies to mobilise public and private investments at a larger scale. -All economic branches integrated: public, political, labour, services, industrial, transportation, housing, and rural economics. -Increase in population growth needs to be followed with increase in economic system. Manufacturing industry and agriculture given importance, with expectations they could increase employment and food security and foster rural development. -The role of the governments is shrinking; the ratio of public to private spaces has been altered, so that amount of public spaces are declining.
Results	**Micro-morphology**	• -Compact city has environmental, economic and social benefits, containment of urban development, reusing of infrastructure and of previously developed land, rejuvenation of existing urban areas, urban vitality, conservation of countryside, reduce transportation, a better environment and health, and social mix. • -Polycentric cities are the outcome of urbanisation, reduce traffic congestion at the city-centre, reduce the travel time and distribute the economic activities. But some time cause segregation between communities.	• -The economic factors that affect city micro structure are relations between: spatial distribution of the economic firms, informal and formal firms, small and biggest firms, semi industries, needed capitals, services and production firms, industry and market, residence and job, infrastructure and public services needed, and the time and cost of transportation for individuals and firms. • Economic firms and industries collaborate together, create special zones in city diagram that redesigns city structure and networks.
	Micro-spatial growth	• -'Stages' of urban dynamic growth model are: urbanisation, sub-urbanisation or ex-urbanisation, dis-urbanisation or counter-urbanisation and re-urbanisation. • -Physical patterns and the morphology of city growth: infill, and expansion growth. • -Urban sprawl forms: increase in urban area as spatial scale with low density or suburban sprawl. • -Shrinking is a negative growth. • - Reasons of decline of cities: sub-urbanisation; economic decline; political decisions, poor- urban quality and environmental problems. That causes: wasted houses units and industrial areas, deterioration of the inner-city and expensive cost of infrastructure.	• -Economy growth needs availability of good quality transportation and infrastructure. • -Liveability challenges face cities, such as sprawl, air and water pollution, traffic congestion and poverty, draws on the city spatial zones. All should be studied by economics to define their results in human behavioural and economic productivity efficiencies. • -The relations between firms and work-residence journey determine transportation lines which control urban growth. • -New patterns of return migration from urban to rural areas that happen in the future, result of high costs of urban living, unemployment and development in communication. • -Shrinking cities are not only experiencing a decline in their population, but also in their economic and social bases.

Table(6-2d): The effects of population growth and economic activities upon the (CMM)-Element (Macro- influences/ external networks) (Researcher/ Alia- 2018)

		Population Growth	Economic Activities
Acts	**Nodes**	-The primate city refers to a city that accommodates a large number of a country's population. Capitals are considered as primate cities, but there are cities bigger than them or more primates for other purposes. 'Edge city' created-by and shaped by transportation and is functionally independent of the urban core.	-Cities became nodes in national and regional networks direct the movement of goods, services, raw materials, people, money, credit, investment and information. Cities categories: government or service centres, transportation cities, and specialised-function cities are dominated by one activity such as mining, manufacturing or recreation.
	Gravity	-In the global scale, there is increase in number of people who prefer to live in developed places. Aggregations of migrants, attracted by the possibilities that cities offer, create diversity and ethnic zones in those cities pattern.	-Improvement in the economic capacity and city liveability are the major directors of migration waves. Those migrants provided all categories of labours: high, mid and low qualified. Their diverse backgrounds assort city activities and consumption needs.
	Domination	- The primate city dominates the national urban system and attract economic and political functions. The concentration of governmental institutions, jobs, services, elections votes, products, and factors such as nationalism, culture, religion, and history, led them to grow.	-Availability of resources and decision-making machines increase city domination in the regional and national context. Domination in the global context needs strong impacts in the global economic system. That must be followed with increase in city capabilities to accommodate and facilitate global activities.
	Agglomeration	-Countries developed because of their capacity to develop national spatial patterns based on agglomeration relations with efficient urban governance and management structures. Availability of resources and amenities control the directions of population movements' pattern.	-Cities growth is due to economic reasons. The economical relation between resources, producing firms, and markets create national and global urban agglomerations. Development in communication and transportation decrease the importance of transnational borders.
Interventions	**Centre and margins**	-The stages of primate cities growth: city attains spatial dominance role and attracts a large proportion of regional migration; city is still mono-centric in form but with sub-urbanisation; appearance of suburban nodes that causes nuclei of a future multi-nodal city emerge; and the expansion of the urban system as a whole leads to one or more intermediate-size cities. The 'saturation point' for this growth happens when the rural population is not reduced much further. Globalisation adds new hierarchy to the capital cities related to global rank.	-Urban centres are the engines of economic and the (GDP) growth. Primate cities, played an important role in: national and regional economic development, institutional building, cultural progress and, political integration. But Urban primacy creates imbalances in the distribution of population and resources. As countries move from low to intermediate levels of development, the primate cities role starts to decline and small and intermediate cities start to emerge, they act as centres of economic, services or information, affect the federal system of the state. Global economic nodes dominate other urban centres.
	Guides to regional and	-Urban population is distributed among settlements of differing sizes. Most of the urban population lives in intermediate towns	-National urban systems depend on the economic relations and vary in accordance to their degree of closure or openness to outside influences:

	transnational planning	that function as links between urban and rural settlements where agricultural surpluses are exchanged for manufactured goods and services in the precepts of central place theory. -Urbanisation determinate by the concentration of city centres in the individual urban area or cities as centres in the regional scale, the number of the concentration points, their growth directions, influences and the type of links between them. -There is importance to focus attention on the potential consequences of unrestrained urban growth and underlining the concept of sustainable urban development.	countries where no real systems of cities exist are characterised by little economic and social exchange between settlements and with the outside the World; countries where each centre has strong external ties, no national system of cities exists but instead individual centres have an international system of exchange; countries with a high level of interdependence but where the whole system is also subject to strong exogenous influences; with a high level of international trade with strong transport and information links to other cities throughout the World; and in the large developed countries the inter-city movement of goods is stimulated by the absence of tariff and quota barriers on trade.
Results	**Macro-morphology**	• -Different forms of urbanised regions: as mono-centric urban areas with less densely populated parts; multi-nodal functional urban units dominated by the largest city, and a core urban area and hinterland of population, with an outer limit of two hours' driving time, related to increase in personal mobility. • -Urban system cohesiveness depends on the existence of communications and transportation facilities. • -A considerable number of small and intermediate cities grew around primate cities, depending economically on them, as bedroom communities, residential suburbs or satellite cities, offering the amenities of urban life – proximity, convenience and diversity – without air pollution, congestion and crime.	• -Settlements exist because certain economic activities need to be clustered together rather than dispersed in: linear patterns related to the networks of transport routes; cluster patterns related to the localisation of resources; and uniform patterns consist of places whose prime function is to provide a range of goods and services to the surrounding area and require to be accessible to users. • -There is an emergence of networks of cities and towns which are related by economic functions. • -Information industries and the growth of a global economy produces a new geography of centres and margins; global cities are command centres in a global economy and sites for immense concentrations of economic power.
	Macro-spatial growth	• -Urban growth causes problems in cities influence related to their new volume that need to reform and increase their abilities to dominate. From the other side, the other urban and rural parts of the region which have economic and strategic importance are affected with the shrinking of their population. So sustainable regional and urban planning and design was debated as a rational solution to these problems.	• -There is decline of traditional geographical borders in an age of high technology, developments in transportation and communications are important in undermining spatial and juridical borders that make distinctions such as between urban and rural, centre and periphery and change even governing boundaries within countries.

6.5 Conclusion:

To explain the effects of population growth and economic activities within the research (CMM), the study uses the (CMM) to make an imaginary utopian real time city. This real time city is characterised by urban scale, governing system, compaction, harmonization, sustainability, intelligence, networks, being a capital city and a global city. That includes discussing the city modification process in the case of being limited economy city (LEC) and describing the characteristics of micro and macro-morphology there. To support understanding, it provides two diagrams for the real time city (CMM) and (LEC's-CMM). The effects of population growth and economic activities upon the city morphology is concluded in a detailed study bases by the (CMM) internal relations.

The study finds that the effects of population growth within the city morphology are: first, in the micro-morphology: compaction city has many benefits and helps increasing city efficiency. Urbanization is a dynamic process creates continuous changes in city, and affects densification directions in city diagram with differ shapes of patterns of growth. Sprawl and shrinking forms of growth are negative growth and consider as reasons of declining of cities. Second, in the macro-morphology: there are differ forms of urbanised regions, related to the number of urban centres, polarization directions, and the shape of relations with hinterland. A considerable number of satellite cities grow around primate cities, depend economically on them, and offer better quality of residence. Uncontrolled urban macro growth disaffect economic and strategic importance of the rural areas.

The study finds that the effects of economic activities within the city morphology are: first, in the micro-morphology: The spatial distribution of economic firms and industries affects city diagram that redesigns city structure and networks. The economic growth needs availability of good quality of transportation and infrastructure that can be affected with city spatial growth. Economic activities challenges city liveability, and new patterns of return migration from urban to rural areas that happen in the future. In the macro-morphology: Settlements exist and clustered because of economic reasons. Information industries and the growth of a global economy produces a new geography of centres and margins. Cities are in need of developments in transportation, infrastructure and communications to compete globally.

Chapter (7)

STRATEGY FRAME FOR CITY MORPHOLOGICAL DEVELOPMENT

7.1 Introduction:

Solving city problems, of population growth and economic activities, needs setting a strategy. This strategy should describe how the ends (goals) are achieved by the available means (resources). It will generally involve: setting goals, determining actions/policies in order to achieve the goals and mobilise resources to execute such actions and policies. Any strategy includes two processes, one is formulation and other is implementation. This study focuses only on the outlines of the formulation section, in order to generalise results to all cities. This chapter introduces a proposed strategy frame for city morphological development, focusing on the effects of population growth and economic activities.

7.2 The Approach towards Formulating Strategy for Morphological Development by (CMM):

The proposed strategy frame is based on (CMM) internal relations, and is distributed into two parts: the first one is a strategy frame that was set to confront urban development constraints in (LECs), to improve their capabilities and solve poverty and spatial growth problems related to the development constraints. This strategy is a prerequisite to enable the start of the second step. The second part is a strategy frame that was set to convoy the characteristics of the real time city. All parts of the strategy regard the effects of population growth and economic activities upon a city morphology, the first part as a constraint and the second part as a phenomenon. The strategy is able to be generalised globally to all cities, to achieve the (CMM) utopian statement of the real time city.

7.3 Strategy to Confront Urban Development Constraints:

7.3.1 Relation between Urban Development Constraints and (CMM) Efficiency Aspects:

Table (7-1), discusses the relationship between (CMM) urban development constraints: challenges and opportunities, poverty and resources, and institutionalisation and partnerships, in two elements of the model: actions/activities and stores/interactions. Actions concern the effects of any constraint individually and stores concern the effects of the constraint relating to other activities.

7.3.2 Strategy to Confront Urban Development Constraints:

Table (7-2), discusses a proposed strategy frame to confront urban development constraints, see tables (4-4), (4-5) and (7-1). This frame is based on the previous study of the effects of urban development constraints in (CMM), and it is in a shape of alternative policies and procedures. This strategy was designed to convoy urban development constraints there: challenges and opportunities, poverty and resources, and institutionalisation and partnerships. Each constraint relates to its main considerations, and for each providing alternative policies and procedures. The selection of this form is to make a high rate of flexibility that shall enable it to be applied to any city.

7.4 Strategy to Convoy the Characteristics of the Real Time City:

7.4.1. Orientation of Urban Planning and Design to Utopian Real Time City:

The orientation of urban planning and design toward real time city includes the nine city morphology evaluation factors in chapter (2), as planning and design directions to achieve the characteristics of the mentioned real time city. Those are characterised by city concepts related to activities: "Urban scale"; "Governing system"; and "Compaction"; related to interactions: "Harmonised"; "Sustainable"; and "Intelligent"; related to micro- influences: "Network", and related to macro-influences: "Capital "and "Global".

Table (7-1): Relation between urban development constraints and (CMM) efficiency aspects. (Researcher/ Alia- 2018)				
Strategy items			**Acts: Activities aspects**	**Stores: Interaction aspects**
Challenges and Opportunities	Basic necessities	Affordable housing	-Providing adequate shelter for all; with different supplies to cover different demands.	-Good quality and high performance of all city needs.
		Human social services	-Promoting integrated and adequate public services.	
		Transportation	-Promoting sustainable transport systems in human settlements.	
		Fresh water and energy supplies	-Promoting sustainable fresh water and energy systems in human settlements.	
		Drain, drainage, and waste disposals	-Promoting integrated provision of the environmental infrastructure: sanitation, drainage and waste disposals.	
	Dynamic Effectiveness	Sustainability	-Enhance city capacity in consuming of natural resources and producing of pollution and waste. -Planning for short and long duration.	-Sustainable good quality of living and environment, and -Promoting rational, fixable and achievable planning decisions.
		Flexibility	-Promoting human settlements planning and management in uncertain situations and disaster-prone areas.	
Poverty and Resources	Poverty	Alleviating the poverty of money	-Good employment opportunities; support basic necessities and increase income rates.	-Make abundance of national treasury, -Resist urban poverty, and -Increase human welfare.
		Alleviating the poverty of access	-Supporting funding alternatives for individuals.	
		Alleviating the poverty of power	-Democracy, respectable, safe and freedom environment.	
	Capitals	Finance	-Improvement in economic activities.	
		Labours	-Healthy, strong and qualified labour.	
		Technologies	-Follow the technological development.	
Institutionalisation and Partnerships	Institutionalisation	De\centralisation	-Improving human settlements management; and distribution of authorities and resources.	Development in the physical planning mechanism, coordination and efficiency.
		Institutionalisation		
	Partnerships	Monitoring and evaluation mechanisms	-Methods of follow up, implementation and checking goodness and mistakes.	
		Partnerships	-Benefiting from in and out country bodies and organisation associating in the urban development process.	

Table (7-2-a): Formulating strategy to confront urban development constraints in (LERs)/Challenges and opportunities. (Researcher/ Alia-2018)				
Constraints		**Development proposals**		
		Adaptation strategy	**Policies**	**Alternative procedures**
Challenges and Opportunities:	**Basic necessities:**	**Priority to housing sector in city development**	Approaches and methods:	1. The housing strategy and policies should regard needs, demand levels and resources; 2. Rebalancing of population density; to avoid sprawl and over concentration. 3. Making new intermediate and satellite cities to accommodate city growth; 4. Re-structuring the urban transportation and infrastructure patterns with housing pattern; 5. Free patterns instead of monotonous grid iron is to be introduced; 6. Conservation and modernization of local identities and architectural heritage; 7. Clustering of the plots should reflect the socio-cultural aspect of the residents; 8. Mixed-classes neighbourhoods improve services provision and strengthen efforts of self- development ; 9. New locations for the third classes must be safe and easily accessible; 10. Resettlement of functions that are not compatible with the environment of residential areas. 11. Create urban open squares, green areas and open streets between building masses.
			Supporting demand and supply in housing:	12. Expand housing options to satisfy different residences' demands; and support weak social classes; 13. Activation of financial options such as cooperative housing, public funding and mortgage real estate stock, 14. Involving the private sector and other partners in the urban community; 15. Remove all obstacles that lead to low efficiency in land and real estate markets; 16. Provide residential regulations to support security and fairness for weak social groups.
			Upgrade poor housing:	17. Plan new residential areas or integrate by planning tools these settlements in the urban fabric; 18. Identify their urban centres and establish trade/markets spatial association; 19. Connecting these settlements and villages with the transportation and infrastructure networks; 20. Create different economic activities to support poor citizens and strengthen their economic base in the city.
			Controlling city growth (in migration):	21. Designation of regional decentralized special economic zones, to decrease primacy of few urban centres; 22. Developing regional networks of public services, transportation and infrastructure; 23. Improvement to transport and communications infrastructure; 24. Investments in information and communication technology; 25. Investments in and supporting country common quality of life; 26. Administrative and/or legal changes in city status; 27. Sustainable rural development; 28. Supporting shrinking settlements and adjusting them in the regional development plans; 29. Boosting the revenues of the rural productions; 30. Conservation of rural natural resources.

		Covering the basic social services with welfare consideration.		31. Strengthen services capabilities; 32. Increase accessibility to public services; 33. Maintain affordable cost for the public services; 34. Design intergovernmental, regional and international cooperation; 35. Open investment in basic services; 36. Provide options to modern and international quality of services; 37. Consider emergency and crisis needs.
		Efficient and secure transportation networks.		38. Integrating climate change considerations into urban transport policy; 39. Investing in transportation research and development practice; 40. Using efficient public transportation system in all international, national, regional, and local ranges; 41. New design standards and planning for urban roads, rail, etc. to cope with the environment and infrastructure; 42. Affordable cost for public transportation; 43. Incentivising the use if low energy need applications and fuel substitution; 44. Using vehicles with high efficiency in performance; energy use; and cost; 45. Using environmentally friendly transport system.
		Covering the infrastructure needs with sustainability consideration.	Water supply and resources management:	46. Water-management related to hazards management; (climate change); 47. Techniques to controlling, storage and conservation groundwater extraction; 48. Water reuse; water recycling; and desalination; 49. Controlling the efficiency of using of ground water; as domestic or industrial; 50. Greater investment in water supply systems; 51. Public education and public participation in water use field.
			Energy supplies and resources managements:	52. Sustainable urban energy procedures; and regulations; 53. Incorporate climate change in design standards and codes; 54. Strengthening supplying; overhead transmission and distribution networks; 55. Protecting residences from networks equipment risks (underground cabling for utilities); 56. affordable cost for supplies; 57. Increasing energy efficiency use; 58. Incentivising the use of green energy and building with emphasis on renewable resources.
			Drainage, sanitation and wastes disposal networks:	59. Design standards and codes; regulations; procedures; and insurances for performance and health safety; 60. Encouraging investments; 61. Continuous cleaning and maintaining for drainage system; 62. Improved primary system of sanitation by efficient networks; 63. Integrate climate change considerations into networks design; 64. Public education regarding risk of living in hazard prone areas; 65. Flood risk map; flood adaptation and mitigation programmes.

	Dynamic Effectiveness:	**Sustainable development.**	66. Conservation of natural resources and capitals; 67. Stability of city efficiency, by providing services preserving of the human development rate; 68. Considering urban growth; and the need for extension in the city capabilities; 69. Any solution considers sustainable if it is in the frame of sustainable strategy of the whole country. 70. Increasing categories and sub categories of urban economics activities help in sustaining economy.
		Flexible plans.	71. Plans and development programmes must consider the high rate of uncertainty; 72. The long run plans must forms in multi alternatives of actions related to different situations. 73. The short run programmes deal better with the accident changes, case of poverty and unstable economies.

Table (7-2-b): Formulating strategy to confront urban development constraints in (LERs)/Poverty and resources. (Researcher/ Alia- 2018)				
Constraints		**Development proposals**		
		Adaptation strategy	**Policies**	**Alternative procedures**
Poverty and Resources:	**Poverty**	**Alleviating urban poverty.**	Alleviating the Poverty of Money:	1. Adopting plans to increase the level of GNP and the per-capita income; 2. Improving the role of rural area's in generating jobs, making economic growth and sustaining settlements. 3. Supporting and integrating the economies of the poor into the formal economy; 4. Providing the necessary infrastructure and services to create the basis for a knowledge-based economy; 5. Promoting community-based secure-nets in health, education and unemployment.
			Alleviating the Poverty of Access:	6. Recognise and build upon the investments that the poor need to their own housing and settlements. 7. Organises residents into community-based organisations; 8. Providing technical assistance for people to self-help improving the provision of infrastructure and services.
			Alleviating the Poverty of Power:	9. A free flow of information contributes to transparency in decision-making; 10. Capacity-building, among the organisations of the poor and among the civil society organisations; 11. Help poor to be able to build equitable partnerships with governments and other actors in society; 12. Benefiting from the efforts of the non-governmental organizations in helping slum and squatter dwellers.
	Resources:	**Increasing financing sources and efficiency of using them.**		13. Directed plans to increase the local sources and decrease the loans constraints; 14. Participate with the private sector in development plans and other services investment; 15. priorities of the budget to address the basic needs; 16. Income structures of the people at large have to be restricted and continuously improved; 17. Decrease the taxes and revenues which taken from the public people especially poor.
		Increasing labours qualifications, situations and employment rate.		18. Increasing the skilled and qualified labours by capacity buildings programmes; 19. Balancing the regional economic and social development planning to facilitate substantial job opportunities; 20. Taking environments as a principle in making jobs opportunities, considering natural resources and pollution.
		Increasing technologies useful adaptations and decreasing using cost.		21. Supporting technological change in community; 22. Create affordable equipment and material markets to develop private and public investments; 23. Develop local industries and minimise depending on imported products.

Table (7-2-c): Formulating strategy to confront urban development constraints in (LERs)/Institutionalisation and partnerships. (Researcher/ Alia- 2018)				
Constraints		**Development proposals**		
		Adaptation strategy	**Policies**	**Alternative procedures**
Institutionalisation and partnerships:	**Decentralisation:**	**Developing very simple and flexible hierarchy of transforming authority**		1. Increase the level of influence of the governmental coordination of development; 2. Efficient participation by people in government programmes to help in implementing the plans; 3. Supporting planning process with data treatment programmes to obtained needed information; 4. Using adequate number of skilled labours in supplying of services; 5. Increase centres of urban management capabilities; 6. Developing the communication and transportation to support decentralisation process.
	Institutionalisation:	**Deal with the uncertainty situations and economising in labour, materials and equipment**	Institutional change:	7. The process of providing public services needs to be in harmony with the cultures and economies of the public; 8. Increasing transparency level in the administration system; 9. Solving conflict in the distribution of the duties between institutions which are interest in the same field; 10. Making advantaging of the expediencies of international institutions with regard to the situation on the ground; 11. Reviewing and considering the causes of successful and unsuccessful past plans and decisions; 12. Dealing directly with the social forces, by transparency and justice methods.
			Human Resources Development in the Government or Public Sector:	13. Strengthening and expanding collective mechanisms of government; 14. Improving the process of define and calculate public needs and demands; 15. Developing governor's skills to: interact with public, address problems and improve working environments; 16. Develop public skills in working in groups, management, negotiation, coalition-building and networking ; 17. Support public to build partnerships with other actors.
			Actions at the Regional Level:	18. Advocating issues such as decentralisation of authorities, security of tenure and good governance; 19. Regional actions include: allocation of resources, comparative research, norm setting and national poverty; 20. Cutting-edge regional actions include: integrating the local economies into the formal global economy, decentralising community-based management systems, organising community-based social-nets and using information technologies in capacity-building of local governments; 21. Documenting and disseminating innovations, networking and promoting exchange of experience and information among governmental, non-governmental and community-based organisations as well as research and training institutions on various aspects to encourage learning from each other.

	Monitoring /evaluation mechanism	**Protecting resources and insuring increase in productivity.**	22. Setting up benchmarks to help effective policy formulation, implementation, and monitoring mechanisms; 23. Using external advisory panels of academics or professionals to help tracking progress, capturing lessons and signalling when a change of direction is necessary.
	Partnerships:	**Efficient and beneficial partnership relations.**	24. Strengthen legitimate government in formulating, and conducting: stable, justly and rational development; 25. Increasing participation of all local population in the decision-making process; 26. Increase the role of the local government by developing their capabilities; 27. Improve collaborative exchange and discussion of information between planners and the public; 28. Rate the role of the private sector and investment in the urban development projects 29. Defending weak classes by regulation, taxes and as priorities in plans; 30. Strengthen the local private sector to compete with the (TNCs) which has existence in whole the Globe; 31. Increase the relation between cities inner and out the country to transporting assistances and experience; 32. Reactive the role of international nongovernmental organisations; 33. Efficient role in the global efforts to the sustainability and humankind secure; 34. Controlling urbanisation and decreasing poverty of rural population.

7.4.1.1 Land uses:

a) **Enhancement of land uses:** This is presented in the form of a diagram which helps in determine the strategic functional allocation and organization of land uses in the city morphology. That enables preserving, increasing and managing them to achieve the sustainable future.
b) **Compacting city:** This is focused on the negative environ-consequences of a land-consuming and sprawling urban development in terms of comparison with other uses, loss of natural and agricultural areas and use of energy for transport and buildings.

7.4.1.2 Resources levelling:

a) **Possess assets:** The relative value of sharing of wealth and public resources among citizens vary from country to country. To all communities, the possess of assets distribution must be ordered and identified.
b) **Collaborative decisions:** Resources levelling defines as a legal public right to resources and government assistance. The access to that is the ability to obtain the use of assets in recovery process to unaccompanied units of the country/city. The decisions on that need to be taken with consideration to all alternatives.
c) **Decreasing expenditure:** Decisions should consider inexpensive solutions in the near and far future, or the need for expensive maintenance in accordance with quality insurance.

7.4.1.3 Detailed zoning:

a) **Harmonizing/Decreasing Urban Disorder:** The discipline to that is to search for “common values” and “social solidarity,” “territorial belonging” and “common identity”.
b) **Environ-management**: This is based largely on information gained from earth science, environmental science and conservation biology. Human consumption of resources directed according to economic considerations.
c) **Green city:** As an ideal sustainable urban form, this focuses on local self-sufficiency, resources and waste management, and better living environment.

d) **Electronic addition to design:** Intelligent buildings use electronic and information mediators to enhance energy use and environment by applying flexible control strategies between indoor and outdoor. These types of buildings economize, enhance and reserve city environment.

e) **Electronic additions to planning:** They are used as methods to connect the intricate living urban fabric; repair urban spaces; overlay pedestrian, automotive and public transports, and provide network-based urban planning.

f) **Communication Access:** In the city functional zones, access to community services, transportation and infrastructure responds to the basic human needs. The recent technology provides many means to enhance electronic and physical social networks, infrastructure, services provision and human mobility.

7.4.1.4 Land values:

a) **Diversity effects**: The need to, and the opportunity to share resources, differs with regard to attitudes and behaviours that allow co-existence, active inclusion, curiosity and signals of respect for the other. The relative decisions need to co-operate with multiple group identities, loyalties and memberships.

b) **Changes in land values: (**CBD)/ metro area/capital area is still much desirable place for investment that investors are willing and able to pay a very high land rent there. This needs maximising site potentials by building many stories. The inner-city importance declines as a result of decentralisation of living through spatial growth of satellite centres from the (CBD); and with agglomeration of retail stores. The value of industrial areas is affected by location economy and the need for agglomeration. For housing location, the importance of the environment and comfortable healthy life replaces the importance of travel distance.

c) **Increasing land value:** Cities attempt to develop new ways of improving the performance of their older services, transportation and infrastructure. Also, creating preferential places for work and living in harmony with nature (psychological and environmental comfort, without pollution). These technological methods help in developing cities smart management and living ecology by use in creating manufactured and imaginary environment.

7.4.1.5 Transportation and infrastructure patterns:

a) **Cutting-edge infrastructures:** To become economically and environmentally sustainable, cities and their regions must create infrastructure and transportation that integrate with advanced technologies and communications in the local and global contexts.

b) **Developed roadways and vehicles**: They are undergoing evolutionary change to: improve safety, reduce the costs of travel, simplify operations, and maximise system capacity. Those networks of transportation are designed to satisfy the needs of three stakeholder groups: (system users; system operators; and system providers).

c) **Advanced technology**: The technology is to provide comfort, security, and productive quality of life, by improving the capabilities, supplies and equipment of each type of transportation and infrastructure.

7.4.1.6 Micro-morphology:

a) **Enhancing centres**: Increasing competitiveness of the cities in the global urban system by providing good transportation and infrastructure. Compacting cities strength their centres' dominations.

b) **The 'polycentric city'**: It has increasingly been promoted as a more efficient distribution of services without crowd, congestion, and associated with the compact city model.

c) **Controlled city:** More flexible controlled zoning and city management to adopt and contain the global forces which create a new context of institutional organization in cities.

d) **Integrated city**: City needs to decrease marginality and segregation of activities and communities. Different categories of residents mean different needs and abilities, which must be solved by planning.

e) **Unity and harmony**: Related to different backgrounds of inner urban migrants who are characterised by increasing depersonalisation of all social relations under capitalism, the city becomes distributed to different territories of identities, which need to be reconnected through planning.

7.4.1.7 Micro-spatial growth:

a) **Accommodating city growth:** That include these acts: rejuvenate inner city to reduce further losses of population and jobs, improve public transport both between and within all towns, encourage mix use of land and zoning, develop people-intensive activities around public transport nodes, and promote urban (or regional) infrastructure systems in new and existing developments.

b) **Smart sprawl:** That includes orientating economic and social networks to establishing a system of nodes in different sizes at strategic locations throughout the city access to the metropolitan area networks. Also, transforming a single-function land uses (residence) into mixed-function land uses (residence with commerce) according to the expansion of transportation networks that create transportation zones to each neighbourhood around the main network of transportation stations (mixed-vehicle streets catering to low-impact vehicles). This also enhances the CBD and inner city areas to receive high-performance automobiles.

7.4.1.8 Macro-morphology:

a) Integrating all: The image of the region' cities and the quality of life they offer are synthesis of economic, technological, demographic and environmental factors. Successful urban planning maintains the capacity of historic towns to sustain development and enhance the urban character and local identity, respects heritage, pedestrians, traffic, and utilities, and protects from natural hazards.

b) Change to global economy: This requires enabling the manufacturing and service firms in metropolitan areas to become more flexible in their operations, to use advanced technology to produce high-quality but reasonably priced goods; and to rely on speed-to-market methods of operation. Cities must foster an attractive quality of life that nurtures the cultural, social and recreational amenities and provide healthy environmental conditions that manage and attract high quality workers and firms.

c) Transnational system: the national urban system planning should adopt integration with the transnational system of relations with the World cities as a planning guide.

d) **New boarders:** The meaning and importance of distinctions such as between "urban and rural" and "centre and periphery" are changing and that requires management of interventions.

7.4.1.9 Macro-spatial growth:

a) **Determination of value of growth:** Factors scaling the effects of urban spatial growth in planning are: sustainability consideration; the new urban scale related to the state boundaries; centralisation and domination relations; and network efficiency.

b) **Controlling inner migration:** Policymakers have to control internal migration or labour mobility from lagging to leading regions or rural to urban areas. Development policies should focus on building human capital that enables people to become geographically stable; and investing in infrastructure in lagging regions to improve their welfare and reduce the push factors inducing migration.

7.4.2. Strategy for Real Time City:

According to the nine city morphology directions, that are deduced by the research, to orient urban planning and design toward real time city, the strategy frame of development of a real time city is divided by subject into:

7.4.2.1. Governing system toward the real time city: See tables (4-4), and (5-5). This focuses on: developing rationalisation by using efficient mediators, techniques, scientific principles; and creating a spirit of excellence, creativity and innovation; integrated coordination between planning devices, vertically and horizontally, at all levels, and in all categories or sectors; and introducing integrated planning session curriculum; in the development. Table (7-3), discusses a frame of transferring decisions, authorities and resources.

7.4.2.2. Interventions toward the real time city: That includes plans, policies, decisions and regulations to make a morphological development in a city focusing on the effects of population growth and economic activities upon a city morphology, see table (6-2), according to (CMM) modification process and defined by its interventions. Table (7-3), discusses the tools of regional planning, urban planning and urban design in activating a city morphological development.

Table (7-3-a): Formulating a strategy toward the real time city focusing on the effects of population growth and economic activities upon a city morphology/City activities/City needs(Researcher/ Alia- 2018)					
Strategy aspects		**Policies toward the utopian form of the real time city**		**Procedures of Interventions toward the utopian form of the real time city**	
City morphological development aspects see tables (4-3)	**City modifiers aspects see tables (3-2), (3-3),**	**Challenges, for more information see table (6-1)**	**Policies**	**Challenges, for more information see table (6-2, a-d)**	**Procedures**
Spatial policies	• The concentration of population and spatial scale	• Governing institutions are different, fragmented, uncoordinated and owing to multiple jurisdictional and electoral boundaries.	• The structures of governments have to concern: the territorial isolation, fragmentation of technical and political interests, legal restrictions on municipalities and different levels of functionality of the fiscal and administrative systems. • The capacity of governing institutions increases with: intergovernmental relations, popular local representation processes, sub-national administrations and financing mechanisms to support.	• More complex governing system, urban areas with differ morphologies, over different administrative forms.	• Transferring functions and resources from central to local governments/ Decentralisation. • Empowering municipalities. • Promoting local economic growth. • Reinforcing metropolitan governance in the long-term. • Improving the provision of federal and local transportation and infrastructure.
		• Dynamic increase in urban population means dynamic increase in the demand of basic needs.	• The governments must find joint actions between local, regional and national authorities, to develop clear visions and strategies to enhance economic and social conditions in their cities. • The governments must develop the capacity of the rural governments to effective coordination with the urban government.	• Difficulties in supplying rapid increase in city needs quantity.	• Connecting regional settling system by provision of basic needs and infrastructure in rural and urban areas and between minor centres. • Implementing smart growth policies include urban growth boundaries to control national habitation and settling system. • Rural-urban interactions demand serious consideration regarding the impacts of existing policies and future planned interventions in both of them.

	-Land-use economics returns	• Dynamic changes in economic activities affect city functional diagram and efficiency.	• Planning efforts to accommodate future population growth must include alternatives to save their needs.	• Unstable capacity of land uses, services, transportation, and infrastructure.	• Making compact live-able urban neighbourhood to keep city efficiency.
Resources management	-Employment and productivity	• Transition of human civilisation cause changes in urban life ecology.	• The current items of family expenses have to be taken as a guide to define preferences of public and the priorities of governmental supports that are related to per-capita income.	• Technology provides new categories, and hierarchal structure of services.	• Decreasing inefficiency or any defects in cities composition by applying high tech solutions. • Using satellite cities, as a solution in case of cities saturation or inability to change.
		• Need for extension in economic capacity and employment opportunities.	• The extension or altering of new economic activities in need to be related to the previous planning strategically visions.	• Difficulties face achieving stable economic development.	• Cities plans should include scenarios for population growth, that to maintain efficiency of the city morphology.
	-Allocation of capitals, investments and resources	• Urban economics have big share in country economics.	• National, regional and urban plans must be developed to avoid problems of over urbanisation and shrinking of cities.	• Economic activities affect city diagram and direct population movement.	• Directing land-uses planning and design to create more jobs, increase economic capacities and revenues.
		• Public expenses	• Public services and the human security are state social responsibilities. • The political ideology of the ruling party must not be imposed identification of needs for public-service.	• Governments are obliged to provide public essential needs and protect weak classes.	• Making an arrangement for the essential supports of the public. • National expenses of Global restructuring, must not induce any reductions in government expenditure of the basic needs of citizens.
		• Socio-economic inequality created by city growth.	• Planning efforts should address issues of poverty and social exclusion. • Governments have to solve economic difficulties to support the welfare state. • Private resources in cities must be improved to reduce the risk of competing over shared resources to	• Equal access to gains of economic development for the public, between regions,	• Mobilising social capitals and strengthening collective actions. • Planning decisions should consider scientific estimates projecting city future development patterns, other practices from places around the World, and local characteristics.

			resolve conflicts and match public demand and supply. • Government has to encourage building up voluntary associations, strengthening families, and supporting public and private actors.	cities and within cities.	• Increasing public participation abilities to influence on urban decision-making, by exhibitions, public meetings, publication of surveys and reports, media publicity, ideas competitions, referendums and public inquiries, area management and advocacy planning.
		• Natural resources are highly demanded and consumed with urban ecology.	• The ecological determination areas approach enhanced the administration system of governing, increased planning rationality and helped entrepreneur competence. • The urban surrounding wild life, farmland, and environment, must be protected in all development aspects.	• Difficulty in balancing economic and sustainability concerns.	• Compacting cities to help sustainability considerations. That is guided by: safe land uses, efficient transportation and infrastructure; avoiding waste in resources, determining the possibilities of extension; improving delivery of public services and decreasing the consumption of resources.
		• Natural and manmade disasters have huge cost	• The planning for urban development has to include scenarios for possible disasters.	• Difficulty in decreasing the disasters' cost of losses.	• Preparing predetermined economic methods to decrease disasters expense and damages.

Table (7-3-b): Formulating a strategy toward the real time city focusing on the effects of population growth and economic activities upon a city morphology/ City interaction/ Characters of urban zones. (Researcher/ Alia- 2018)					
Strategy aspects		**Policies toward the utopian form of the real time city**		**Procedures of Interventions toward the utopian form of the real time city**	
City morphological development aspects see tables (4-3)	**City modifiers aspects see tables (3-2), (3-3),**	**Challenges, for more information see table (6-1)**	**Policies**	**Challenges, for more information see table (6-2)**	**Procedures**
Conservation of natural environment	• The urban environment	• Human physical health, behaviour and feelings, strongly impact by environments.	• The national policy must protect residence welfare and fulfil the responsibilities of each generation as trustee of the environment for succeeding generations.	• Maintain environment to supports heritage, diversity and individual needs.	• Using all practicable means and measures, including financial and technical assistance, to create and maintain conditions under which man and nature exist in productive harmony for present and future generations. • Assuring for all citizens safe, hygiene, healthful, productive and aesthetically and culturally pleasing surroundings.
	• Economic activities environmental effects	• Climate change damage environment.	• Cities should adopt solutions to avoid and solve the results of daily urban life in natural resources including water and fertile land and environment like: heat waves, extreme weather, droughts, flooding, biodiversity loss, disease, and soil erosion.	• Natural resources consumption level, Energy use and environmental emissions, increase by population growth, urbanisation, and motorisation.	• Providing solutions to conserving the natural resources, and using systems and technologies of resource-use reduction include waste management; and recycling techniques to minimise the need for raw materials. • Using vehicles minimises energy consumption by using techniques minimise the need and bad effects of fuel burning. • Using technologies depend on clean renewable energy sources. • Using technologies which are more energy-efficient and involve renewable resources; and minimises energy consumption in buildings.
		• Effects of industries in the natural ecology.	• Planning to achieve a balance between population and resource use which permits high standards of living and a wide sharing of life's amenities.	• Urban life ecology undermined by industrialisation.	• Managing industries with regulations: related to their effects on people, land, the environment and resources. • Emerging new industries must regard: city functions: residential sectors, public services,

			• Industrial beneficial uses have to comply with the environment without risks or other undesirable and unintended consequences.		economic activities and city networks of transportation and infrastructure.
Urban quality	• Living behaviours	• Technology use in materialistic and esthetical values, to perform activities, and for human comfort.	• Entering modern intelligent methods to manage and improve the urban environment, may be considered a costly commodity in the short run of planning but at the long run it is viable economically.	• Daily changes in city management, life applications and supplies.	• Using new technological practice to organise and serve the increased urban areas and scale of population. • Using intelligent methods in services delivery reduces costs and improves the quality and time length.
		• Accommodating diversity in city composition.	• Equity as a planning guide, is translated to citizens by providing them with all suitable and adequate access to transportation, infrastructure and public services.	• The complicity of providing and distributing different supplies and services between diverse land uses, and community groups.	• Seeking locations that minimise production and distribution costs and maximise accessibility for locating the public-facilities. • Supporting consumers by increasing their accessibility to public facilities regarding their different characteristics and choices. • Enhancing citizens' value of a residential property by minimises travelling costs and using cost of public facilities.
	• Economic returns by urban quality	• Globalisation, changing the economic bases of competitive metropolitan areas.	• Attracting global and local investments is a planning guide especially in central and inner city zones.	• Urban planning and design should decrease the cost of residency and create affordable land for investments.	• Controlling the value of housing units by: The location and site utilisation; quality and cost of neighbouring buildings and surrounding neighbours; the impacts of transportation networks; adopting less automobile use with better access to inner city districts; comfortable and enjoyable life; healthy environment; accessibility to public facilities; commercial and industrial expectation development and reservation of local culture and traditions. • Controlling the value of commercial investment by: The distance from CBD and other sub-centres; accessibility; neighbouring investments and

					running costs; the quality of production zones and firms; the characteristics of residence; the densification versus outward urban expansion; and availability of infrastructure and public services.
		• Urban development is for all city residence.	• Creating social justice, by evaluating current socio-spatial distributions against unethically defined norms and considering the means of inequality.	• The advantages rate of share by individual citizen.	• Adding diversity in the design of housing districts, by: mixing land uses and classes; connecting between different zones and activities with secure allying; and making unity by searching for a soul to the city design supports its different personalities and identities. • Planning to everyone in both a comprehensive and a sophisticated way, considering that the elderly, disabled, ethnic minorities, the youth and women – have particular needs.
		• Need for a dynamic extension in urban economy.	• In the case of economic growth planning directions must sustain cities liveability.	• Urban economic development creates congestion, affecting environments and city appearance.	• Giving maximum employment opportunities with emphasis on the service sector rather than manufacturing. • Giving a variety of housing types with variety of rental cost. • Creating an efficient transport system and efficient services and infrastructure system linked with the regional and local one. • Providing differ degrees of design control ranging from maximum control in the main city centre diffusion to the other centres. • Considering natural reservations.

Transportation and infrastructure pattern	• Need for transportation and infrastructure.	• Sustainable transportation and infrastructure systems.	• Cities must provide comfort and non-stop travels with a variety of means of public transport system for their citizens and visitors. • Public costs of infrastructure and transportation supplies must address consumers' income level.	• Dynamic needs for extension and improvement with daily changes in the technology means, and quality specifications.	• Taking the triple relations between work, residence and public services as the main guide in city diagram. • Improving urban transport systems design and decreasing travel trips time to decrease needs for fuel. • Using transportation networks with smart management system to help drivers avoid congestion and improve the efficiency of all networks. • Using infrastructure networks smart methods of meters that inform consumption rates, and determine consumption taxes and tariff.
	• Need for transportation and infrastructure for certain economic activity.	• Essentiality of smart management of city networks in large metropolitan areas.	• Cities must adopt partial smart management systems for each district alone and other integrated management system for all city.	• Regarding that each industrial areas within the city is in need for special infrastructure and transport means.	• Regarding that industrial sector is the main generator of trips which associate with the heavy movement directions in the centre of public services. • Addressing the different needs for the public infrastructure between different city land uses. • High-tech is also used in city development methodology by applying methods of simulating behaviour and phenomena, data collection and analysis.

Table (7-3-c): Formulating a strategy toward the real time city focusing on the effects of population growth and economic activities upon a city morphology/ Micro influence- internal networks/City design considerations. (Researcher/ Alia- 2018)					
Strategy aspects		**Policies toward the utopian form of the real time city**		**Procedures of Interventions toward the utopian form of the real time city**	
City morphological development aspects see tables (4-3)	**City modifiers aspects see tables (3-2), (3-3),**	**Challenges, for more information see table (6-1)**	**Policies**	**Challenges, for more information see table (6-2)**	**Procedures**
Micro/ - influences and growth	• Micro-growth controlling methods.	• State, region and city are networks of complex web of territories power.	• Increasing local government's efforts to ensure equal information technology access for all population. • Advances in telecommunications control economic, social and cultural fragmentation.	• Technology changes networks of human sense of territorial and personal identity.	• Putting priorities to increase efficiency of the political, social, work, transportation and infrastructure networks to develop residences quality of life. • Virtual electronic public spaces, should be considered as a part of the human communities, in planning social networks.
		• Rapid changes as a decrease or increase in city volume and economic functions.	• Planning new satellite towns and compacting city to accommodate city micro growth. • The economical capacities of the cities must guide efforts for controlling population movement.	• Difficulties face achieving Sustainable urban plan. • Satellite towns' fragment city, and act as sub-nodal points of interactions.	• The compact, pedestrian friendly, decentralised, and mixed functions development; promote a significant degree of self-containment that supports city cohesiveness. • CBD, is the more accessible zone and the main centre of work and services which supports the other city sub-centres. • The metropolitan cities with sprawling inefficient growth need enhancement in land densities, housing tenures, infrastructure and public services to decrease economic inefficiency and deterioration of natural ecosystem in and around. • Using polycentric distribution of public services and supporting efficiency of land uses distribution. • Reserving the efficiency of transportation, and infrastructure networks.

	• Economic activities in city micro-morphology	• Rapid changes in economic and social composition of interactions in city.	• Governments have to support investments in housing, infrastructure, public services, and conservation of urban quality. • Governments have to provide continuous enhancement efforts for city liveability. • Spatial growth policies should not be piecemeal and every intervention should contribute to a larger whole.	• Difficulties face achieving Sustainable urban design. • Problems of inequality, poverty, and blight areas	• Mixing of uses and activities is essential to all city districts economic and social well-being. • Designing streets networks in a way to provide the greatest number of travel routes. • Following higher-density development, with conservation of urban green space and local identity. • Creating a 'sense of place'; based on principles like human scale, pedestrian access, safety, complexity, legibility or spatial enclosure; • Fostering social interaction; • Equalising public services access and ensuring closer proximities between where all people; • Creating imageability and vitality to enhance the visual, aesthetic city experience; and • Influencing the ecological principles.
		• Globalisation, deindustrialisation and information economy transform cities.	• The economic bases of competitive metropolitan areas must be designed to serve in the global scale. • Cities must adopt advances in telecommunications to enhance communication and urban life, and attract inward investment. • Importance of ensuring diversity of industries. This generates economic growth in close proximity because it fosters working, income, education and other services opportunity.	• Cities planning and design depend on the industrial relations, telecommunication adds new definition of city spatial relations.	• Using industrialisation process and marketing possibilities as guides in planning. • Adopting socio-spatial patterning and physical structure of cities, result from multiple webs of relations, each with its own space–time dimensions. • Developing clusters of knowledge-based firms (techno poles). • Providing advanced, integrated, multi-nodal transportation infrastructure, • Facilitating the expansion of (ICT), and digital communications infrastructure and services. • Developing human resource capacity to operate global knowledge-based enterprises. • Creating an attractive and sustainable quality of life.

Table (7-3-d): Formulating a strategy toward the real time city focusing on the effects of population growth and economic activities upon a city morphology/ Macro influence- external networks/ City accentuation. (Researcher/ Alia- 2018)					
Strategy aspects		**Policies toward the utopian form of the real time city**		**Procedures of Interventions toward the utopian form of the real time city**	
City morphological development aspects see tables (4-3)	**City modifiers aspects see tables (3-2), (3-3),**	**Challenges, for more information see table (6-1)**	**Policies**	**Challenges, for more information see table (6-2)**	**Procedures**
Macro-influences and growth	• Macro-growth controlling methods	• Globalisation and informationalisation increase importance of capital cities.	• National and regional authorities must support capitals with high degrees of communication and transportation to increase their centrality. • The national and regional urban composition must be supported by growth of 'corridor cities' linked by movement of information and capitals.	• Un-Convoying capitals, besides the difficulties to move them without affecting available national urban system.	• Using technology as a method to reinforce the centrality of cities with communications networks in their regional context. • Enhancing old centres to reserve the deeply cultural and heritage roots. • Supporting capital role as a gate in national and regional context. • Relocating of capital city, solves congestion and inefficiency in the old capital. • Supporting the national perspective with interventions in transportation, connectivity and development of infrastructure inner and between main urban centres.
		• Information technology and intelligent networks decrease the importance of physical geographical borders.	• National planning has to support three levels of cities: truly global centres contain many global firms; with zonal centres serving as important links with the international business system; and regional centres with weak links in global system but with definite regional importance.	• A growing interconnectedness and internationalisation between certain sections of most cities and the outside-world.	• Considering the global cities centres out the territorial nation-state; contain a disproportionate number of the headquarters of the World's largest corporations and international banks. • Adding separate link (sub centre) to connect global cities with the national governing system.

		• Planning varying from city to city based on political climate, social networks and the goals of cities and people.	• The role of central governments determine the prosperity and growth of cities. • The national, regional and local governmental roles have to translate to functional and spatial relations.	• Municipalities, different in legal restrictions, specialised functions, and fortunes. • Harmonize regional development.	• Strengthen coordination and collaboration between: national, regional and local authorities. • Influencing the role of central governments to put forward legislation, adopt social and economic policies and allocate budgets through a continuous dialogue with regional and local authorities in support of city growth. • Balancing urban and regional development by investments in transport and communications infrastructure, human development and welfare. • Creating regional cohesion by promoting economic opportunity, access to affordable transportation, infrastructure, social housing, slum improvement and poverty reduction.
	• Economic activities in city macro-morphology	• Global firms need highly flexible work environments to work effectively. • Global economics are up scaling and downscaling economic functions.	• The national authorities have to carry out the increasing in international trade, investment and global mobility of production factors. • The national federal system of states governing authorities must be fixable to restructures by global economic.	• Global forces lead to change in a city morphology. • City government need to modify and embed globalisation in their local context.	• Transforming local economy into free-flowing global information economies. • Arranging tele-working to re-engineer local corporations to follow globalisation. • Protecting local economies, industries and labours. • Providing regulations and measures to control the concentration and domination of private ownership over essential necessities, declining level of public control of private commodities in general and declining level of local control over such commodities in particular.
		• The normal post-modern, industrial city turn to be mid-tire city in the availability of global one in the	• Regional and national authorities have to change the national main cities to be global centres. • Reshaping metropolitan areas to remain competitive location in the global economy.	• Cities compete with each other to attract top-level global activities, transnational capitals and elite population.	• Developing cities by decentralisation of routine office jobs, recentralisation of governing and managing functions; supporting some selective re-industrialisation in high-technology. • Providing the technology and infrastructure for transportation, communications, production and service delivery that help local enterprises to compete globally.

		national urban system.			• Creating and sustaining institutions that develop the knowledge and skills that people need to participate in the global economy • Fostering an attractive quality of life for global investments. • Increasing international trade and investment. • Supporting emergence of knowledge industries linked through global virtual networks and supply chains; • Increasing demand for high-quality goods and services anywhere in the World.
		• There are spatial strong linkages between rural and urban areas.	• Any development planning efforts should recognise the flows of people, resources, wastes and the disparities experienced by people in both rural and urban communities. • Creating sustainable regional/ rural and urban economic development was debated as a rational solution to inner migration problems.	• Rural to urban influxes of unemployed, create marginal jobs, affect city capabilities, and increases contradictions in residence.	• Enhancing production and trade between rural and urban areas by linking rural productions (e.g. food) and urban consumers, this helps ensure urban security (food, natural resources for industries), as assisting people in the pri-urban context to find sustainable livelihoods. • Urban and pre-urban agriculture generate income sources among urban poor; especially immigrants from rural areas. And safe land in the rural-urban interface • Enhancing the use and state of rural natural resources. • Improving the livelihoods and living conditions of rural poor and weak classes. • Organising migration to urban with strict migration controls. • Encouraging return to rural areas. • Promoting scattered urbanisation through resettlement policies. • Promotion of small and medium-sized towns to attract migrants, as new spatial growth poles.

7.5 Conclusion:

The study produces a proposed strategy frame to focus city development on population growth and economic activities aspects; depending on (CMM). That is divided into two parts: the first one is to confront urban development constraints, include alternative policies and procedures to improve city capabilities and solve poverty problem. The second part of the strategy frame is to convoy the characteristics of the real time city, which is able to generalise globally, for all cities with different development situations. This is distributed by subject to first, the devices making development, such as planning, monitoring, implementation and interventions to control the effects of population growth and economic activities in shapes of plans, policies, decisions; and second, regulations to (make) development in operation areas, consider the problems and causes of problems with futuristic vision, all in sustainability considerations.

Chapter (8):

APPLICATION OF THE STUDY ON *KHARTOUM* METROPOLITAN CITY

8.1 Introduction:

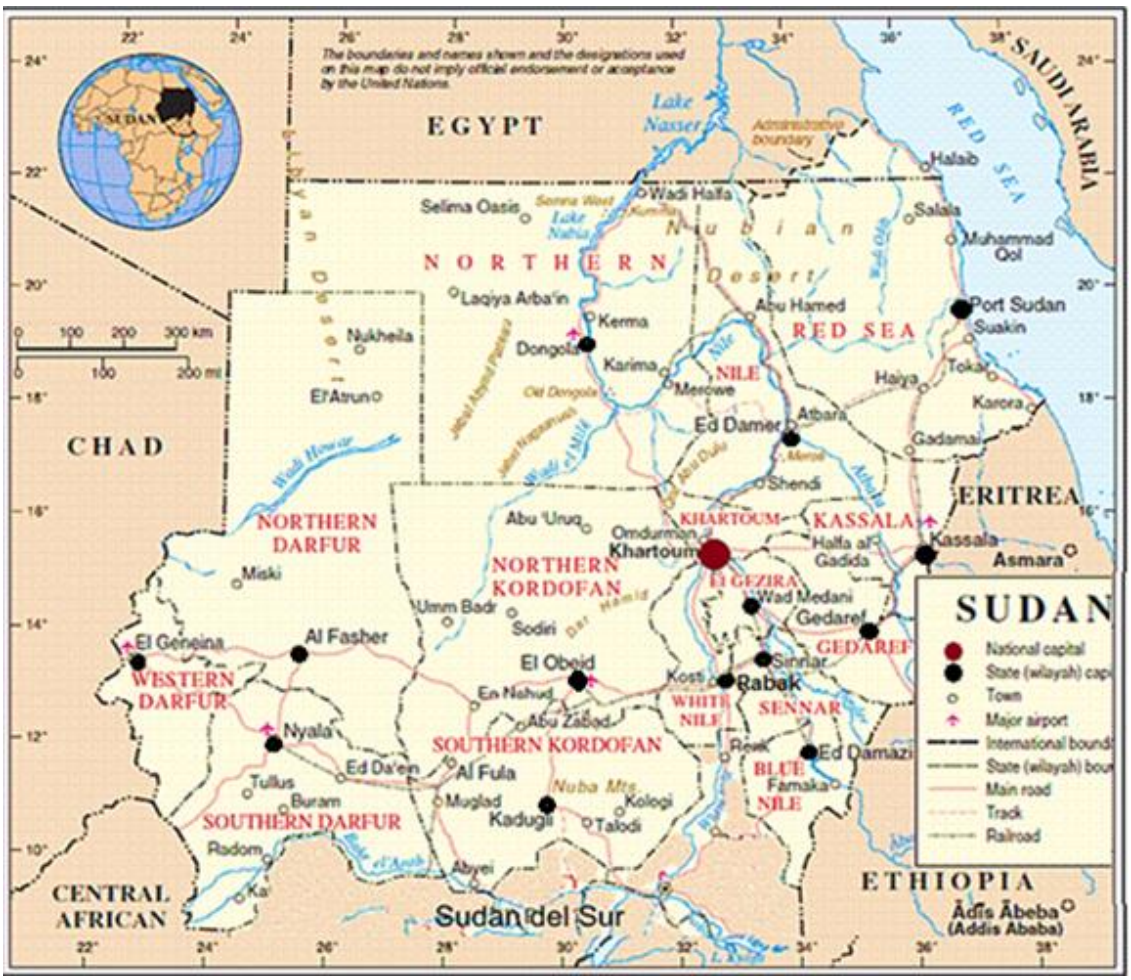
In this stage of the study, the effects of population growth and economic activities within a city morphology are identified and a strategy frame to confront them is proposed. The case study has to test all these findings in a real city. *Khartoum,* the capital of *Sudan,* is suitable of study. It is a metropolitan city, with over 7 million dwellers, and includes all the three mentioned types of economic activities: services, industries and agriculture. It is in a developing country which suffers from various types of development constraints, and is, also, a primer city with high rate of inner migration.

The case study analysis include: defining intervening factors in *Khartoum* (CMM), assessing *Khartoum* (CMM), discussing the effects of population growth and economic activities within *Khartoum* (CMM), and providing a strategy frame and recommendations for morphological development of *Khartoum* (CMM).

8.2 Approach to the Case Study:

Khartoum is the capital of *Sudan,* a country located in the North-Eastern part of *Africa*. It is divided into 15 states or *"Wilayat".* (See maps: (8-1). *Sudan,* has a total area of 1,886,068 km2 (728,215 sq. mi), and the total country arable land amounts to 15.7%. The last population census of *Sudan* 2008, showed a total population of about (30,894,000) and a population density of about (17) persons per square kilometre. The concentration of population is in the *Nile River* strip and in the rich savannah areas, see Map (8-2).

Natural hazards facing *Sudan* are floods, dust storms, and periodic persistent droughts, inadequate supplies of potable water in some parts of the country, threatened wildlife habitats from excessive hunting, soil erosion, desertification, and famine.



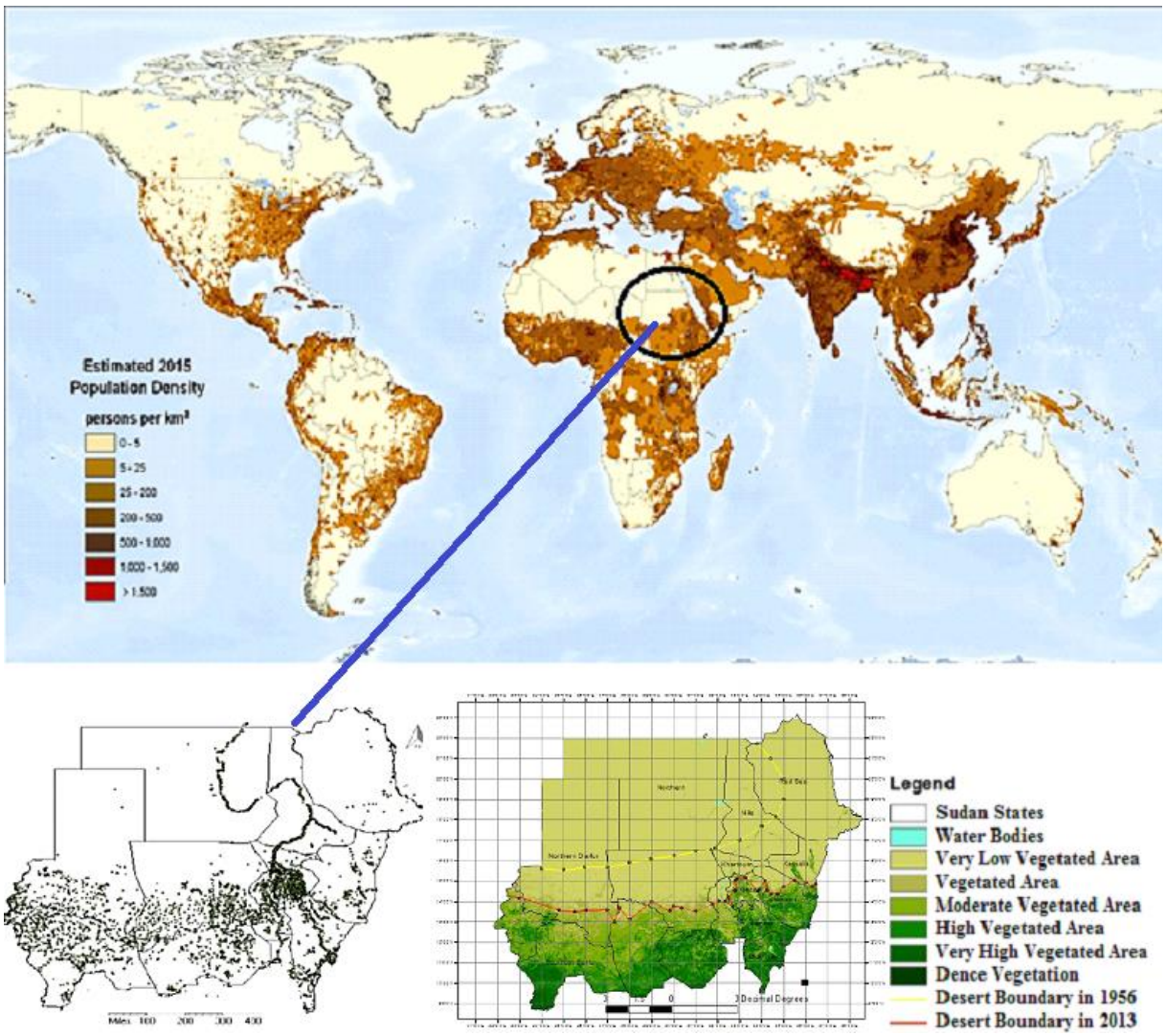
Map (8-1): *Sudan*- geographical location and its capital *Khartoum* city. (UN-Department of peacekeeping operations 2007)

8.2.1 *Sudan* as a Limited Economy Country:

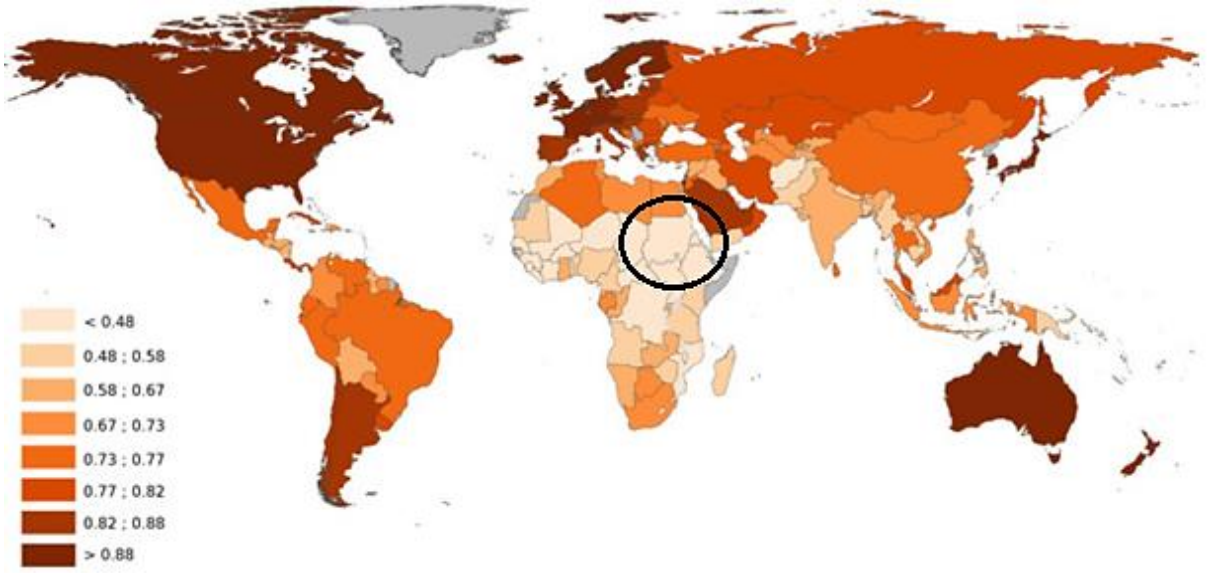
Sudan is considered as a (LER) country that faces many problems, among them: unsettled domestic political and social conditions, poverty, low human development indicators, unbalanced resources distribution, administrative and institutional problems, that involve high rate of intervention from the international community. See map (8-3). The underdevelopment consequences relate to historical colonisation, social development, governing system, economic development, and international relationships.

8.2.1.1 Historical colonisation consequences:

Sudan was colonized by the Othman empire from 1821 to 1885 and British government from 1898 to 1956. This made many changes in its local governmental, cultural and social context and gave it its recent geographical boundaries. Colonisation caused other negative effects including civil wars and local conflicts.



Map (8-2): *Sudan*- population concentration related to the World countries and the environment. (Internet, Google maps-2018). Note: global population densities calculated as person per square km.



Map (8-3): *Sudan*- development situation related to the World countries. Human development Index (UNDP-2014). Note: human development Index (1=perfect/ 0=bad)

8.2.1.2 Social development:

In 2015 Sudanese population reached 40.2 million and is projected to be 56.4 million in 2030, with over 60% rural population. According to the Population and Housing Census, in 2008, the estimated rate of population growth is 2.66 % per annum, among the highest in the World. And according to UN- Human Development Report 2016, the socio-economic indicators explained 67.8 % of variation in crude death rate. Literacy rate is 70.2% of total population, for the male: 79.6%, and female: 60.8%. Human development index is low about 0.49, see map (8-3), and figures (8-1) to (8-2).

The main ethnic group in *Sudan* is Arabs. Their presence is estimated at 70% of the Sudanese population. *Sudan* has 597 other ethnic groups that speak over 400 different languages and dialects, but the primary language spoken at all levels is Arabic, and the second, officially used, language is English. The majority of Sudanese population are Muslims. There is a high rate of social services inequality in *Sudan*, reaching 31.8% in health and 42.7% in education. See figure (8-3). The 2015 multidimensional poverty index indicated that the poverty line reached 46.5%, see figure (8-4).

Unsettled political conditions cause the displacement of 3,182.000 people, and a large number of refugees and homeless people. Despite being a refugee-generating country, *Sudan* also hosts refugees. According to the World refugee survey 2008, there are 310,500 refugees and asylum seekers who were living in *Sudan* in 2007. The majority of this population came from Eritrea (240,400 people), Chad (45,000), Ethiopia (49,300) and the Central African Republic (2,500) and Syria (100,000), see figure (8-5).

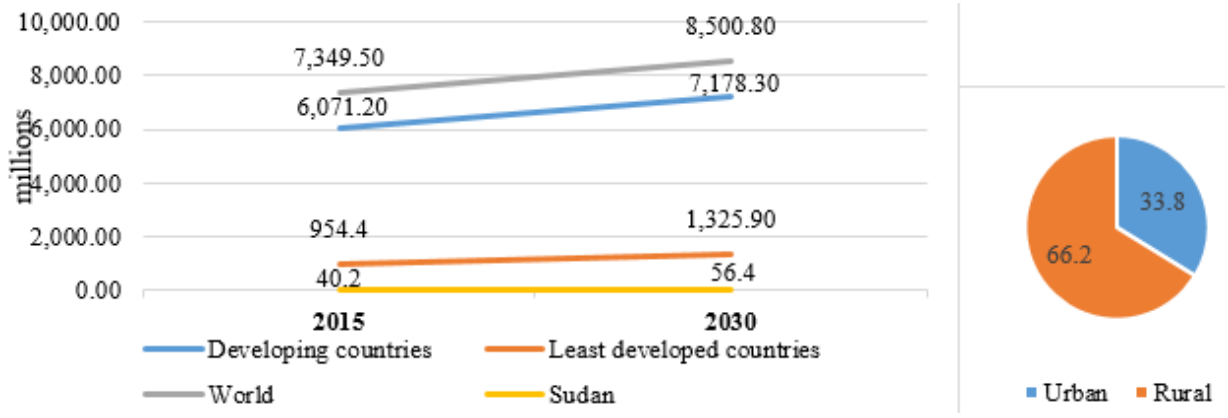


Figure (8-1): *Sudan*- population growth related to the World development groups and the urban rural classification. (Human Development Report -2016- (UNDP))

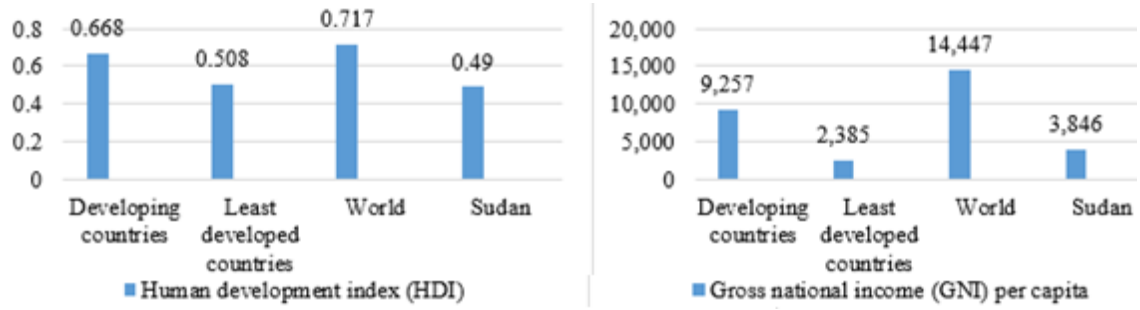


Figure (8-2): *Sudan*- human development index and gross national income (GNI) related to the world development groups. (Human Development Report -2016- (UNDP))

Figure (8-3): *Sudan*-inequity, adjusted human development index related to the World development groups. (Human Development Report -2016- (UNDP))

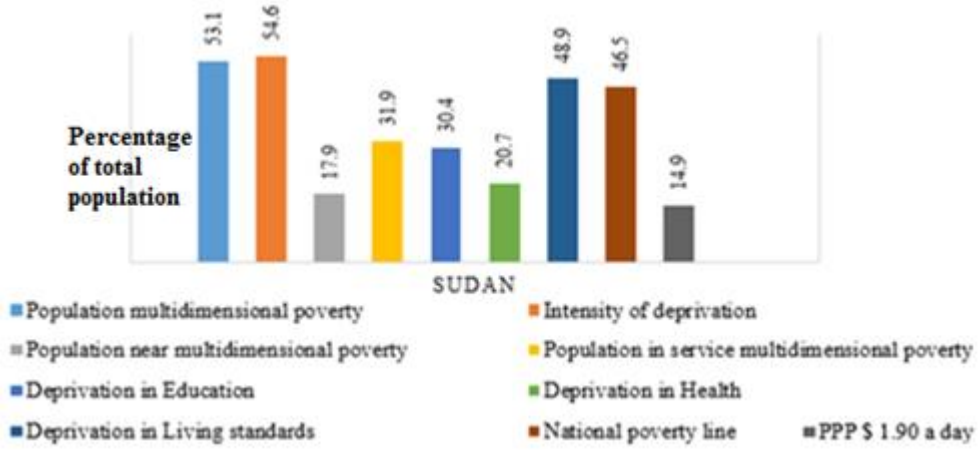


Figure (8-4): Sudan- multidimensional poverty index. Note: PPP- Percentage of the population living below the international poverty line- (Human Development Report- 2016- (UNDP))

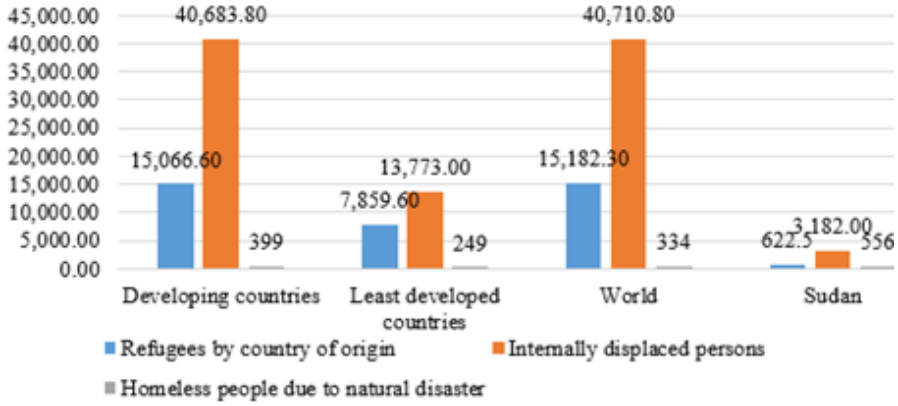


Figure (8-5): *Sudan*- human security related to the World development groups. (Human Development Report- 2016- (UNDP))

8.2.1.3 Governing system:

The Sudanese cultural differences, together with other social, economic, and political factors, have plunged *Sudan* into one of the most violent civil wars in the modern history[11]. The political situations are unstable and governmental institutions are ineffective. *Sudan* development plans have been crippled by many difficulties manifested in huge internal and external deficits, mounting debts, high inflation rate, and low or negative (GDP) growth.

Officially, the politics of *Sudan* take place in the framework of a federal, presidential, representative, democratic republic, in a multi-party system, where the President of *Sudan* is head of state, head of government and commander-in-chief of the *Sudan* People's Armed Forces. Legislative power is vested in both the government and the bicameral parliament—the National Legislature, with its National Assembly (lower chamber) and the Council of States (upper chamber). The Legal system is a mixed legal system of Islamic law and English common law. The judiciary is independent and obtained by the Constitutional Court. There are many political parties in *Sudan*, but with limited influence than the governing party (National Congress).

8.2.1.4 Economic development:

The governmental expenditure in basic commodities is very low relevant to averages established by the World and other countries, see figure (8-6). Employment force is under 50% and the majority of them work in agricultural and services sectors, see figure (8-7). The agricultural sector contributes 95 % of all export earnings and the industrial sector contributes a small proportion in (GDP). *Sudan'*s external debt is about $53.35 billion (31 December 2017 EST.). *Sudan's* economy was a subject to comprehensive US sanctions for more than 20 years, partially lifted in October 2017. The (GDP) in 2017 reached 186.8 billion, see figure (8-8), and (8-9).

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11 First Sudanese Civil War, the year before independence in 1956, a civil war which began between Northern and Southern *Sudan*. This civil war went for more than 49 years, displacing many people within *Sudan* and into neighbouring countries. It damaged *Sudan*'s economy and led to food shortages, resulting in starvation and malnutrition. Peace was consolidated in 2005, but southerners voted for separation as an independent country in 2011. A new rebellion in the western region of Darfur began in early 2003. The rebels accuse the central government of neglecting the Darfur region. The government claimed victory over the rebels, in early 2004, but humanitarian situation still remains very poor.

Agricultural production remains *Sudan*'s most-important sector, but most farms remain rain-fed and susceptible to drought. The total country irrigated land: 18,900 sq. km (2012), distributed to: permanent crops 0.2%; permanent pasture 84.2% that indicates very low percentage of advantage. The other *Sudan's* natural resources include: petroleum; small reserves of iron ore, copper, chromium, zinc, tungsten, mica, silver, gold; hydropower. The industrial production growth rate: 2.5% (2017 EST.). Conditions of political instability, lack of basic infrastructure, weak investments in natural resources, weak industries, and weak world-agricultural prices ensure that much of the population remains at or below the poverty line for years.

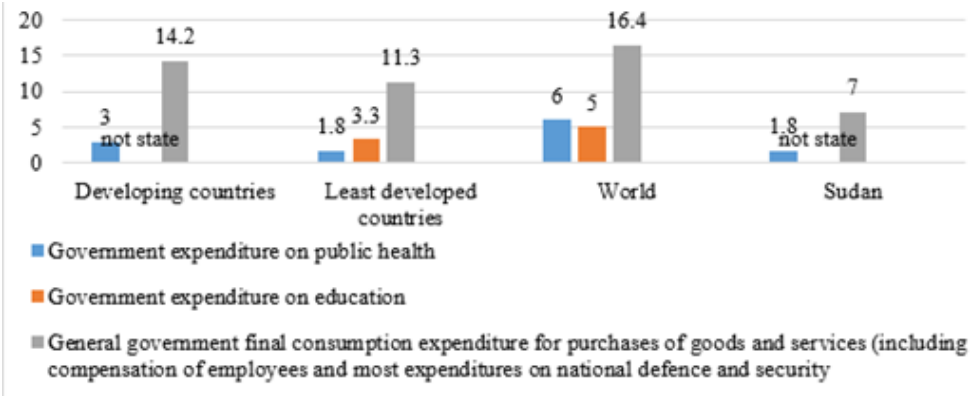


Figure (8-6): *Sudan*- governmental expenditure in basic commodities related to the World development groups. (Human Development Report- 2016- (UNDP)).

Figure (8-7): *Sudan*- employment characteristics. (Human Development Report -2016- (UNDP)).

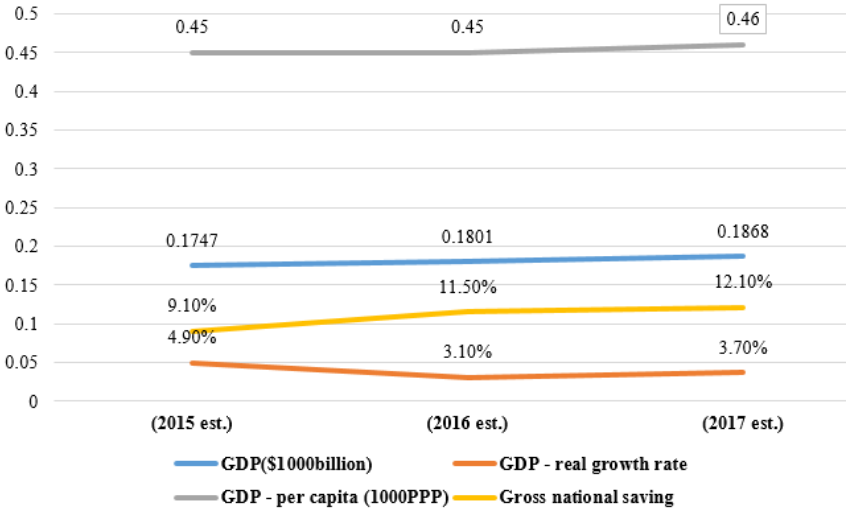


Figure (8-8): *Sudan*- (GDP). (Human Development Report-2016- (UNDP))

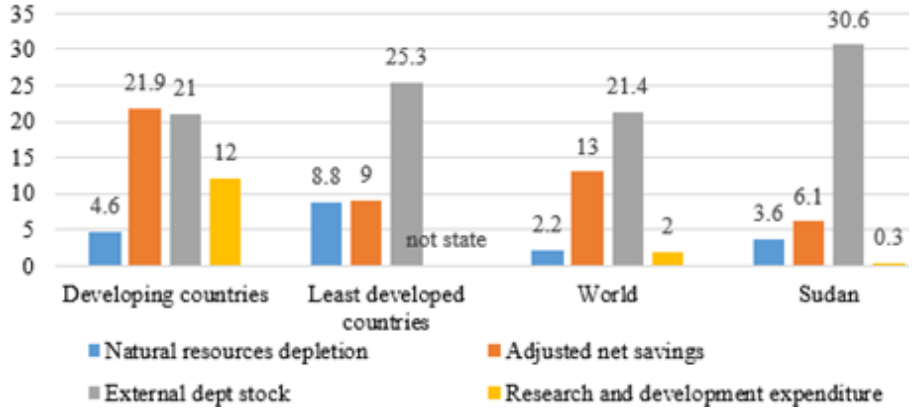


Figure (8-9): *Sudan*- sustainable development –Economy- related to the World development groups. (Human Development Report-2016- (UNDP))

Sudan is considered a technology consumer, not a producer; so there is a difficulty in following real time technological matters. There is no clear strategy towards achieving technological transition, based on supplementing equipment, enhancing working environment, or special training. Sudanese are kept up and able to improve their technology using skills. In communication, the total number of mobile cellular users reaches 27,807,293 that exceeds 75 telephones per 100 persons. The telephone system is well-equipped, compared to regional standards. Cellular communications started in 1996 and have expanded substantially with wide coverage in most major cities. That makes daily improvement in smart development in urban life, by using mobile applications, especially in commercial services.

In transportation, the International airport is in *Khartoum* city, the capital, the number of registered air carriers is six, and the annual international passenger traffic on registered air carriers is 496,178. The annual international flight traffic on registered air carriers is 13,161,592 MT-km (2015). The number of other Sudanese airports - with paved runways is 16 (in each state's capital).The major seaport is Port *Sudan* in the Red Sea state, merchant marines: 17, general cargo 1, other 16 (2017). The total country: pipelines: gas 156 km; oil 4,070 km; refined products 1,613 km (2013); railways: 7,251 km; roadways: 11,900 km, paved: 4,320 km, and unpaved: 7,580 km (2000).

8.2.1.5 International relationships:

Sudan association in the global economy and trade is very limited due to its unstable situations, see figure (8-10). *Sudan*, is a member of (UN), (AFU), (LAS), organisation of Islamic Cooperation and Non-Aligned Movement, as well as an observer in the World Trade Organisation. It faces a lot of interventions from the international

community in its domestic affairs.[12] The *Sudan* overall international assistance levels reached more than $1.3 billion after the (UN)'s September 2003 appeal; principal implementing agencies included (WFP), (UNHCR), (UNICEF) and other various (NGOs)[13].

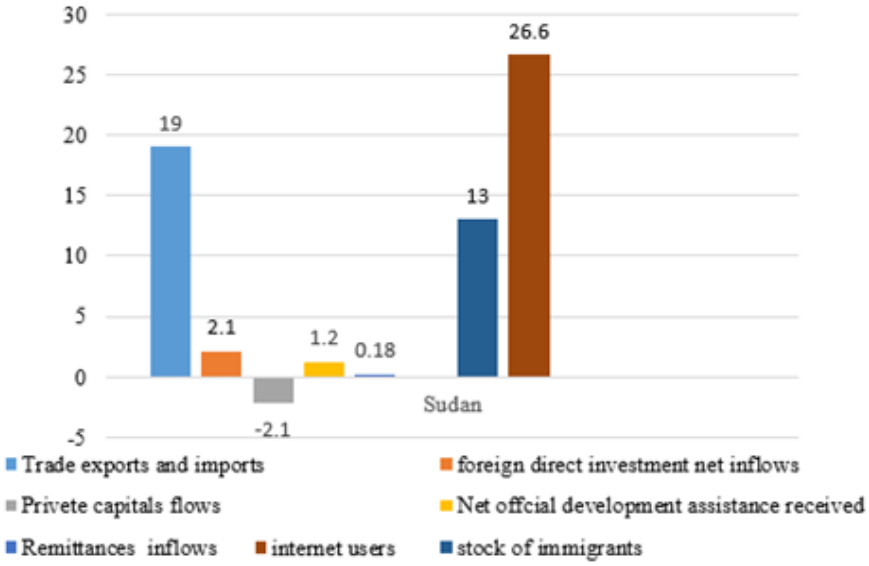


Figure (8-10): *Sudan*- percentages of international integration. (Human Development Report-2016-(UNDP))

Sudan also has had a troubled relationship with many of its neighbours and much of the international community. The *Hala'ib* triangle is a disputed region between *Sudan* and *Egypt*; it is currently under Egyptian administration. Also *Abyei* Area is another disputed region between *Sudan* and *South Sudan*, it is currently under *Sudan* rule. Not only that there are other problems in *Fashaga* and some parts from the country. In order to export oil, *South Sudan* relies on a pipeline to *Port Sudan* on *Sudan*'s Red Sea coast.

Sudan has extensive economic relations with *China*. The major Sudanese imports-partners: UAE 15.4%, *India* 11.2%, *Egypt* 10.4%, *Saudi Arabia* 9.2%, *Turkey* 8.9%, and *Japan* 5% (2016). In 2015, *Sudan* participated in the Saudi Arabian conflict

[12]This reached the limit of using the (UNSC) international military in Darfur problem.

[1313]Several UN agents are operating in *Sudan* such as the World Food Program (WFP); the Food and Agriculture Organization of the United Nation (FAO); the United Nations Development Program (UNDP); the United Nations Industrial Development Organizations (UNIDO); the United Nations Children Fund (UNICEF); the United Nations High Commissioner for Refugees (UNHCR); the United Nations Mine Service (UNMAS), the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and the World Bank. Also present is the International Organization for Migration (IOM). *Sudan* is a part of the Northern Africa grouping of the UN geo-scheme. International organization participating are: ABEDA, ACP, AFDB, AFESD, AMF, AU, CAEU, COMESA, FAO, G-77, IAEA, IBRD, ICAO, ICC (NGOs), ICRM, IDA, IDB, IFAD, IFC, IFRCS, IGAD, ILO, IMF, IMO, Interpol, IOC, IOM, IPU, ISO, ITSO, ITU, LAS, MIGA, NAM, OIC, OPCW, PCA, UN, UNCTAD, UNESCO, UNHCR, UNIDO, UNWTO, UPU, WCO, WFTU (NGOs), WHO, WIPO, WMO, WTO

with *Yemen*. This led to Sudanese army intervention in *Yemen*. Sudanese relation with USA were on transition in January 13, 2017, by that USA lifted many sanctions placed against *Sudan* and released assets of its government held abroad. In October 6, 2017, it lifted other remaining sanctions against the country and its petroleum, export-import, and property industries.

Sudan, as a part of the globe, is affected by climate changes issues, but *Sudan* is regarded as a limited polluter with 1.9 carbon dioxide emissions, see figure (8-11). The *Sudan* association in international agreements in environment include: Biodiversity, Climate Change, Kyoto Protocol, Desertification, Endangered Species, and Hazardous Wastes, Law of the Sea, Ozone Layer Protection, and Wetlands.

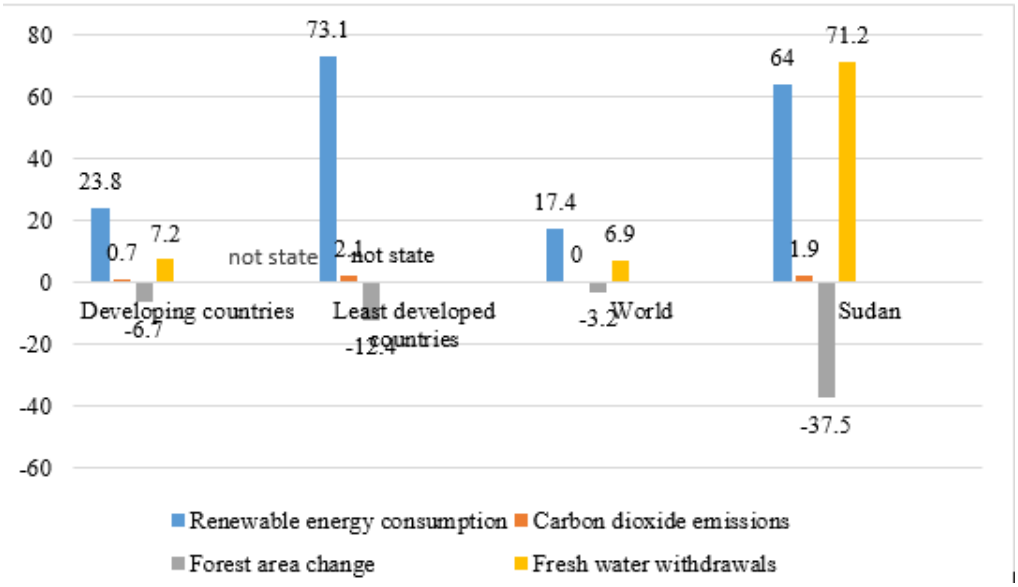


Figure (8-11): *Sudan*- sustainable development –Environment- related to the World development groups. (Human Development Report-2016- (UNDP)).

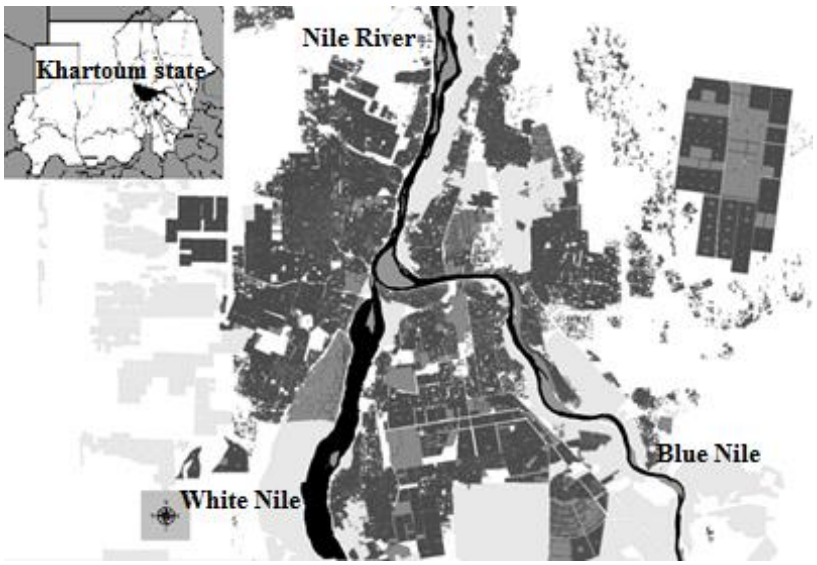
8.3 *Khartoum* the Place of the Case Study:

Khartoum,[14] is the capital of *Sudan*, it is the main international gate for air transportation and the main node of regional and national land transportation. It is the prime mega city in the country. *Khartoum* state, compared to other states of the country, has the lowest area: 22,142 km², and the highest population count: 5,274,321, see figure (8-12).

[14] There is a multiplicity in the meaning of *Khartoum* related to the geographical distribution: *Khartoum* the whole state, *Khartoum* the metropolitan city includes all urban part of the state, *Khartoum* city one of the three towns that compose metropolitan *Khartoum*, *Khartoum* locality the centre of *Khartoum* city. *Omdurman* and *Khartoum north* are also named cities and localities in the same time.

Khartoum is also a metropolitan city and the strongest economy in *Sudan*. Its share reached 18.07% in the Sudanese (GDP) in 2015, distributed to 22.5% from agricultural sector, 27.7% from industrial sector and 49.8% from services sector. That indicates *Khartoum* city as a services centre. (Ministry of strategic affairs and information- *Khartoum* state- 2015).

Khartoum city, see map (8-4), is located in the heart of *Sudan*, at the confluence of the *White* and *Blue Niles* where both rivers contribute to the creation of the *River Nile*. Under *Köppen's* climate classification system, *Khartoum* features a hot arid climate, with only the summer months seeing noticeable precipitation. The city averages a little over 155 millimetres (6.1 in) of precipitation per year. Based on annual mean temperatures, this city is one of the hottest major cities in the World. Temperatures routinely exceed 40 °C (104 °F) in mid-summer.



Map (8-4): *Khartoum*- the location. (The ministry of the physical planning- *Sudan*-2010).

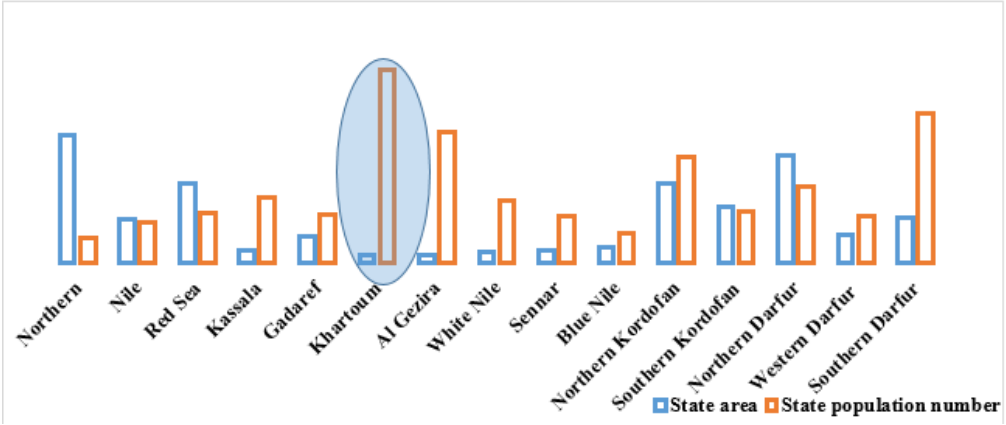
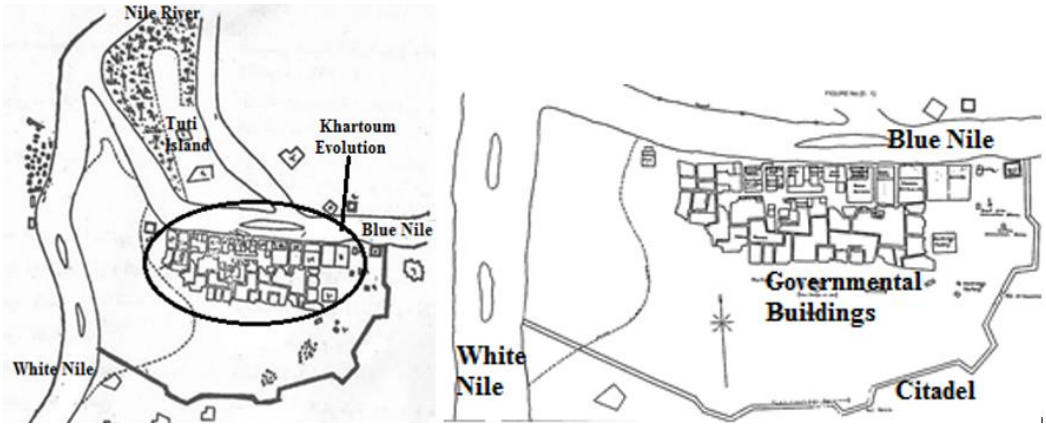


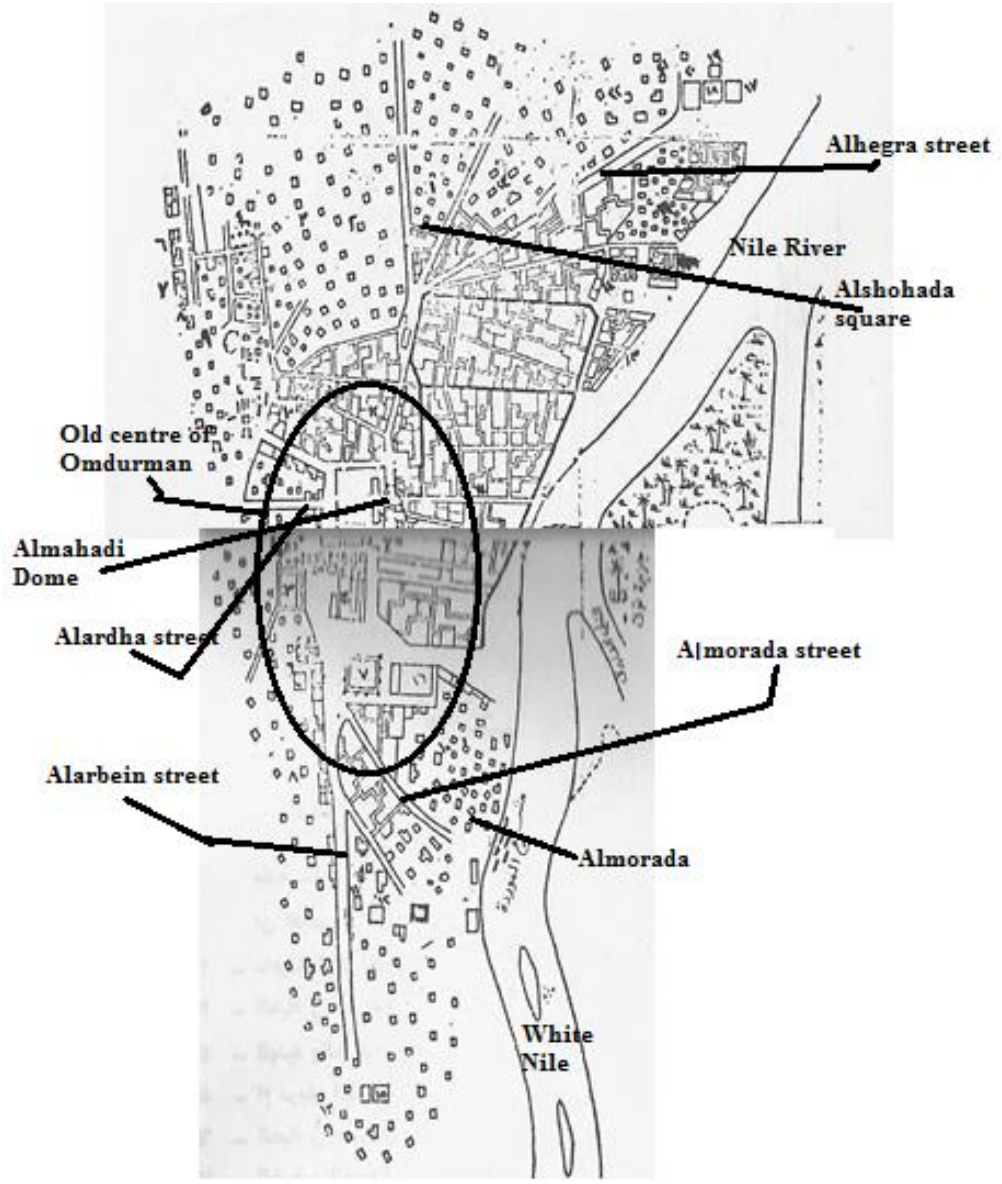
Figure (8-12): *Sudan*- comparison between states areas and population numbers. (Central Bureau of Statistics -*Sudan* (web-2017) and 5th Population Census- *Sudan*- 2008)

8.3.1. *Khartoum* Historical Background:

- Before 1691: Early settlement in *Khartoum* location started in *Tuti* Island in the conjunction of the three Rivers, it was in the shape of a small village established surrounding a mosque and a religion school.
- In 1820: *Egypt,* as part of the *Ottoman Sultanate,* sent military force to conquer and unify the northern portion of *Sudan*. Many of the members of the force perished from disease and the unfamiliar climate. In 1821: *Khartoum,* for its healthier environment, became the capital and was established to grow as a regional centre of trade. *Khartoum* morphology, in this era could be functionally distributed to: administration buildings, military campus, religious buildings, cemeteries, commercial centre, and manufacturing zones. In the residential zones, density was very low and there were multi un-built up areas between houses. The roads in central *Khartoum* were very wide; the main roads were the *Nile Street, Victoria and Gordon Streets.* The rivers port of the city was on the *Blue Nile*. See map (8-5).
- In 1884: *Almahadia,* a religious revolution against *Turkish* taxes takers, succeed in ruling all *Sudan,* including *Khartoum* city. They established their capital in *Omdurman to the* west of the *Nile*. This city grew rapidly with internal migration from all *Sudan* especially western parts. It was considered as centre of rule, religion and trade. *Khartoum* declined and was abandoned in that time. *Omdurman was* established around *Almahadi* Dome (the place where *Almahadi* was buried), main mosque, public plaza, and *Khaleefa* (governor) house. *Omdurman* was planned as multi districts and *Omdurman* market was the central core. The city streets were unorganized and narrow. *Alardha, Almorda* and *Alarbaeen were also* regarded as main streets. See map (8-6)



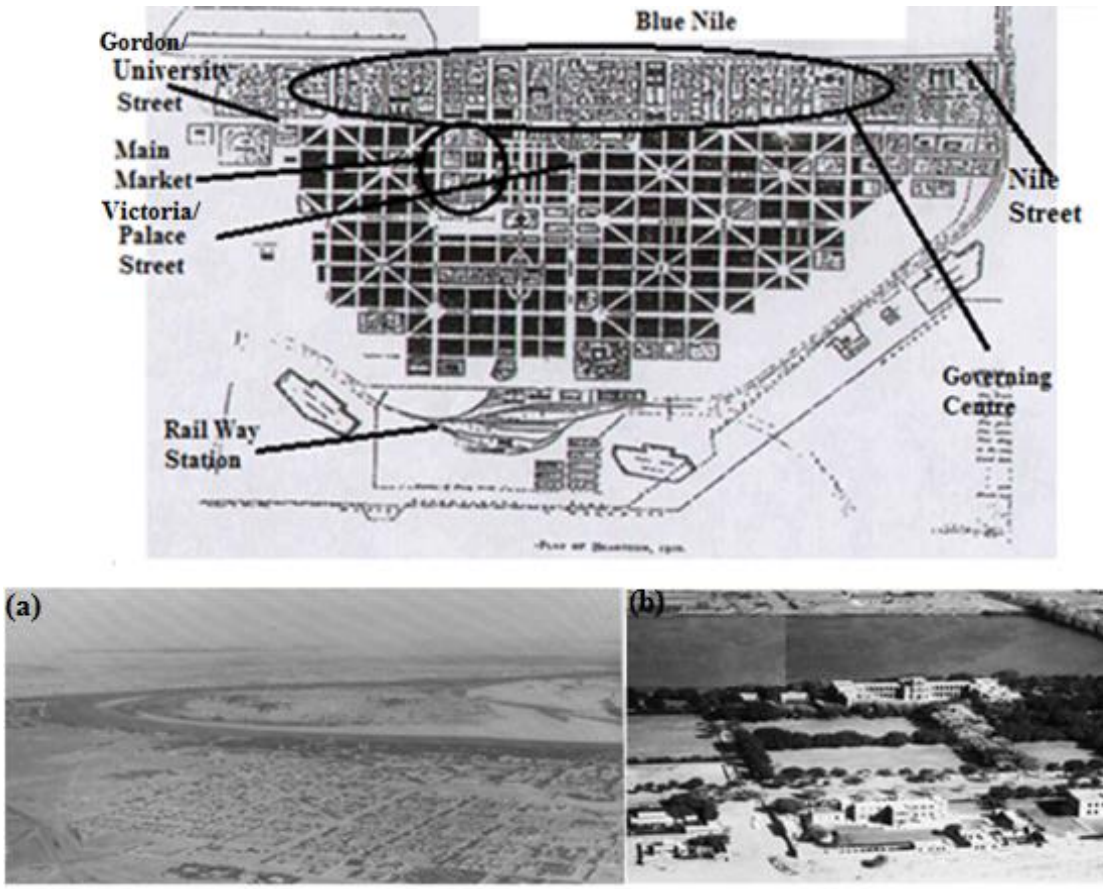
Map (8-5): *Turkish Khartoum*- during Early *Turku- Egyptian*. (Abu Saleem-1991)



Map (8-6): *Almahadia Khartoum-Omdurman* evolution. (Abu Saleem-1991)

- In 1898: *Sudan* was colonized by the *British*, and *Khartoum* returned to be the capital but for the *Anglo-Egyptian Sudan*. In that period *Sudan* had: its definition as a country, boundaries, governing system and regional context. *Mac Leans* plan[15] in 1910, was designed for *Khartoum* to accommodate a population of (50,000). The plan adopted a solid grid pattern. It was the first plan that adopted the housing classification system, which classifies the housing into four class zones each with specific building regulations. The plan focused on *Khartoum*, where all governmental buildings were located, giving less attention to *Khartoum North*, and *Omdurman.* See map (8-7).

[15]It was not only the first comprehensive development plan in the modern history of *Sudan* but also the first master plan in colonial *Africa*. MacLean was a lecturer at Gordon Memorial College in *Khartoum*.



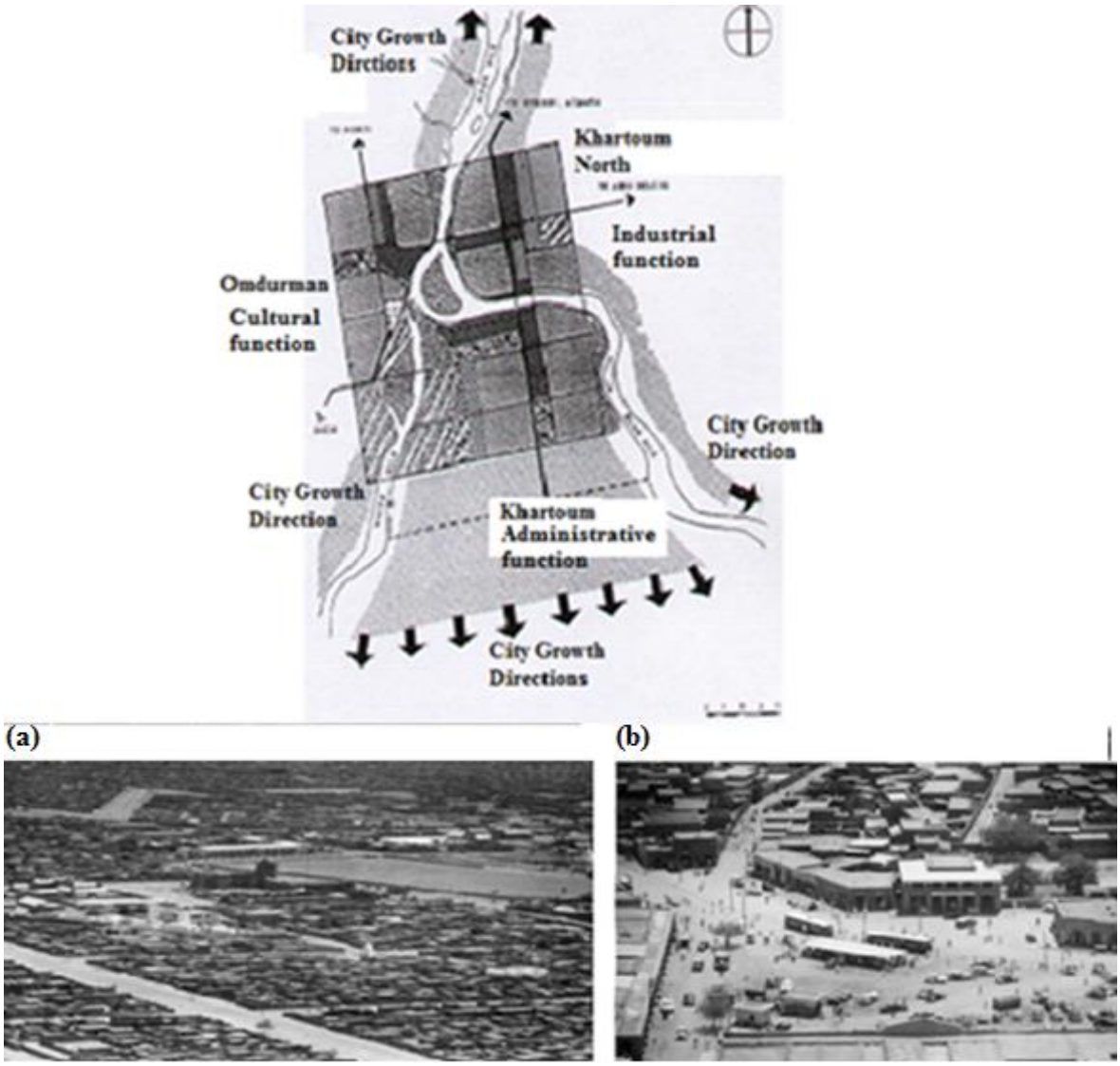
Map (8-7): *British Khartoum* (Mclean plan 1910)

Photo (8-1/ a and b): *Khartoum*- (1910), (Internet-Google images-2018)

- In 1956: Greater *Khartoum* (combination of: *Khartoum*, *Khartoum North*, and *Omdurman*) became the capital of the independent *Sudan*. Its population reached (253,000) - (Hafazalla-2008), forming the largest urban centre in the country. The period after independence was a period of growth of the national spirit and the feeling of identity. The country faced unsettled National governments with multi-dimensional parties' conflicts; this divided the country to ethnic, racial, religious, and regional grounds.
- In 1958: *Doxiadis*[16]prepared a master plan for *Greater Khartoum*, which included the three cities, but with some distinction in the urban functions of each. *Khartoum* city was primarily administrative, *Khartoum North* was industrial, and finally *Omdurman* gained a cultural function and remained as a national native city. The three cities shaped a clear multi-nuclei and a multi-directional model of city expansion, each city with its own centre but the centre of *Khartoum* city was a major

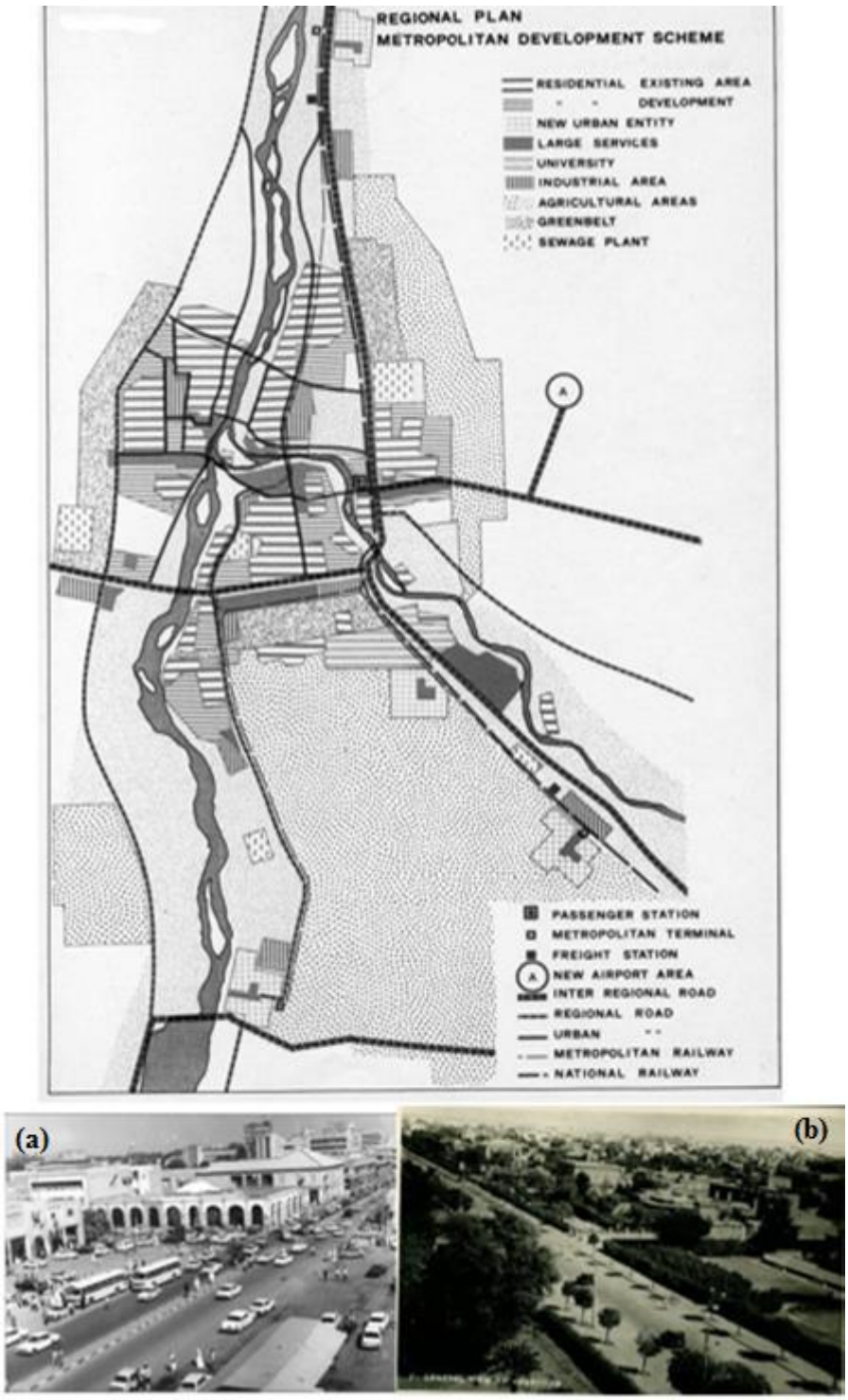
[16] *Constantans Doxiadis*, a Greek planner, in 1968 adopt an approved plan to *Khartoum* based on what he called Dynametropolis conception of the unidirectional growth.

centre because it occupied most of the governmental and presidential departments (institutions). See map (8-8). The native government widely introduced sites-and-services as a key mode of housing supply. The plan encouraged expansion of *Khartoum* city to the south and adoption of policies to slow the growth of the other two cities. The plan became outdated, mainly because of the huge rural-urban migration that took place after.



Map (8-8): *Doxiadis* greater *Khartoum*- (1959)
Photo (8-2/ a and b): *Khartoum*- (1959), (Internet-Google images-2018)

- In 1974: A new master plan was prepared by MEFIT consultants. The population of *Greater Khartoum* nearly reached one million. For the first time this plan covered the regional and urban levels. The plan included an analysis of the built form of the different housing class zones through physical, socio-cultural, and visual surveys with a special focus on beautification and urban design. Also, the plan was adopted in the development of agricultural land around the city. See map (8-9).

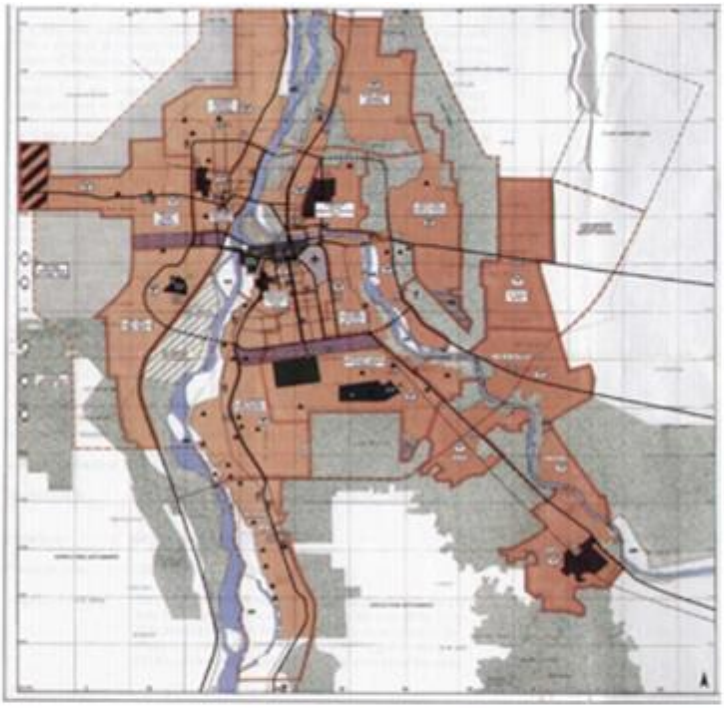


Map (8-9): MEFIT greater *Khartoum*- (1978)
Photos (8-3/ a and b): *Khartoum*- (1978), (Internet-Google images-2018)

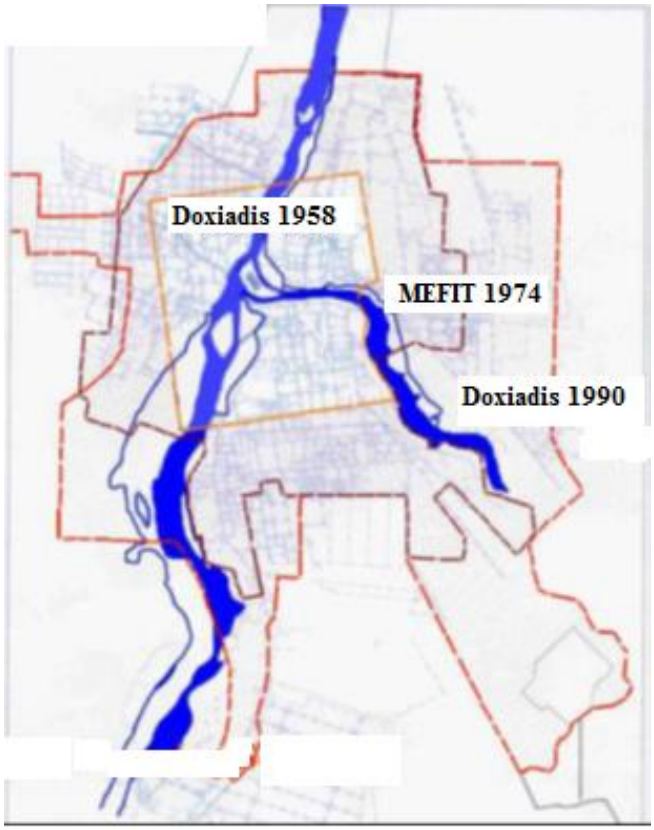
- In 1989: *Khartoum* still was the capital; but with a new military government. Significant religious, cultural, social, political, ethnic and economic changes occurred in a short period of time. Also conflicts in western and eastern provinces of *Sudan* evolved, besides, an escalation that happened in the conflict with *Southern Sudan*. The Government faces dissensions in power and wealth sharing at a federal and regional levels, the central government is accused of neglecting other states

except *Khartoum*. The national urban system in *Sudan* is unbalanced and all *Sudanese* cities suffered from: poverty, unemployment, and a high rate of inner migration toward *Khartoum*, this, besides out of country migration of qualified and high educated citizens. In the international community, *Sudan* is described as: a state sponsor of terrorism, with cases of human-rights, and a troubled relationship with many of its neighbours and much of the international community. *Khartoum* city association in the global community was weak.

- In 1991: Again *Doxiadis*, with *Abdelmonem Mustafa* and partners (local consultants), started a new structure plan for *Khartoum*. The plan was a structural plan based upon different scenarios of population growth extending for ten years only. That reflected the huge predicted expansion of *Greater Khartoum*, and a high consumption of urban land by relying on site-and-services as a sole option for housing supply, together with the self-help approach and squatter upgrading. Other aspects of the plan, such as the infrastructure and transport networks, were not satisfactorily implemented during the plan period. See map (8-10).



Map (8-10): *Doxiadis* and *Abdelmonem* greater *Khartoum*- (1991)
Photos (8-4/ a and b): *Khartoum*- (1991), (Internet-Google images-2018)



Map (8-11): *Khartoum* city- sprawl growth (1958-1990)

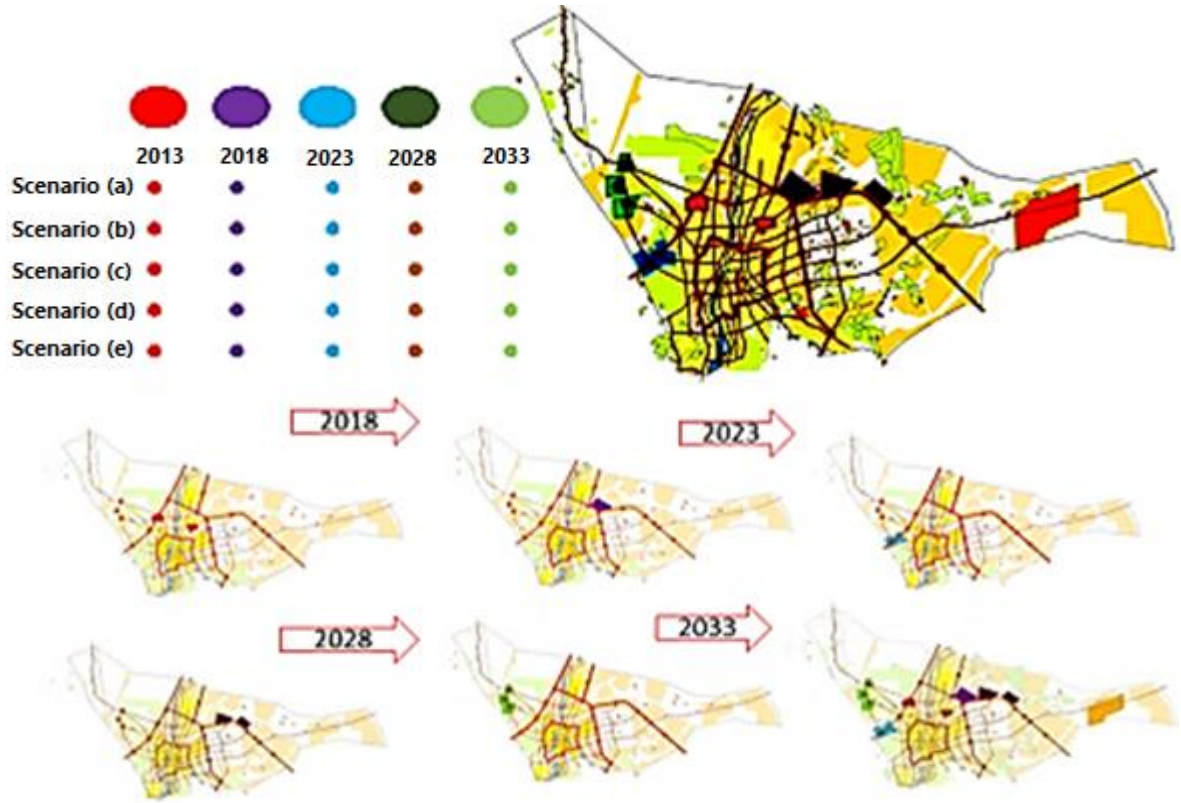
- In 1993: The national census depicted that the annual population growth rate of greater *Khartoum* was (2.4%) while the annual rate of migration was (4.6 %), giving a total growth rate of (7%). The census also showed that, generally for all country, the rural-urban migration rate exceeded (2%). (Hafazalla-2008), the density of population in *Khartoum* city in 1990 was (44person per-hectare) in comparison with (247p per-hectare) in *Cairo* and (194 p. per-hectare) in *Tokyo*, and (95 p. per-hectare) at London. This reflected the problem that this was actually a sprawl of low density residential areas in *Khartoum*. That interrupts problems to city economy and performance. Map (8-11), explains city sprawl growth by comparison between *Doxiadis* 1958, MEFIT 1974, and *Doxiadis* 1990.

Photo (8-5/ a and b): *Khartoum*- (2018), (Internet-Google images-2018)

- There is a new structural plan going on, (2008-2033), for *Khartoum* city. The implementation of this plan faces lots of challenges: In 2010 *Sudan* achieved great economic growth by implementing macro-economic and political reforms. In 2011: related to separation between *Sudan* and *Southern Sudan*, into two countries, *Khartoum* became the capital of Sudan only. *Sudan* faces cumulative debts, disputes with neighbouring countries, and international economic sanctions. In 2016 these sanctions started to be reduced but the Sudanese economy is still collapsing.

8.3.2. *Khartoum* Recent Master Plan:

Khartoum structure plan 2008 is the plan that manages *Khartoum* land uses, networks, and growth. It started in 2008 and has to finish in 2033 that is about 25 years.



Map (8-12): *Khartoum* state- (2008-2033) structure- plan implementation stages. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).

The features of this strategy are: balancing development in all *Sudan* by; supporting the creation of new solutions and plans; making new intermediate and satellite cities; absorption for the squatter areas; developing the evacuation areas; using efforts of professionals and well training experts; spreading of governmental authorities and activation of laws; encouraging public participation through media means; providing solutions for the inner-country migration; adopting solutions for the housing

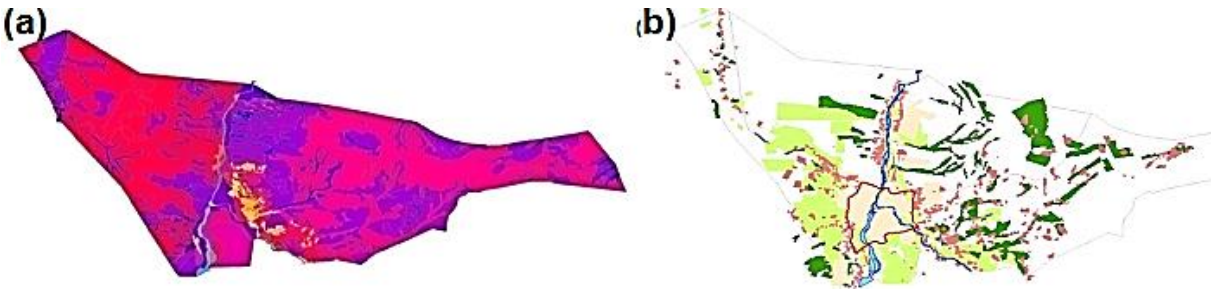
problems; achieving sustainable rural development; boosting revenues of rural productions; increasing urban industries; exporting finished products and reserving rural natural resources. See map (8-12)

The strategy comprises: first, functional frames which include: environmental framework, economic and social framework, and second, levelling frames which include: national regional development frame, states interpenetration development frame, urban development frame, and rural development frame.

8.3.2.1 Functional frames:

a) **Environmental framework:** In terms of natural environment development, *Khartoum* is facing three challenges for accommodation of future urban growth; those issues are: limited scope in addressing the natural current features, environmental constraints to the development (e.g. the green cover and natural streams); and the systems of rural settling. The strategy developed projects to deal with these issues. Map (8-13), indicates,

1. Maintaining the existing green cover for agriculture, forestry and pasture.
2. Maintaining the system of rural settling and its territories.
3. Ensuring the appropriation of urban sites to geological and topographic characteristics.

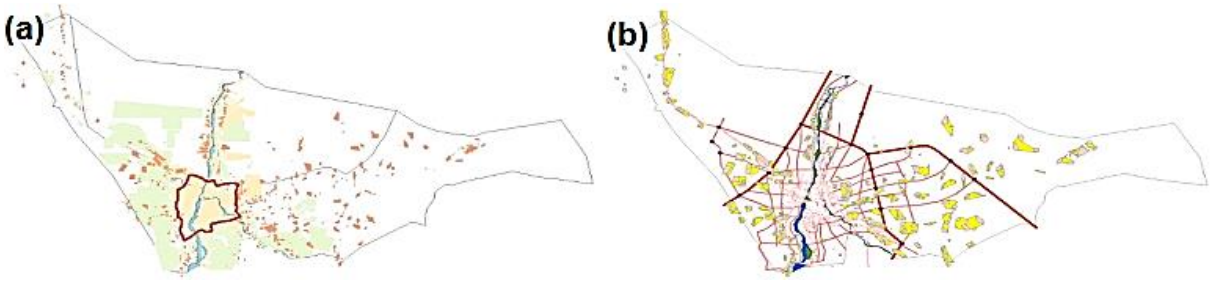


Map (8-13/ a and b): *Khartoum* state- (2008-2033) structure- plan (a) topographical and (b) natural composition. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).

b) **Economic and social framework:** in *Sudan* there is imbalance in urban development at both the national and state levels, which appears as concentration of employment, service and housing opportunities in *Khartoum.* This led to increased inner migration to Khartoum, and widening of its circle of poverty, in particular, the most vulnerable groups in the urban society (new immigrants, displaced persons, women, children and the growing numbers of young people). The structural plan

regarded these phenomena in the formulation of the urban and regional planning. See map (8-14), that illustrates:

1. Integration between the urban and state development plans by establishing projects to contain poverty and inner migration within the time frame of both urban and rural development plans.
2. Confronting the economic imbalance on the state frame by supporting rural agricultural and livestock areas with manufacturing and export orientation projects.
3. Supporting the sustainability and stability of development; by creating association relations between *Khartoum* state and its neighbouring states in economic activities.

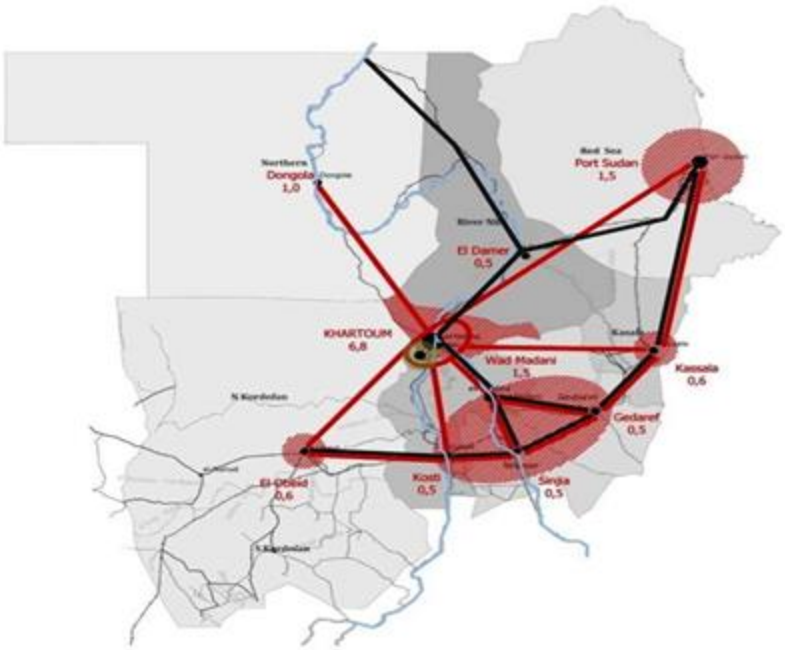


Map (8-14/ a and b): *Khartoum* state- (2008-2033) structure plan- (a) rural communities and (b) rural communities' links with urban morphology. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).

8.3.2.2 Levelling frames:

a) National development frame: The strategy depends on the directions of the strategic considerations of the natural environment plan, and is based on the national strategy visions to deal with country land uses, population, unified social system, transportation, and environment. The general frame of the plan emphasises the national quarter of century strategy and the comprehensive peace agreement.

b) States interpenetration development frame: *Khartoum* state is under pressure by its neighbouring states, because of its special characteristics. There is increasing migration from other states towards *Khartoum* state, affecting all the country urban system, and causing sustainability, economic and security risks. That inspired the structure plan able to: generate multiple development projects and programmes at the national scale, integrate relations with the other states, especially in conflicts areas, and maintain national security in environmental, economical and social perspectives. See map (8-15), the map define the axis of the national development, country gates and define *Khartoum* city as the centre of the country.



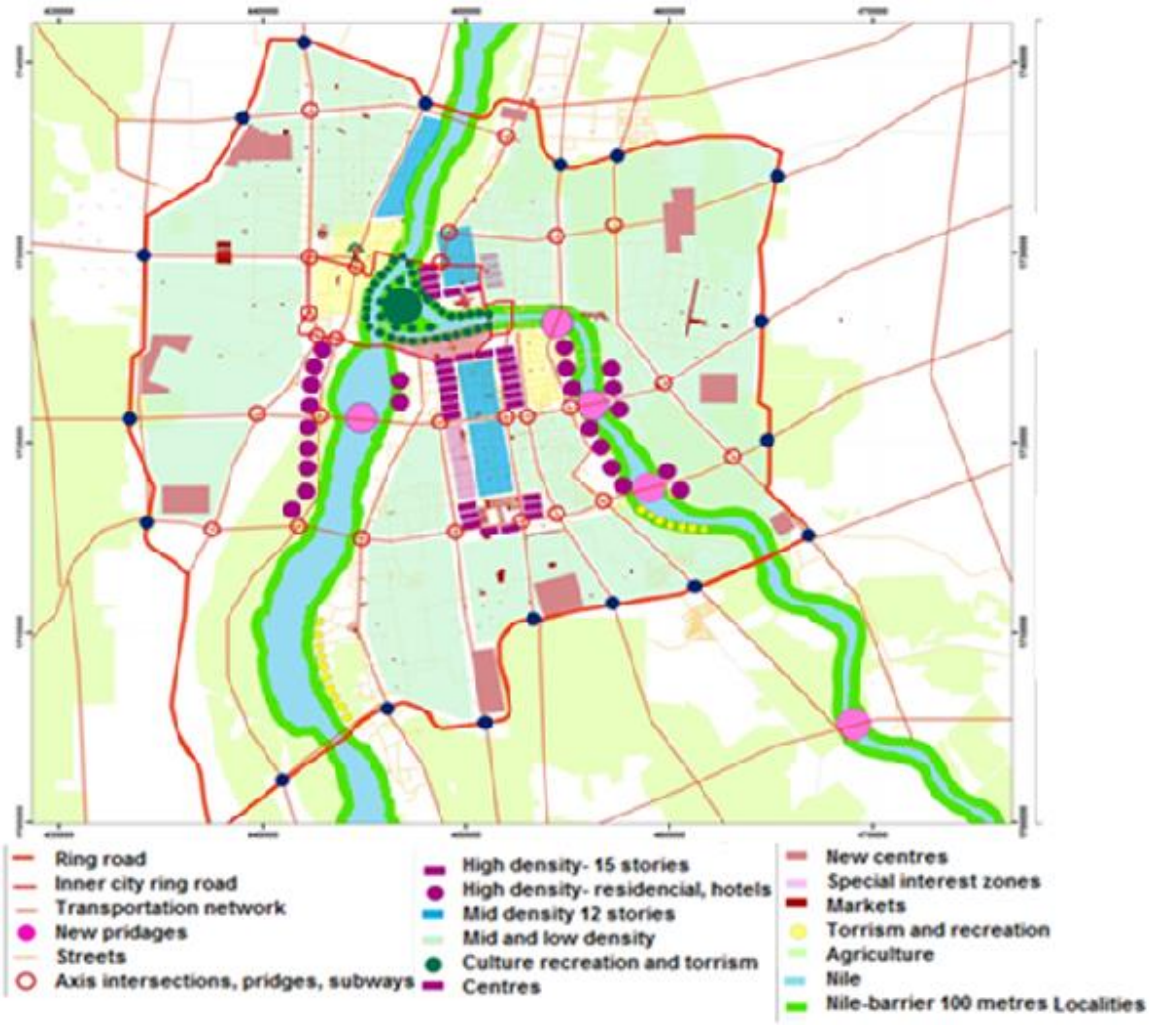
Map (8-15): *Khartoum* state- (2008-2033) structure plan- national and states interpenetration development Frame. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018). Notes: the three states of Darfur region are not included.

c) Regional development frame: the development scenarios depend on nine basic guidelines for the development in the field of environment, economic activity, social and natural development:

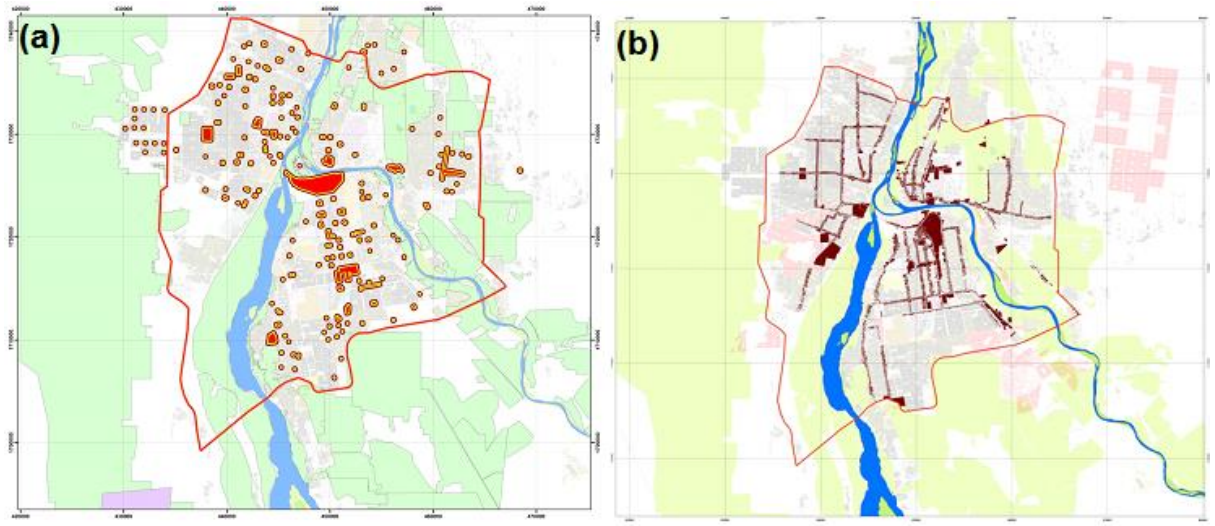
1. Maintaining extension sites for the green cover in the state.
2. Maintaining existing, and creating proposed, arable land.
3. Rehabilitation and maintaining of streams and seasonal water channels.
4. Maintaining the rural settlements fabric with arrangement, organisation and scalability procedures.
5. Stopping the horizontal growth and expansion of the capital, by adopting and using a proposed outer ring street as boundaries.
6. Creating spatial axis of urban development between the East and the West of the state, by nine new towns integrated in work, production, housing and services.
7. Establishing a system of networks and cross accesses between rural areas and cities, and with other states to cover the needs for traffic and infrastructure, and to link their economic systems.
8. Creating regional natural reservation parks in the eastern and western parts of the state to take advantage of the presence of forests in these areas.
9. Creating recreational and tourist zones on the outskirts beside the Rivers.

d) Urban development frame: The proposed interventions for the restructuring of the total urban area are:

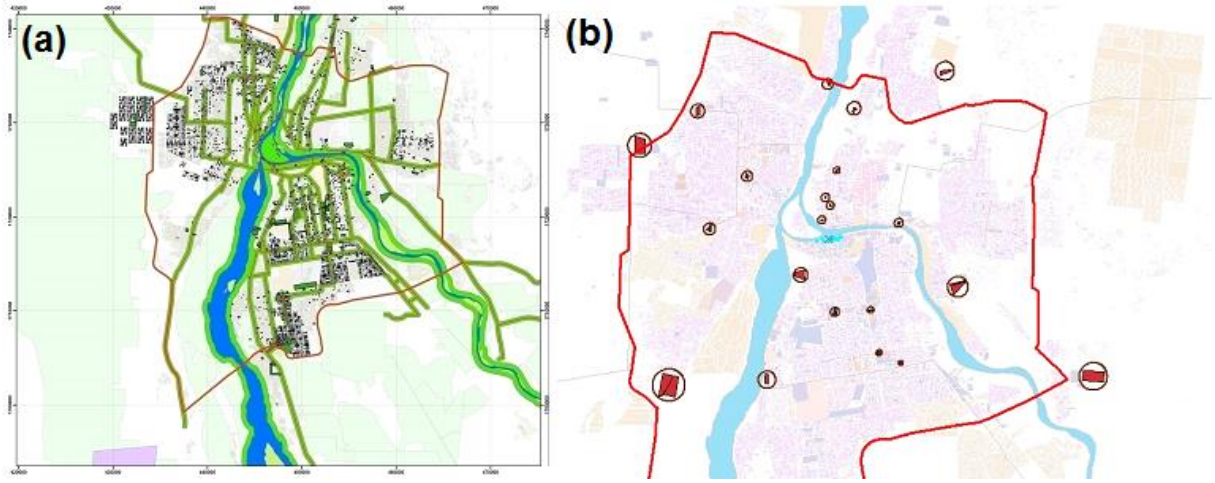
1. Centres, increasing their densities, taking in considerations their domination, historical aspects and heritage, and their recent functional ecologies, in shape of decent urban design and architectural images. Maps (8-16) and (8-17), explain the urban development frame.
2. Redistribution of the current land uses, which are incompatible with their surroundings functions or landscape, to increase city efficiency. That includes: military zones; major public hospitals; ministries and governing units in city centre. See maps (8-18) and (8-19).
3. Rehabilitation, these efforts, in the first place, target disused areas which have significant importance because of their human values, cultural or heritage characteristics in city pattern. See map (8-20)



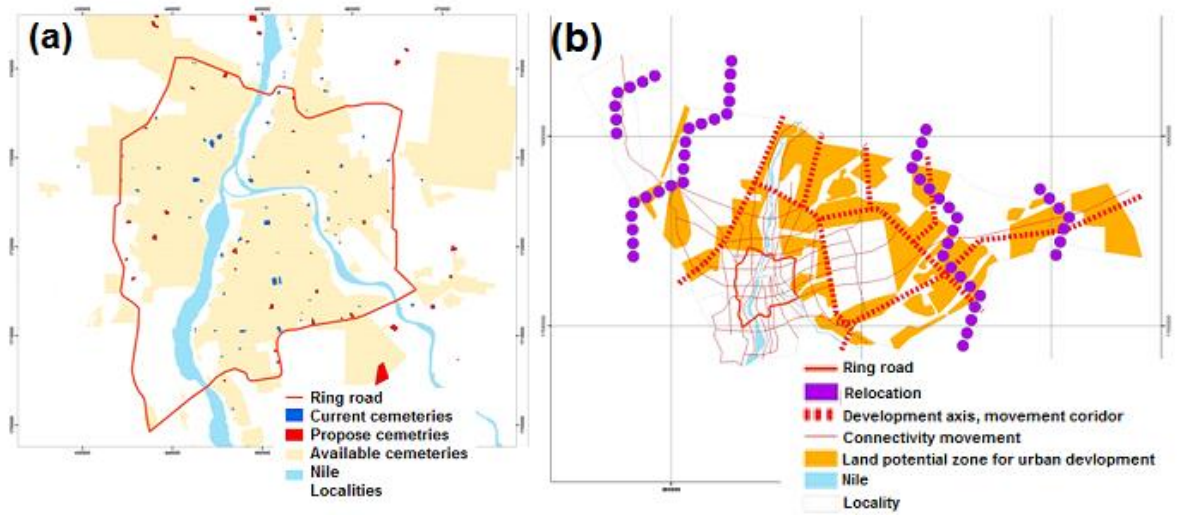
Map (8-16): *Khartoum* state- (2008-2033) structure plan- urban development frame\ development of the city centre. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).



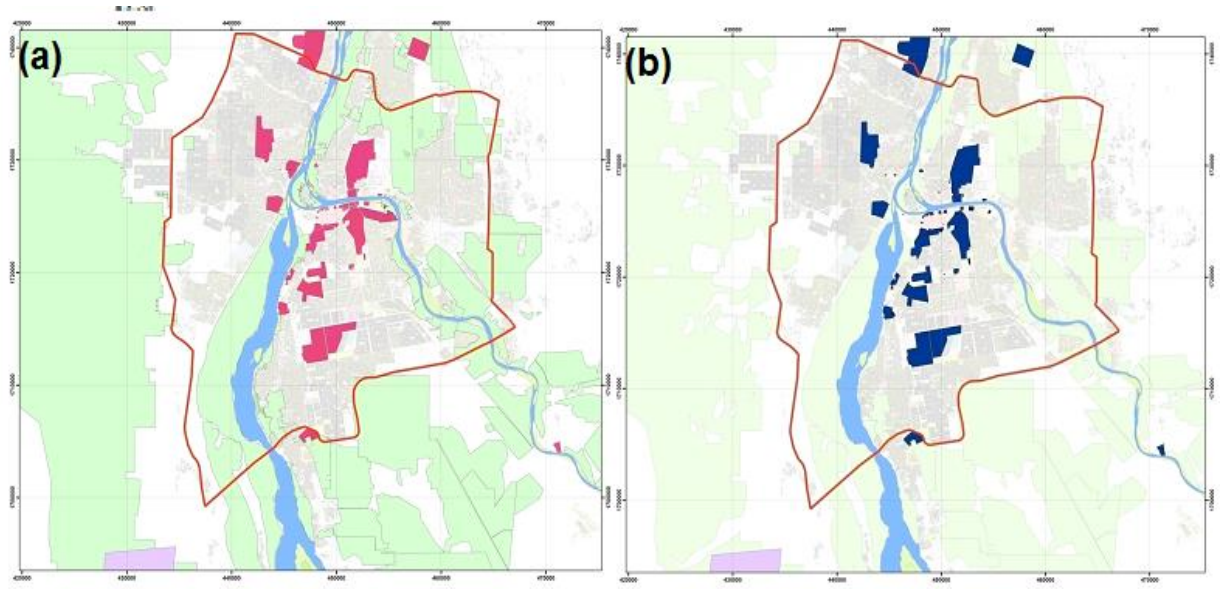
Map (8-17/ a and b): *Khartoum* state- (2008-2033) structure plan- urban development frame\Increasing densities. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).



Map (8-18/ a and b): *Khartoum* state- (2008-2033) structure plan- urban development frame/ Redistribution/ (a) Green areas (b) Governmental buildings. (The ministry of the physical planning/ *Khartoum* state/ Technical unit\ministry implementation\ the fifth Structure plan/ November 2010).



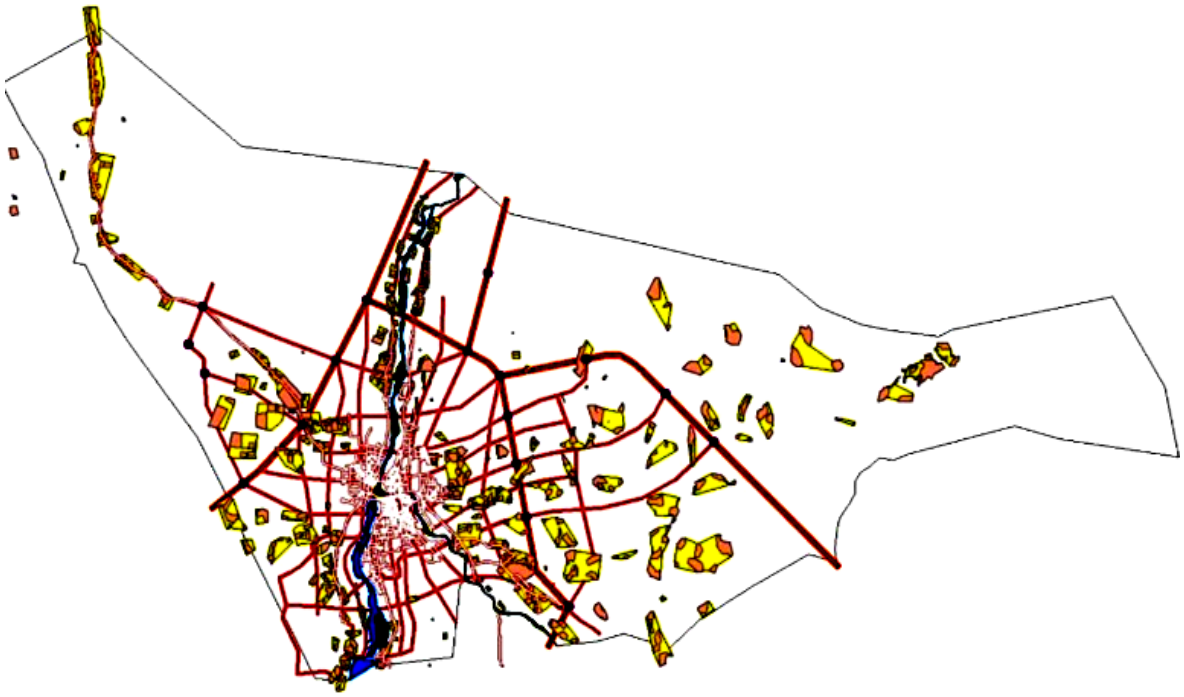
Map (8-19/ a and b): *Khartoum* state- (2008-2033) structure plan- urban development frame/ Redistribution\ (a) Cemeteries (b) Military campuses. (The ministry of the physical planning/ *Khartoum* state/ Technical unit\ministry implementation\ the fifth Structure plan/ November 2018).



Map (8-20): *Khartoum* state- (2008-2033) structure plan- urban development frame/ Rehabilitation/ (a) Interest zones (b) Industrial zones. (The ministry of the physical planning/ *Khartoum* state/ Technical unit\ministry implementation/ the fifth Structure plan/ November 2018).

e) Rural development frame: The framework of the spatial rural development is based on two concepts, see map (8-21) which illustrates that:

1. Growth and extension of any rural settlement is toward the nearby settlements in the vacant area located between them, and
2. Linking their growth with road network relevant to urban road networks.



Map (8-21): *Khartoum* state- (2008-2033) structure plan- rural development projects. (The ministry of the physical planning\ *Khartoum* state\Technical unit\ministry implementation\ the fifth Structure plan\ November 2018).

The actual year of starting implementation of this strategy is in 2012. The implemented parts are extensions in city services, infrastructure and land uses, and preparing re-planning drawings for some villages. The major work done, is in the preparation for implementation, which includes: collecting and analysing data, reviewing the quantity and quality of the strategy supplemented projects, studies in investment capabilities, special training for staff, and attempt to collect the needed capitals.[17]

8.3.3. Powers Intervening *Khartoum* (CMM):

Depending on table (5-4) in chapter (5), the factors that cause transition in the (CMM) include: current formal frames, urban governance, public, interest groups, private investors, and globalisation, table (8-1): explains the role of each one of them in relations to *Khartoum* special characteristics.

8.4 Case Study Methodology:

The main purpose of this case study is to judge and explain the research methodology in finding causes, effects and solutions for cities morphological development, focusing on the effects of population growth and economic activities. The case study applies all main points in chapters (5), (6) and (7), to *Khartoum* city. The urban development constraints are emphasized as factors that affect the formulation and implementation of any development plan for a certain city morphology.

This case study includes, see table (8-1):

(a) Description and discussion: of *Khartoum* micro and macro-morphologies, which include: its (CMM) concept, evaluating its (CMM), and judging its diagram.

(b) Determination: of the morphological development challenges that face *Khartoum*, by projecting the effects of population growth and economic activities within it's (CMM)

(c) Production: of strategy frame for *Khartoum* morphological development include: defining the relations between urban development constraints and its development aspects, and proposing recommendations for its morphological development.

[17]Site visit/interview to: *Khartoum* State- Ministry of physical planning and development-(General Directorate of implementation) February -2018- (interviews).

Table (8-1): Aspects intervening *Khartoum* (CMM). (Researcher/ Alia- 2018)		
Power	**Limit of power**	**Role of power**
(1)Current formal frames	-Planning functions	-*Khartoum* morphology development guides by structure plan from 2008 to 2033 (25 years).
	-Sector or comprehensive planning	-Planning of comprehensive urban development done by the national ministry of the physical planning, that translates to structure plans by the branches of states, and to action plans by each municipality.
	-Planning vs. implementation	-*Sudan* development plans have been crippled by many economic difficulties. -Implication of current laws and regulation is very weak.
	-Interests conflicts.	- Governmental plans and decisions are affected by complex economic, cultural, political, social and global contexts.
(2)Urban governance	-Structure of local government	-Government is in three levels: the national level, the regional level and the local level. -National ministry of environment and urban development is related directly to the presidency. -There are other ministries contribution under the ministry of council of ministries, providing capitals; basic services; and social services. That, in association with ministries which are relevant to economic development.
	-Spatial fragmentation	-*Khartoum* as a national capital hosts all national governmental institutions and high hierarchy services. -State adopted spatial fragmentation methods to state's main ministries and government agencies. -Application of information technology and smart networking governing system is not active yet.
	-Agencies conflicts	-A city capitals, for implementing of any action plan, institutionally comes from three directions: the sector resources, the state resources and the local resources. Sometimes, there are other partners in the shape of investors and assistance.
	-Policy guidance: Ideology,	-Legal system is mixed between Islamic law and English common law. -Politics of *Sudan* take place in the framework of a federal presidential representative democratic republic. - Legislative power is vested in both the government and the bicameral parliament. -Judiciary is independent and obtained by the Constitutional Court. -There are many political parties and leaders in *Sudan*, but with limited influence than the governing party.
	-National urban policy and planning,	-*Khartoum* has mixed economic system, the state is responsible for providing the basic services. -Governmental expenditure in basic commodities is very low related to the World' average and other countries.
	-Local economic and social conditions and Public choice	-Cost of the public services is very high, compared to public income levels. -There are income differences causing variance in consumption contingency between populations. -Human development index is low, about 0.49, with poverty rate reaching 46.5%.
(3)Public	-Intensification of social and economic change	-*Sudan* is a homogeneity country with multiple ethnic groups. *Khartoum* as the capital is full of diversity and contrast. -Unstable inner conditions result in 3,182.000 displaced people and a large number of refugees and homeless. -In migration in *Khartoum* is estimated at 40% of the total migration in *Sudan*. -There is high rate of inequality in *Sudan*.
	-Local government policy and action response	-Decision-making process is designed to include citizens by the national assemblies, sharing their opinions by local range bodies, but the degree of contribution is weak related to political, economic, social aspects and some citizens are not qualified to participate.

	-Information and transparency.	-Public opinion is affected by complex economic, cultural, political, and social contexts. -Operating media in *Sudan*, both public and privet, are managed and monitored by government.
(4)Interest groups	-Diversity of attitudes	-Role of none governmental organisations, related to urban development, is limited. -Participation of universities and researching centres is not effective.
(5)Private investors	-Dynamic development in marketing and production	-There is an increasing number of private ownership of economic activities. -Abilities of the private sector enabling it to make efficient contact with global economy and (TNCs). -Privatization of some public services companies increased the efficiency of. -Private sector also associates with the industrial sector and that provides employment opportunities.
	-Government controlling of private contributions	- Political and economic situations in *Sudan* handicaps the role of the private sectors. -There is growing demand for all living needs. This increases the role of government in protecting the essential needs.
(6)Globalisation	-Differentiation between countries capabilities and governing systems obstacles globalisation applications	-*Khartoum*' attempts to participate globally, require development of services and infrastructure. -*Sudan* is considered as a technology consumer not producer. -There is no clear strategy to effect a technological transition.
	-Domination of some countries	-Sanctions that face *Sudan* from the international community stranded *Khartoum* global association. -*Sudan* has extensive economic relations with China, India, Egypt, Saudi Arabia, Qatar, Turkey, and Japan. -*Sudan* faces strong interventions of the international community in its internal affairs.
	-Global agreements	- *Sudan* as a part of the globe, is affected by climate changes issues. -*Sudan* is regards as a limited environment polluter.
	-The global association in urban development	- Sudanese application of the UN millennium development goals (MDGS)[18], is limited. -Sudanese association in the global economy and trade is very limited due to its unstable situations. -*Sudan* is a member of regional multinational organisations, as well as an observer in the World Trade Organisation. -*Sudan* also has had troubled relationships with many of its neighbours and much of the international community.

[18]Source: http://mdgs.un.org/unsd/mdg/Host.aspx. Content=Indicators/OfficialList.htm.The UN millennium development goals (MDGS) are: Goal 1: Eradicate extreme poverty and hunger, Goal 2: Achieve universal primary education: regards that children everywhere, boys and girls alike, Goal 3: Promote gender equality and empower women, Goal 4: Reduce child mortality, Goal 5: Improve maternal health that by enabling universal access to reproductive health, Goal 6: Combat HIV/AIDS, malaria and other diseases, Goal 7: Ensure environmental sustainability, and Goal 8: Develop a global partnership for development. The importance of housing for achieving the MDGs[18], Related to the previous goals, the importance of housing is: Goal 1: Eradicate extreme poverty and hunger, Goal 2: Achieve universal primary education, Goal 3: Promote gender equality and empower women, Goal 4: Reduce child mortality, Goal 5: Improve maternal health, Goal 6: Combat HIV/AIDS, malaria and other diseases, Goal 7: Ensure environmental sustainability, and Goal 8: Develop a global partnership for development.

Table (8- 2): The methodology of *Khartoum* case study. (Researcher/ Alia- 2018)						
Steps	**(1) *Khartoum* (CMM) concept**	**(2) Evaluating *Khartoum* (CMM)**	**(3) Judging the diagram of *Khartoum* (CMM)**	**(4) Projecting the effects of population growth and economic activities in *Khartoum* (CMM) development**	**(5) Defining the relations between urban development constraints and *Khartoum* (CMM) development**	**(6) Proposing recommendations for *Khartoum* city morphological development with priorities of implementation**
Contents	-Activities -Interactions -Micro-influence/ internal networks. -Macro-influence/ external networks.	-Land uses, -Resources levelling, -Detailed zoning, -Transportation and infrastructure pattern, -Land values, -Micro-morphology, -Micro-spatial growth, -Macro-morphology -Macro-spatial growth.	-Nodes -Gravity - Domination -Agglomeration	-The concentration of population and spatial scale, and land-use economics returns -Employment and productivity, and allocation of capitals, investments and resources -The urban environment, and economic activities environmental effects -Living behaviours and economic returns by urban quality -Need for transportation and infrastructure, and need for transportation and infrastructure for certain economic activity -Micro and macro-growth managing methods, and economic activities and city morphology	-Basic necessities -Dynamic Effectiveness -Urban Poverty -Capitals -De\centralisation -Institutionalisation -Monitoring and evaluation mechanisms -Partnerships	
Con-clusion	**a) *Khartoum* morphology (description and discussion)**			**b) *Khartoum* morphological development challenges (determination)**		**c) *Khartoum* strategy frame (production)**

8.5 Description and Discussion of *Khartoum* Micro and Macro-Morphologies:

To describe and discuss *Khartoum* city micro and macro-morphologies, it is required to include: *Khartoum* (CMM) concept, evaluation of *Khartoum* (CMM), and judgment of the diagram of *Khartoum* (CMM).

8.5.1. *Khartoum* (CMM) Concept:

To modulate *Khartoum* city recent morphology; the study depends on: development situations in *Sudan*, the scope of urbanisation in *Sudan*; *Khartoum* general characteristics, the growth of *Khartoum* city, and *Khartoum* last structure plan (2008-2033). All this information is placed in the research's (CMM).

Khartoum (CMM), see table (8-2), is discussed in terms of: First: relation to city activities: city metropolitan scale, governing system and composition. Second: related to interactions: city sustainability, and intelligence. Third: city micro-influence/ internal networks. And the fourth: city macro-influence/ external networks. See table (6-1): Real time (CMM) in chapter (6).

8.5.1.1 City activities:

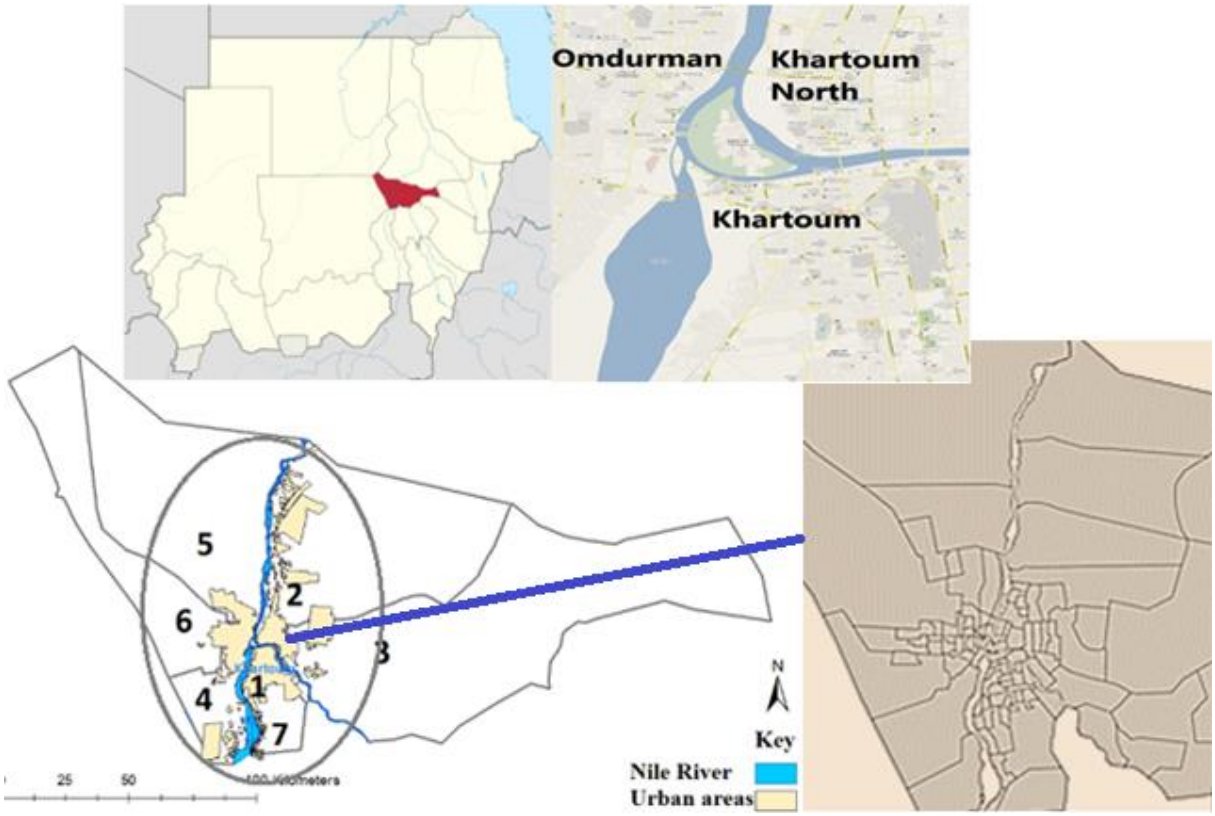
(a) City metropolitan scale:

The metropolitan *Khartoum*, see map (8-22), is the largest city in *Sudan* and is one of its states. Its area: 22,736 km², includes 5,000km² urban area, about 22%, and it has Nile banks of about 400 km. Its population is estimated at 7.1 million in 2015, according to *Khartoum* state- ministry of strategic affairs and information- 2015. It also includes 538 surrounding villages with a total area of 4,000 sq. Km. Those villages feed residences, provide cheap labours and act as predicted future expansion area for the city.

Khartoum state has the largest economy in *Sudan*, it depends basically on being the main transportation gate and node, provides the main and top hierarchical public services that includes central branches of privet institutions and national level of federal administrations bodies. It has 135 markets which act as the biggest centres of trade in *Sudan*, and is an international exporting and importing hub with 60% of Sudanese total industries.

(b) City governing system:

Geographically, *Khartoum* is situated at the junction of three rivers: the Nile, the Blue Nile and the White Nile; this divides *Khartoum* into three small towns: *Khartoum, Khartoum North and Omdurman*: *Khartoum*; includes two municipalities: (1)"*Khartoum"* and "*Gabal Owlia*" see number (7) in map below. *Khartoum North*; includes two municipalities: *"Khartoum North"* (2*)* and *"Eastern Nile"* (3*)*. *Omdurman*; includes three municipalities: "*Omdurman*" (4), "*Karari*" (5) *and* "*Um Badda*" (6). See map (8-22) and figure (8-13)



Map (8-22): *Khartoum* state- administration units, three towns, municipalities, and main districts. (Ministry of physical planning and development- *Khartoum* State- (General Directorate of Surveying- GIS and Digital maps Center) –*Sudan*- Remote Sensing and Seismology Authority – *Sudan* -2018)

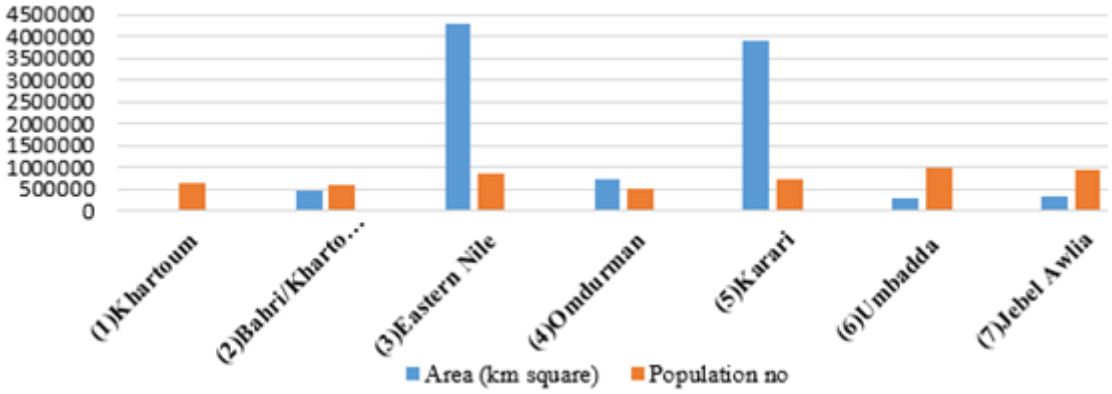


Figure (8-13) *Khartoum* state-comparison between municipalities in areas and number of population. (Central Bureau of Statistics- Ministry of Cabinet -*Sudan* -5th Population Census -2008).

(c)City composition:

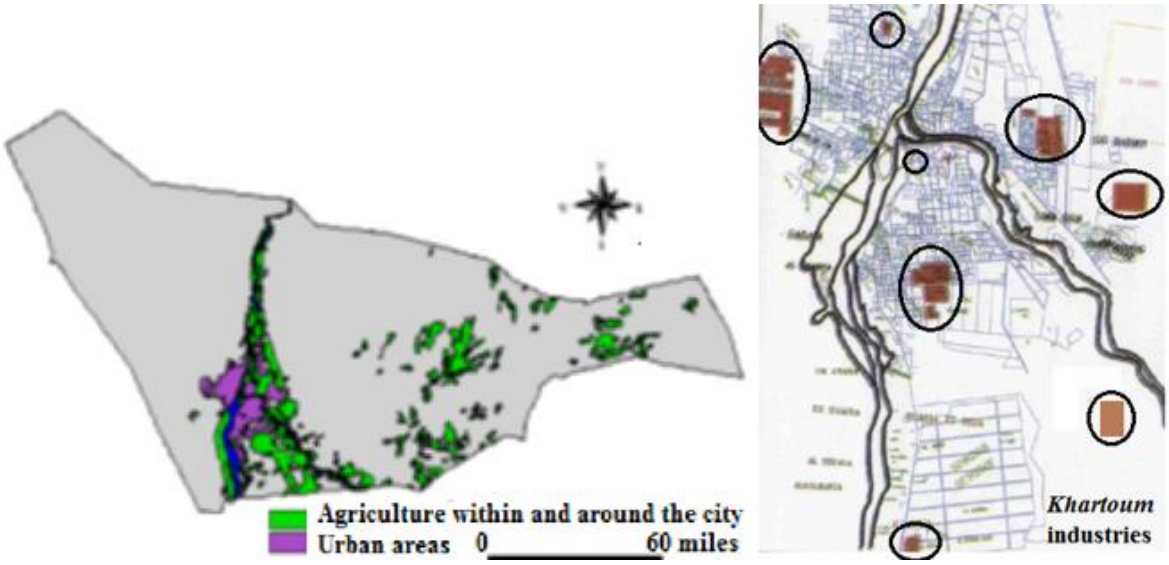
According to 2008 population census, the service sector includes 48% from the economically active population, most of them are governmental employees. Industrial sector is the biggest economic sector with 50% from the economically active population, see figure (8-14). Some of inner-city residents who live at the banks of the River Nile engaged in the river-related works such as agriculture, pottery, bricks making and fishing that about 2% from the economically active people. The total percentage of economically active population who employed in *Khartoum* city is about 31%. Villagers around the city engaged in agriculture, grazing and thus supply the city with vegetables, fruits, and dairy products.

Figure (8-14): *Khartoum* city- total active economically population, employment and their distribution by economic sectors. (Central Bureau of Statistics- Ministry of Cabinet -*Sudan* 5th Population Census - 2008).

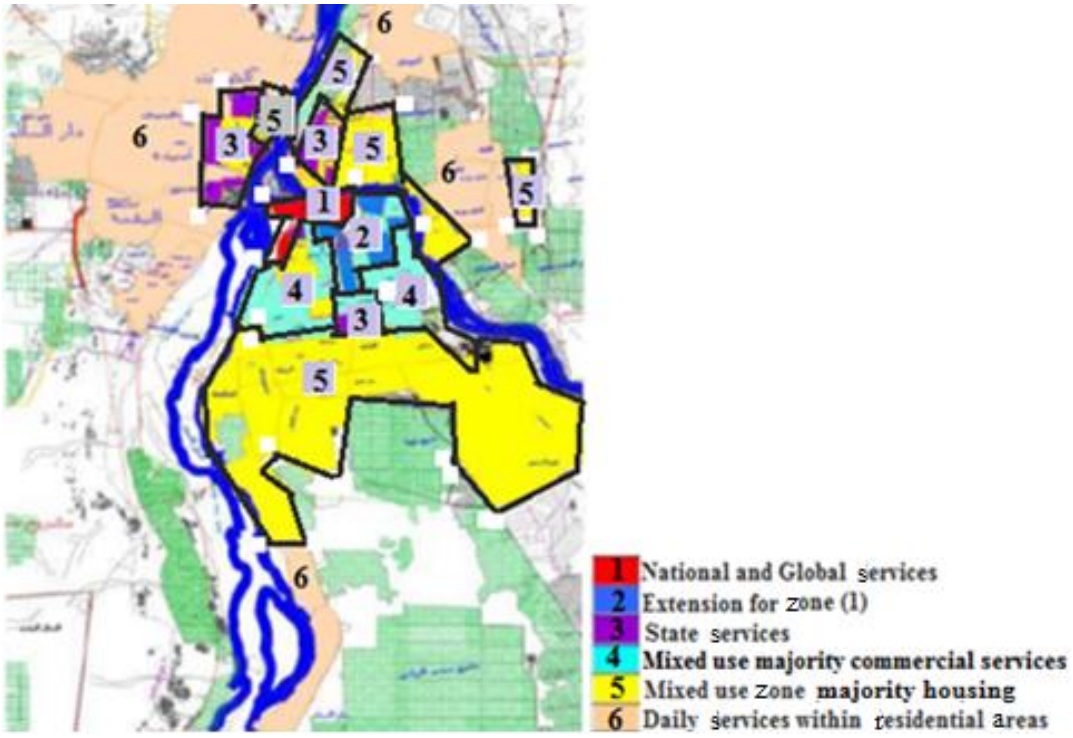
Economical land uses:

- *Khartoum* economic land uses: include *Khartoum* CBD, the major centre of services for both public and private ownerships, it serves in different global, national, regional, and local levels. It is where the main administrational, financial, investment, communication, commercial, educational, transportation, cultural, recreation institutions are located. The government is planning to create an industrial hub south of *Khartoum* city starting with heavy industries. (GIAD) industrial complex introduced the assembly of small autos and trucks, and some heavy military equipment. *Khartoum* also has "*Sundus*" and "*Soba*" agricultural schemes.
- *Khartoum North* economical land uses: include *Khartoum North* industrial area which is regarded as the largest district of industries in all *Sudan*, with various light industries. It includes also many agricultural projects such as "*Soba East*", "*Seleit*", and "*Kuku*" the largest dairy projects in the national range.

- *Omdurman* economical land uses: the city depends mainly on services. It acts as an ideological city that because it includes the main archaeological, religion, political, cultural, sports, medical, media, and information institutions, and its commerce includes the largest markets in *Sudan.* There are also limited light industries, traditional crafts, and small household agricultural lands. See maps (8-23), (8-24) and (8-25)



Map (8-23): *Khartoum* state- agricultural zones.
Map (8-24): *Khartoum* state- industrial zones.



Map (8-25): *Khartoum* city- services hierarchy. (UN-HABITAT International-*Sudan*-National Consultant Team-2008- with additions)

Residential land uses: There are two major types of the legal residential areas in Greater *Khartoum*, the planned districts and the unplanned settlements. In the planned districts, housing is delivered through Site and Service Schemes. The residential areas are distribute to three classifications: first, second, and third classes. Each class with particularities on plot area, building restrictions, urban services, local economic dynamics, and location. This reflects the big diversity in development possibilities. The minimum size of the plot: 400 sq. meters for the first class, 300 sq. the second class, 200 sq. third class.

The result was that, some houses were overcrowded while others were under occupied. The household income is no longer determined by a household head income; multiple and complex factors are to be considered. Thus, it is common to notice a mix of rich and poor houses, side by side, in the city neighbourhoods, while in the suburbs there are separate residential neighbourhoods for each class. In general the majority of residential buildings are only of one or two floors.

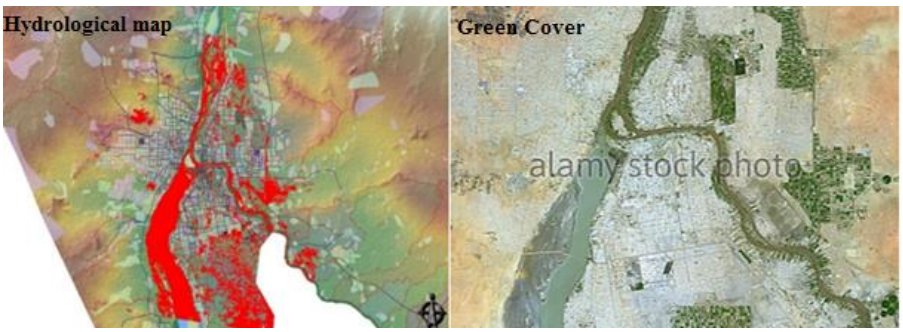
The unplanned districts are related to three reasons: they were villages attached to the urban area, a historical land distributed by local residence without interventions from professional bodies, or illegal settlements for poor migrants and displaced people.

There is an evolution of a new type of suburban gated communities, and also some residential compounds for apartment's residences but still in limited scale.

8.5.1.2City interactions:

(a) City sustainability:

Environmental sustainability, *Khartoum* is not at high risk. Pollution main causes (e.g. heavy industries and energy production) are limited. But there is a need for environmental conservation for natural features and resources. The city faces a problem of desertification in its peripheral areas. It also faces annual unmanaged rivers floods, see map (8-7). Besides that, the other threat to the environment of the city, is the solid waste disposal system, it is ineffective and causes danger for public health. Within residential areas streets, services, and infrastructure are in need of improvement. Some residential areas are in need of re-planning, and some house units are in need of enhancement or replacement. The local green areas and public open spaces are inadequate and unsuitable for resident's needs.



Map (8-26): *Khartoum* state- hydrological map and green cover. (Internet- Google maps-2017). Note: areas under flood risk (in red colour), the plan indicated that *Omdurman* is the less vegetated and less prone to floods.

Socio-economic sustainability, the Sudanese community is shaped and ruled by religion, family, social values, culture, local customs and traditions. The city poor population reach 60%. See figure (8-15) and map (8-27). The city poverty zones comprise IDP camps, squatter areas, villages, site and services zones for third classes, and inner city rental accommodation. The annual population growth rate is 4%, the number of shanty towns surrounding metropolitan *Khartoum* is 96, and the estimated population of unauthorized settlements 2-3 million (Horn -2015).

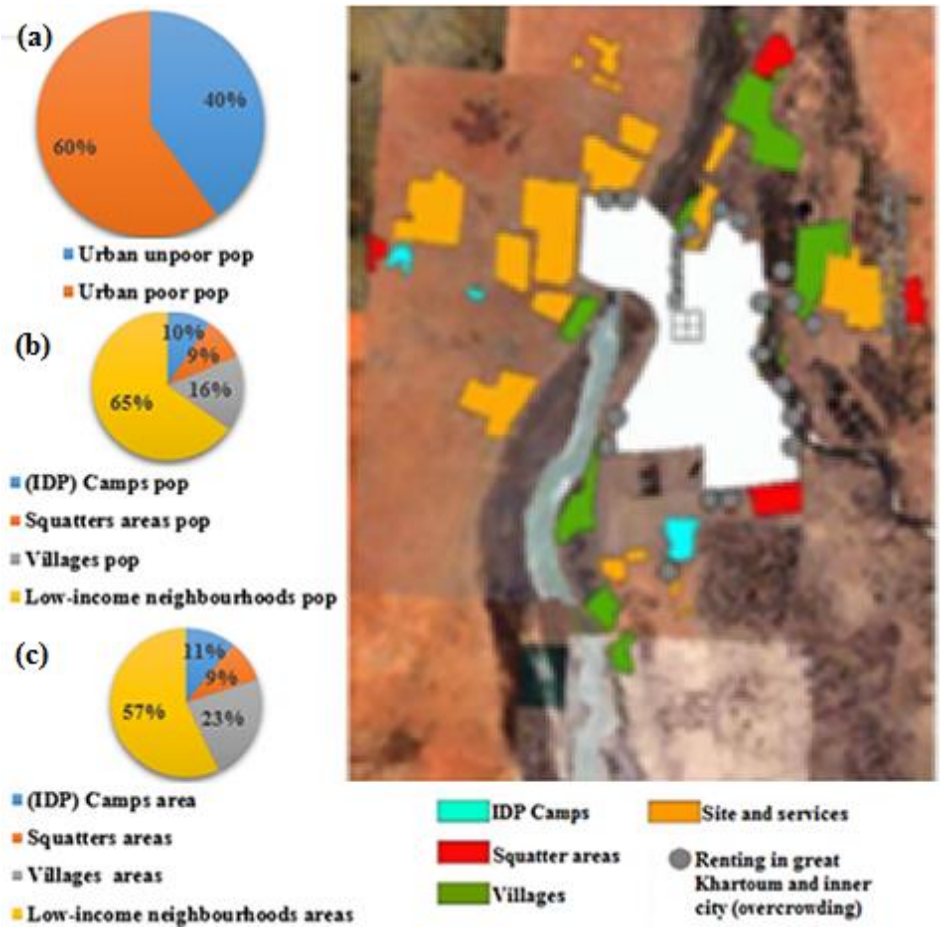


Figure (8-15/ a, b, and c): *Khartoum* city- urban poor population distribution in number and areas by the mode of living. Map (8-27): *Khartoum* city- poverty map. (UN-HABITAT International-*Sudan*-National Consultant Team-2008)

(b) City intelligence:

Sudanese peoples are open-minded and able to use new technologies. Political and economic matters hamper their participation in the global community. *Sudan* is considered as a country with long tradition and experience in civil services, trade, finance and transportation; but the unsettled country political and economic conditions affect city management and system of living.

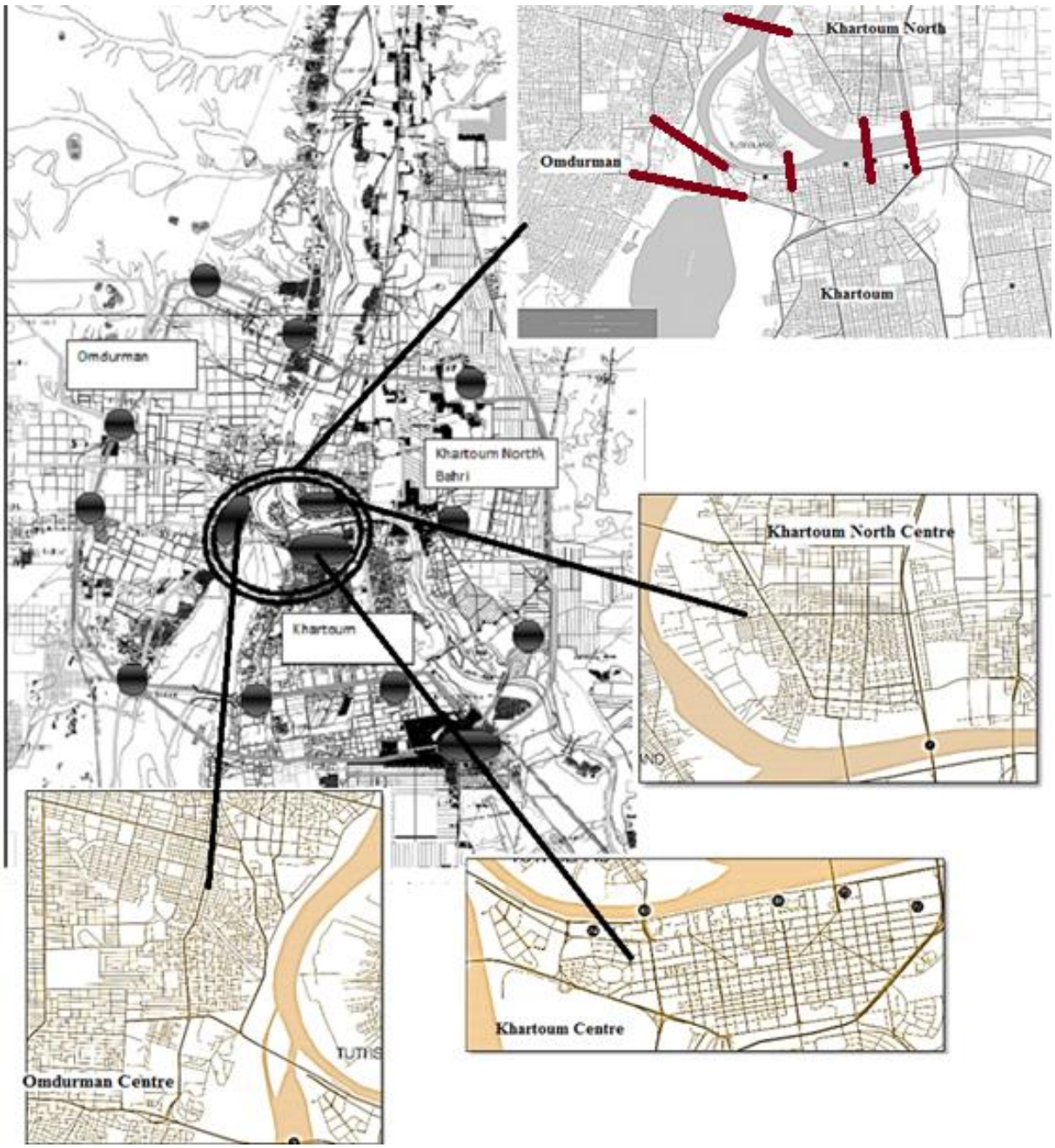
Many local corporations, to contact with international companies, use advanced technological applications. The use of high technology in providing social and public services in the city is still limited. Information technologies and daily life technologies are very expensive in relation to income levels. There is public increase in the use of information technology.

8.5.1.3 City micro-influences/ internal networks:

Each of *Khartoum* three towns, has its own main centre adjacent to the Nile. The three centres act as a metropolitan large centre separated by the Nile branches. Each town has other sub centres to cover a huge sprawled area of the city. The CBD grows in the inner city zones changing land uses from residential to official and commercial, see map (8-28). In accordance to a study by the UN-HABITAT International-National Consultant Team 2008; *Khartoum* planning has been described as mono-functional urban land uses with a disconnected urban structure. This associated with socio-territorial fragmentation.

In the field of infrastructure: 71% of central *Khartoum* is covered by water network, 28% is connected to some sort of sewage system, and 68% use pit latrines or other basic systems (Horn-2015). *Khartoum* city centre is served with a network of sewer system having a capacity of 24,000 m^3 covering 42% of 6.5 km^2 area. (Mahmoud -2014). The condition of infrastructural networks (e.g. Clean water pipes, electricity and roads networks) is good, but the problem is in the adequacies of services; and there is a need for upgrading. Drainage system is not faction or efficient enough to endure annual projected floods and rain.

Social networks in *Khartoum* are strong, but income levels, work places and categories turn to be the main contributor in organising city zones now. Applications of intelligent infrastructure is not reflected in city composition yet.



Map (8-28): *Khartoum* city- micro-morphology. Source: (The ministry of the physical planning and development -*Sudan* -2018, with additions).

8.5.1.4 City macro- influences/ external networks:

Khartoum is the capital, the primer city, the main centre of urbanisation in *Sudan*, and the main node of *Sudan's* urban system. In *Khartoum* there are multi-levels of urban services and institutions to serve at global, national and local ranges. They have many forms and sizes, such as: multi-functional, public, or private. Poverty and limited economy in other states increase inner migration to *Khartoum*. See figures (8-16) and (8-17). Many villages surrounding *Khartoum* city become urban areas connected to the fast city expansion, see figure (8-18).

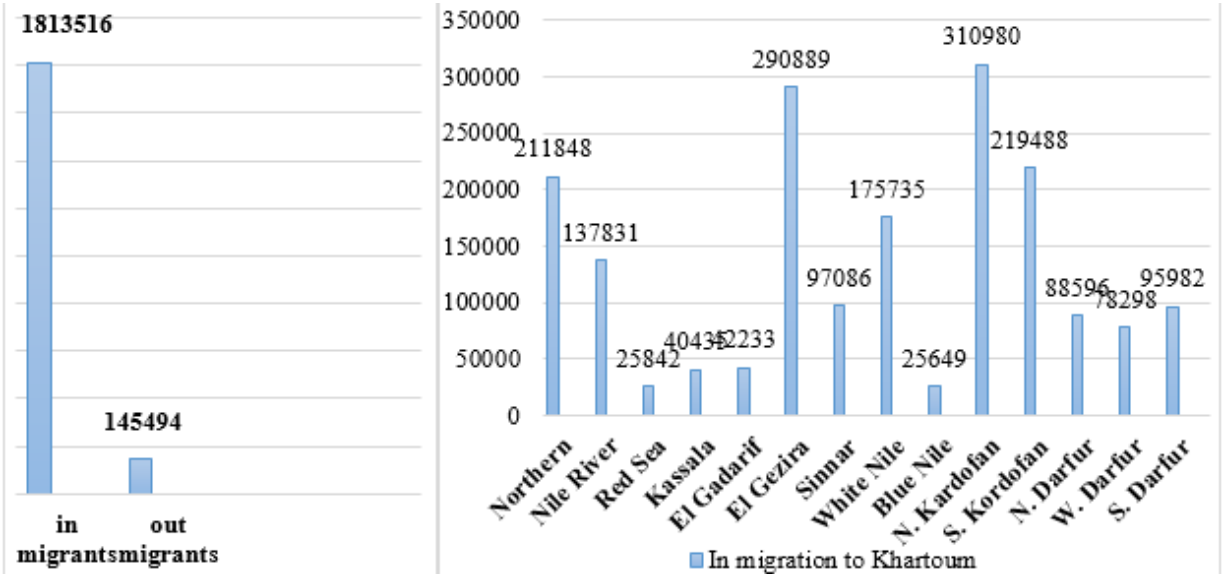


Figure (8-16): *Khartoum* state- in and out migration and in migration distribution by states, 2008 census. (Siddig, Mohd Ahmed, and Mohamed Ahmed-2011)

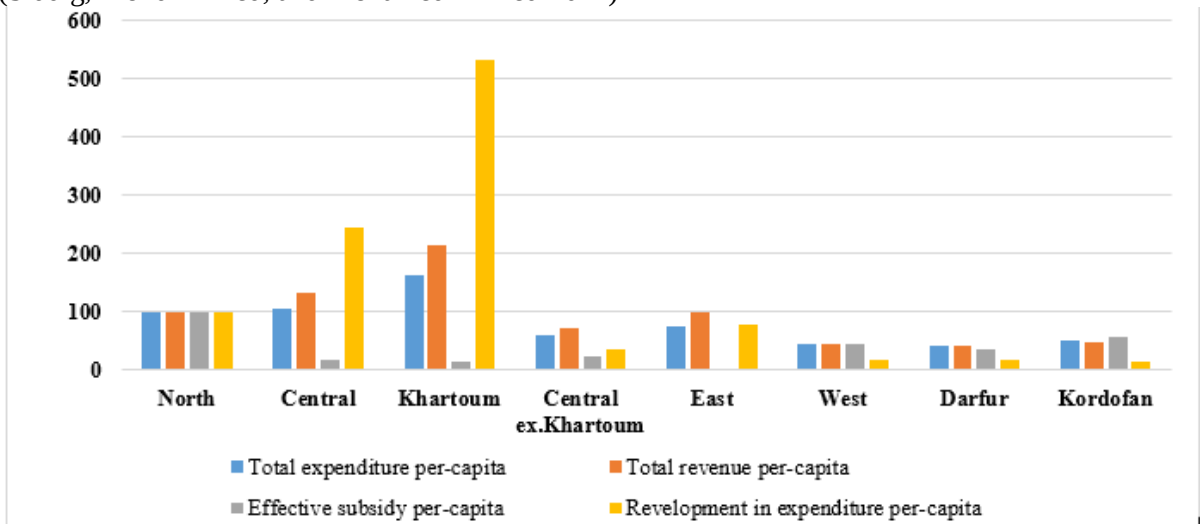


Figure (8-17): *Sudan*- comparison between states in regional revenue and expenditure, (1996-2000) averages. (Google search-2012)

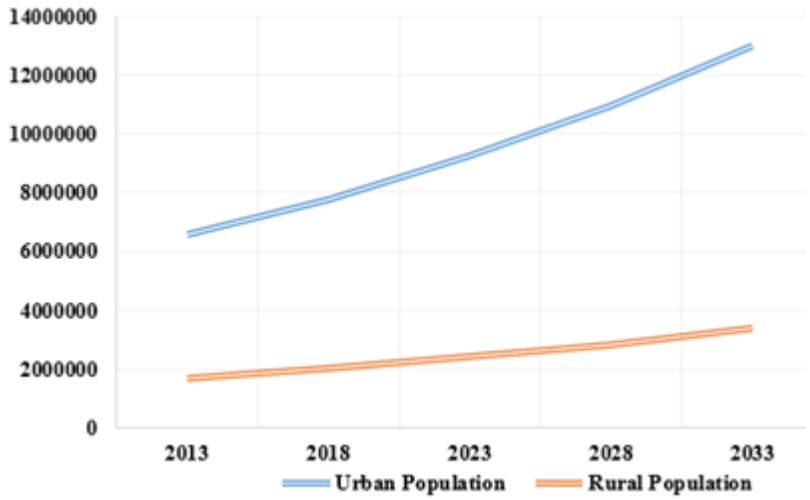


Figure (8-18): *Khartoum* state- urban and rural population growth (2008-2033). (The ministry of the physical planning- *Khartoum* state-Technical unit-the fifth Structure plan- November 2010).

Khartoum is twinned with seven international cities: Istanbul/ Turkey, Addis Ababa/ Ethiopia, Ankara/ Turkey, Brasília/ Brazil, Cairo/ Egypt, Djibouti City/ Djibouti, and Wuhan/ China. *Khartoum* global influence is insignificant, and this is related to its economic, technological and political capabilities.

8.5.2 Evaluating *Khartoum* (CMM):

To evaluate *Khartoum* (CMM) there are nine factors to be included: land uses, resources levelling, detailed zoning, transportation and infrastructure pattern, land values, micro-morphology, micro-spatial growth, macro-morphology and macro-spatial growth. See figure (2-9).

8.5.2.1 Land uses:

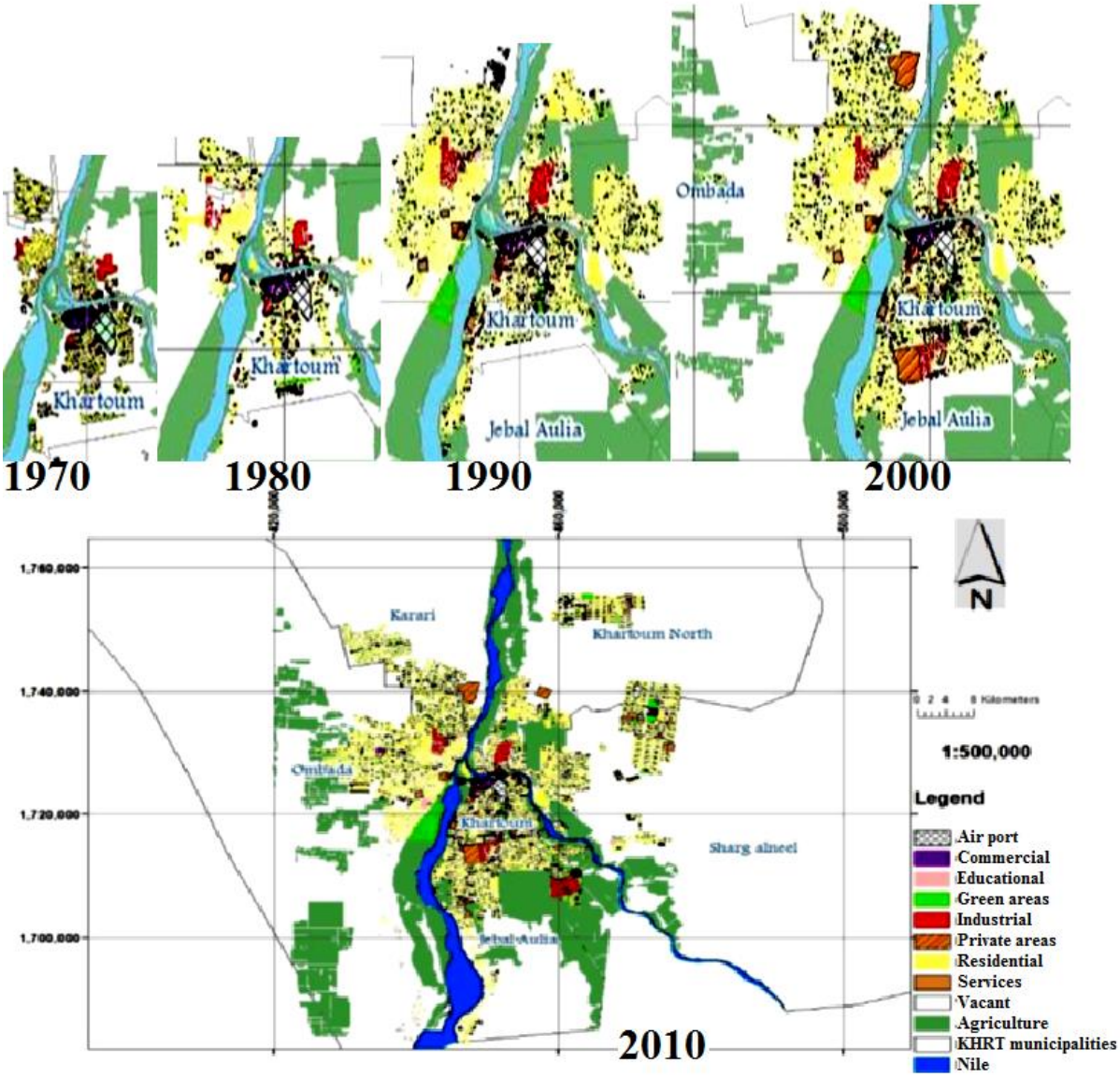
- The distribution of the city into three towns creates multifunctional districts. In 2010 *Khartoum* land uses reached more than 46 thousand hectares for residential, 8 thousand hectares for public uses, and 2 thousand hectares for industrial uses. There is an increase in vacant areas in proportion to the total area allocate for the city. The city total area increases rapidly in a sprawling manner that creates new economical uses in peripherals areas. See table (8-3) and map (8-29).

Table (8-3): *Khartoum*- land use changes from (1970-2010)- (Mahmoud and Al-Tayeb -2017- with additions)

Year	1970	1980	1990	2000	2010
Residential (ha)	3,010.94	5,549.64	16,315.51	23,823.21	46,053.88
Services area(ha)	725.45	1,253.18	2,949.38	4,155.48	8,607.3
Industrial area(ha)	322.00	652.78	1,304.78	1,659.62	2,331.21
Private vacant area(ha)	105.23	257.79	699.81	1,917.80	2,297.91
Public vacant area(ha)	14.09	23.53	95.20	248.53	1,010.76

8.5.2.2 Resources levelling:

- In relevance to *Khartoum* structure plan 2008, priorities of spending capitals at state level are rational but not sufficient: they are for preparing lands for future expansion, solving problems related to sprawl growth, integrating units; and creating axis for urban development. At the urban level, the concerns are for providing public services and infrastructure, that with decreasing the horizontal growth of the city. In the rural direction the priorities of funding are to link rural areas with urban centre. The distribution of budget by municipalities and purposes is illustrated in Figure (8-19). The large portions go to *Khartoum* municipality and infrastructure sectors.



Map (8-29): *Khartoum* city- Land use changes from (1970-2010). (Mahmoud and Al-Tayeb -2017- with additions)

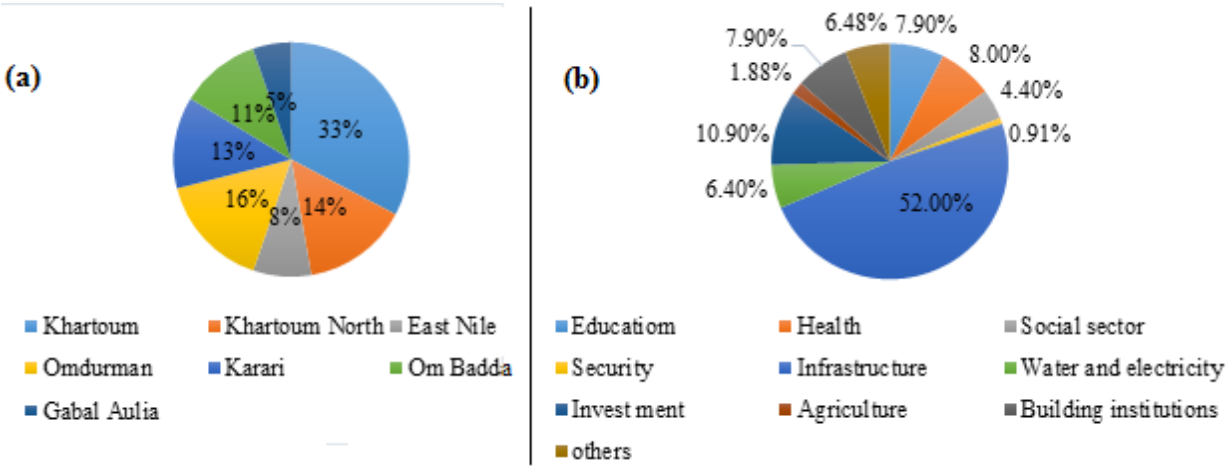
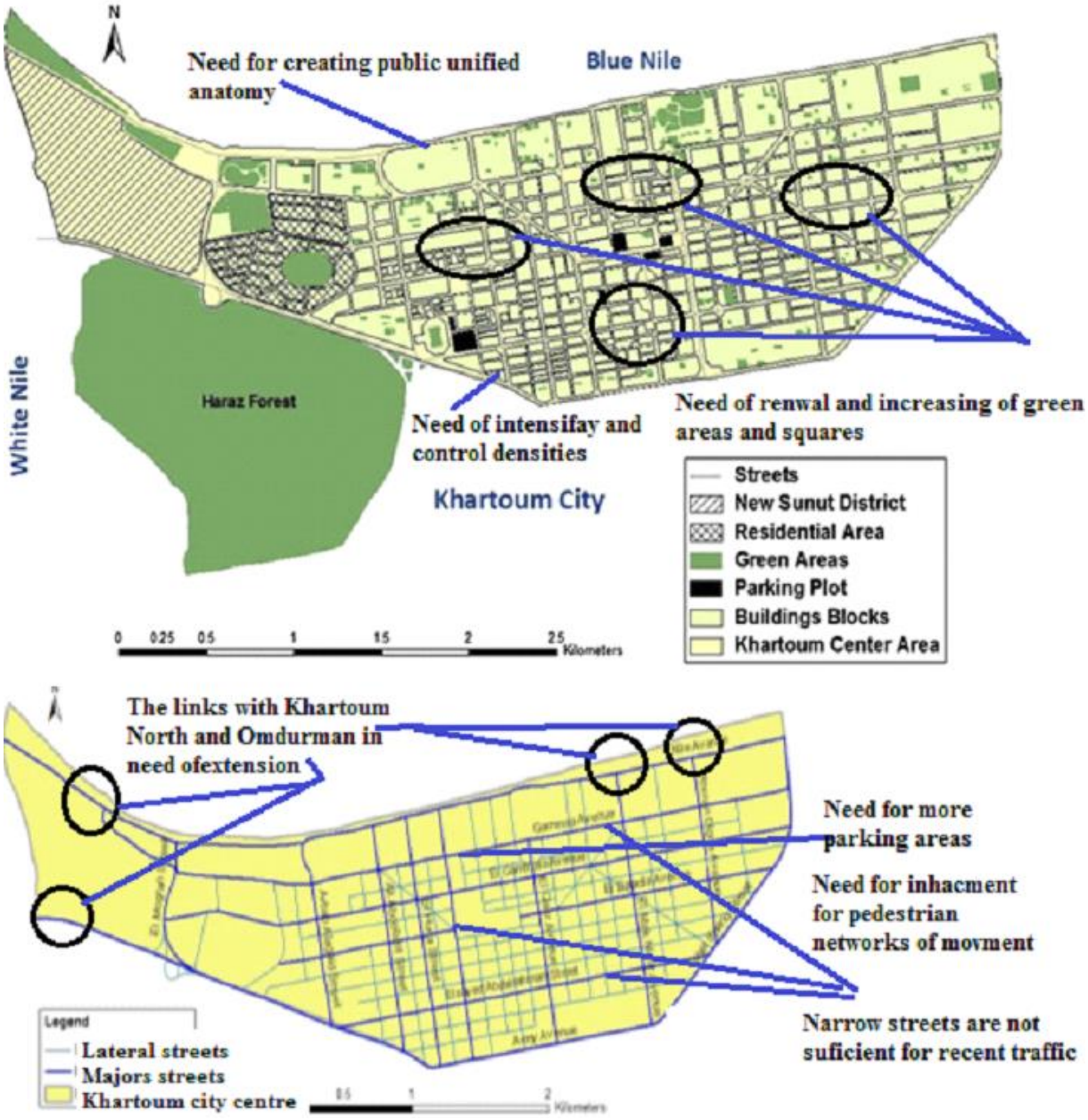


Figure (8-19/ a and b): *Khartoum* state- governmental expenses from total budget of development, in 2014, by: (a) municipalities, and (b) purposes. (The ministry of strategic affairs and information/ *Khartoum* state- 2015)

8.5.2.3 Detailed zoning:

- Efforts to organise unplanned districts in Greater *Khartoum* face challenges with the landownership system, and technical problems in distributing and linking the public services and infrastructure to city networks. The city has very low density. This increases the cost of supplying services and infrastructure. There are many vacant areas, public or privet, within the city pattern. The city central zone of *Khartoum* CBD, is in need of solving transportation and parking issues, reorganizing land uses, increasing green areas and open spaces, and renewing some parts of its built form. See map (8-30)



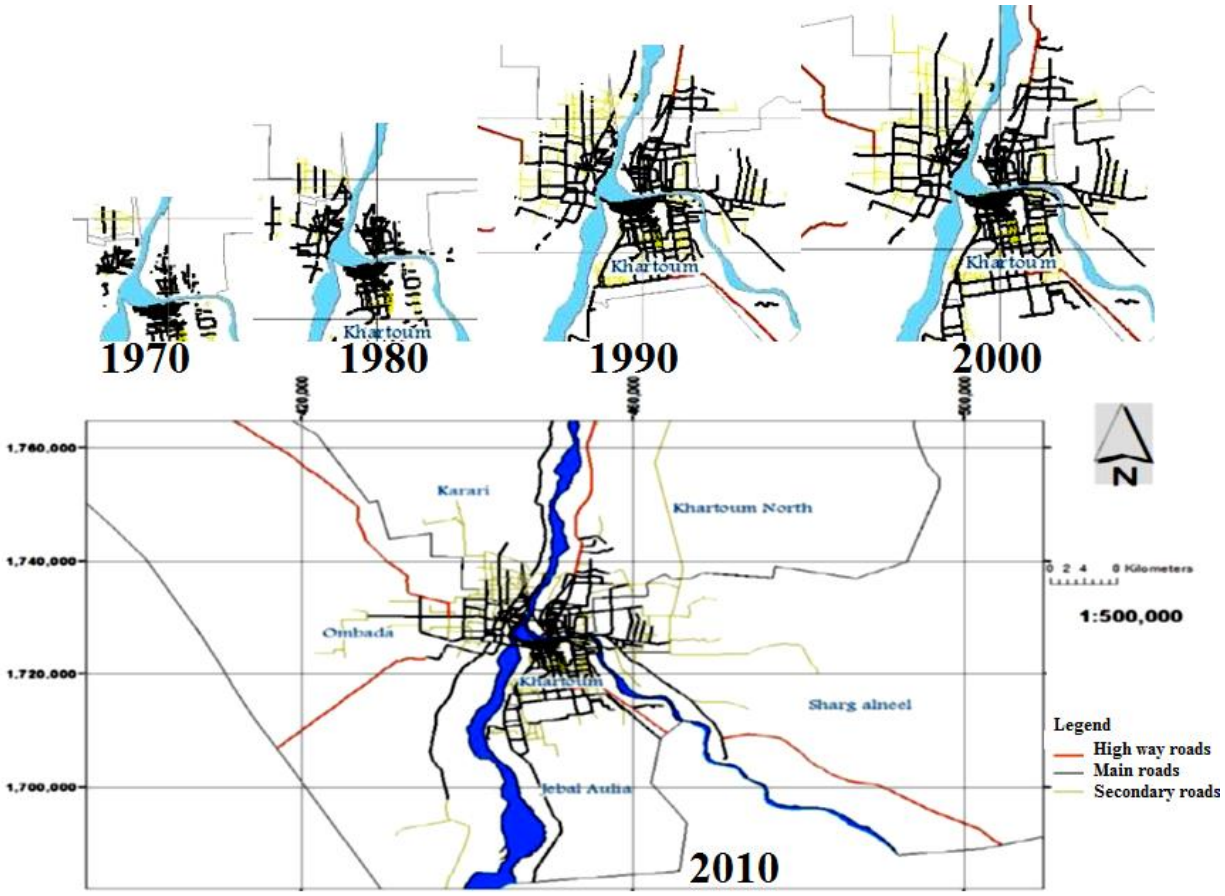
Map (8-30): *Khartoum* CBD- detailed zoning. (Horn -2015, with additions)

8.5.2.4 Transportation and infrastructure patterns:

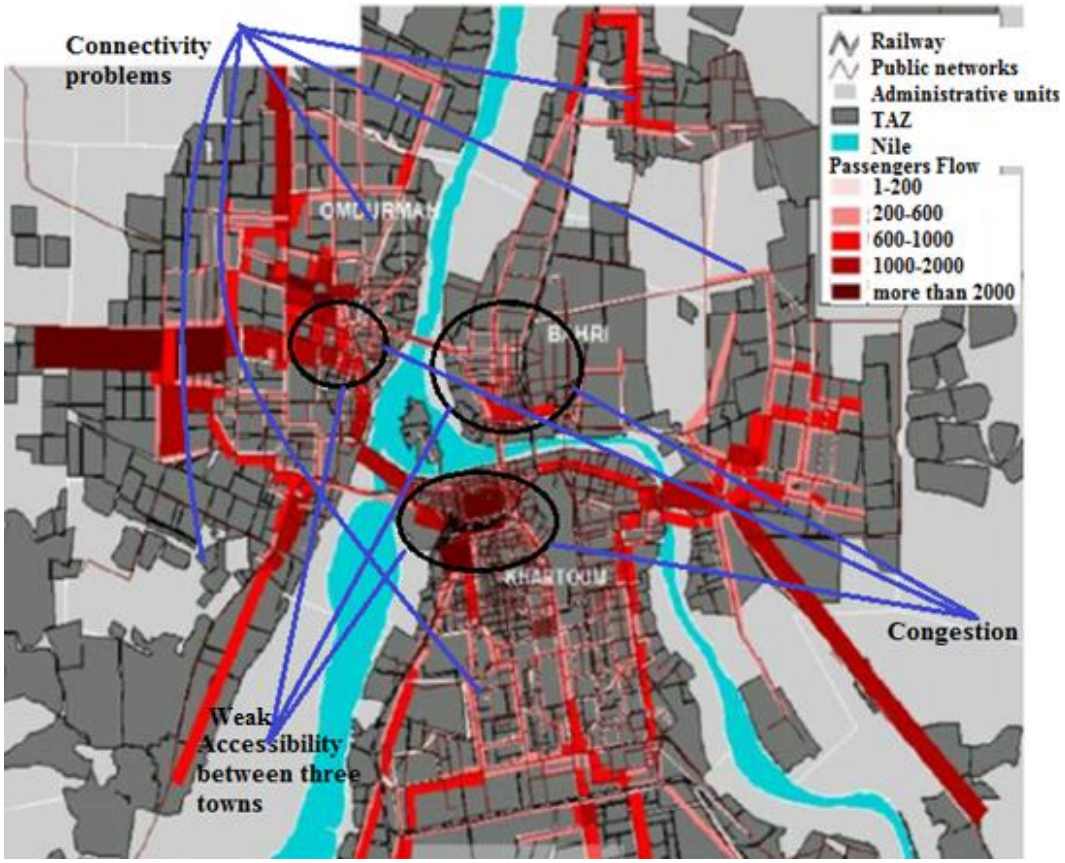
- The existence of the River Nile and its branches is a natural constraint for traffic with limited crossing axles (bridges). This leads to disturbance and congestion of city transportation networks. The horizontal expansion of *Khartoum* city, exhausts the limited abilities of the local economy of the government in providing public services and increases the per-capita cost of provision. There is expansion in city main roads that reached over 1600 km in 2010 see table (8-4) and map (8-31), but the city network of transportation faces problems related to connectivity, congestion and accessibility. See map (8-32)

Table(8-4): *Khartoum*- transportation infrastructure expansion from (1970-2010)- (Mahmoud and Al-Tayeb -2017)

Year	High way roads	Main roads	Secondary roads	Total
1970	1.25	183.21	48.04	232.50
1980	1.25	281.26	73.94	356.45
1990	5.83	535.82	202.87	744.53
2000	15.02	621.74	263.46	900.22
2010	302.11	787.17	579.97	1669.25



Map (8-31): *Khartoum* city- transportation infrastructure expansion (1970-2010). (Mahmoud and Al-Tayeb -2017)



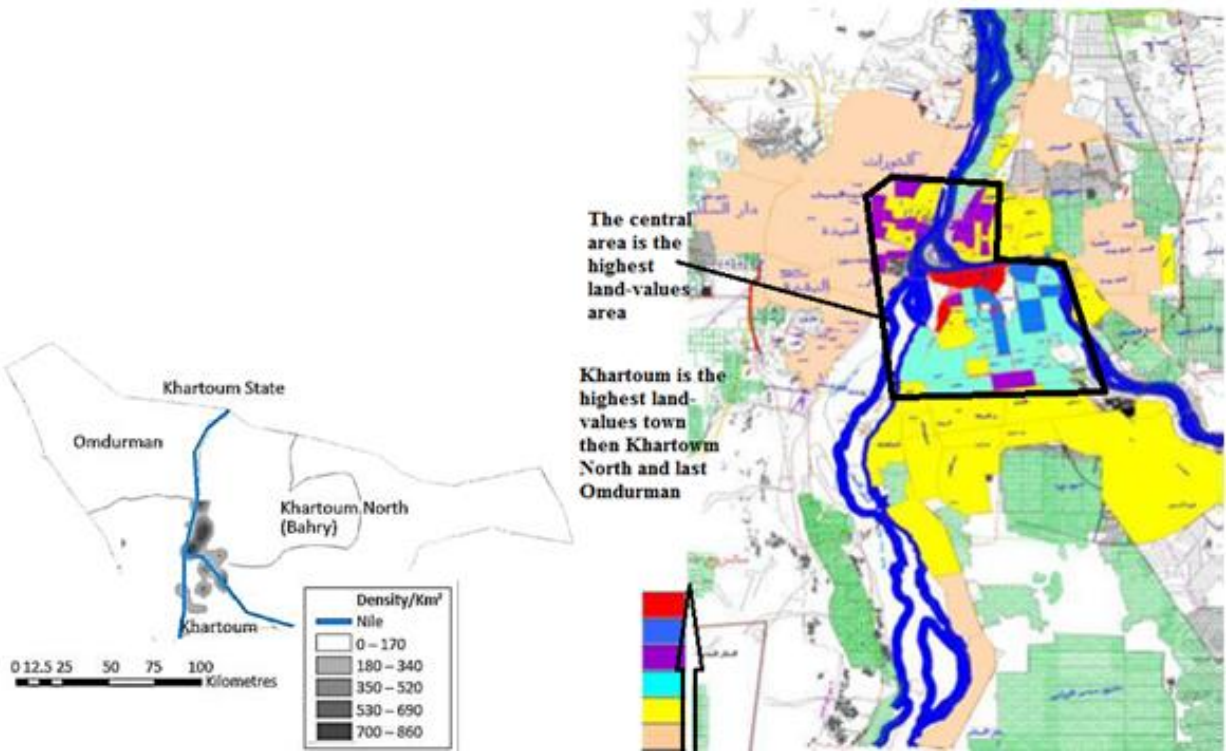
Map (8-32): *Khartoum* city- traffic concentration. *(Eltahir, Abd-Elhaleem, Adil, Adil, Abd-Elrahman, and Jaafar*- 2017) -*Khartoum* transport and mobility master plan, (2010-2035). Mefit LTD *Sudan* branch). Note: map indicated city micro-influence zones with dark red.

8.5.2.5 Land values:

- Metropolitan *Khartoum* inner city areas are very densely populated and relatively to be exact well served, whilst the suburbs and rural areas are sparsely populated and unserved well. *Omdurman* has the lowest density. *Khartoum* city central area and inner city are not preferred for residence, while the suburban and outer city are the most preferred zones. *Khartoum* CBD has the highest land value in the city, then *Khartoum North* and *Omdurman* CBDs. The River Nile and its branches and the availability of biggest public and privet projects increase the price of their adjacent lands. See table (8-5), maps (8-33) and (8-34).

Table (8-5): *Khartoum*-population densities from (1970-2010)- (Mahmoud and AL-Tayeb -2017)

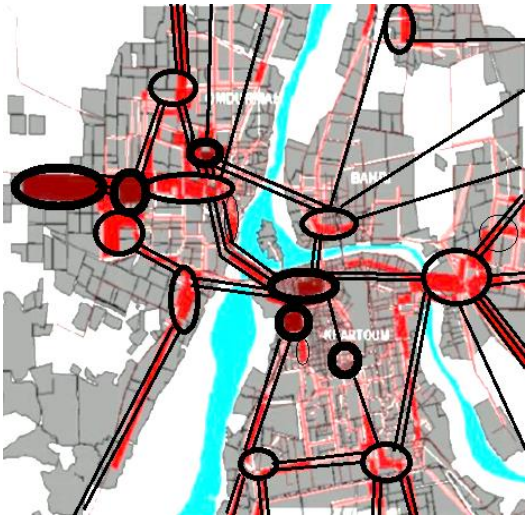
Year	Population(p)	Population growth	Urban land (hectare)	PD (p/hectare)
1970	1,096,000	--	5,109.14	214.52
1980	1,802,000	6.44	9,018.29	199.82
1990	3,512,000	9.49	23,573.26	148.98
2000	4,709,000	3.40	34,708.95	135.67
2010	5,758,234	2.22	65,877.10	87.41



Map (8-33): *Khartoum* state- densification of population
Map (8-34): *Khartoum* city- land prices (2008). (UN-HABITAT International-*Sudan*-National Consultant Team-2008, with additions)

8.5.2.6 Micro-morphology:

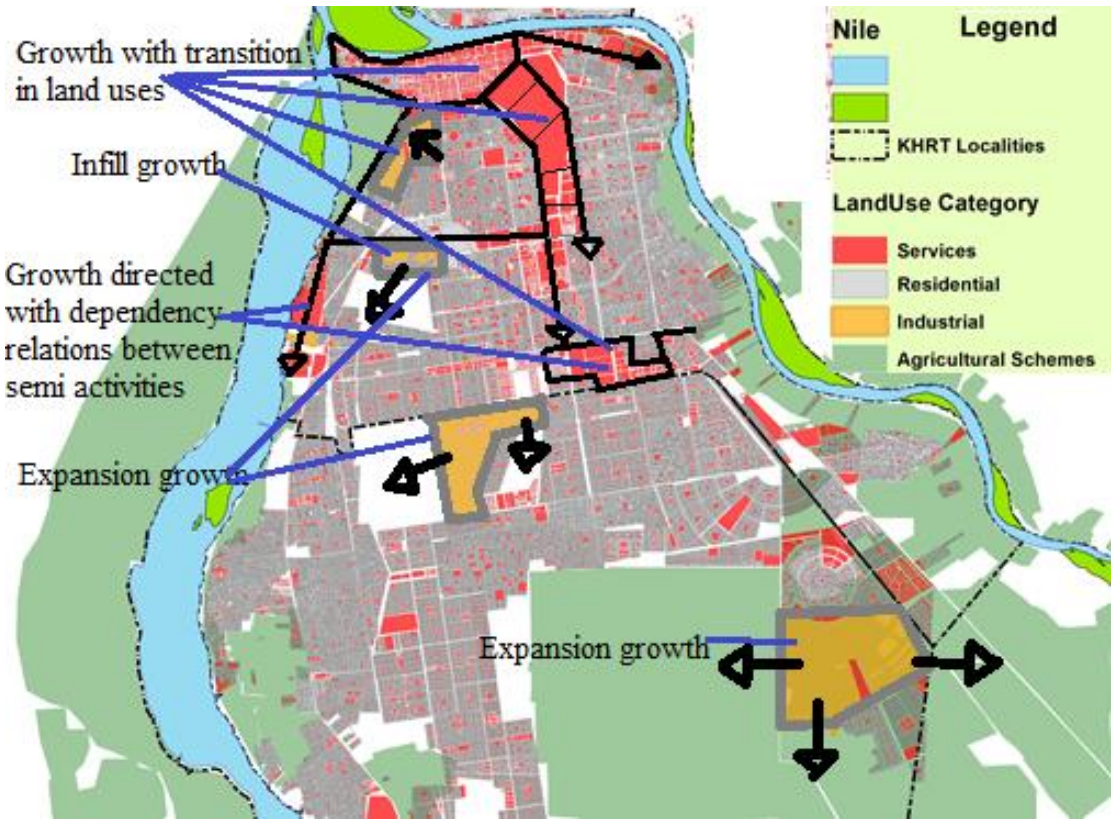
- *Khartoum* micro morphology is affected by the system of concentration of services areas, and the design of serving districts and relations between them. That morphology is in need of adjustment to increase accessibility, efficiency and decrease the bad effects on the neighbouring land uses. The administrational and functional distributions of city zones are not valid and affect city, in both serving and operating performance levels. See map (8-35)



Map (8-35): *Khartoum* city- network of public services with dependency relations. (Horn -2015, with additions).

8.5.2.7 Micro- spatial growth:

- City districts grow in shape of expansion growth in the peripheral areas and vacant lands and infill growth in the central districts. The intensification of city need an adjustment for city provision of public services and infrastructure. See map (8-36).

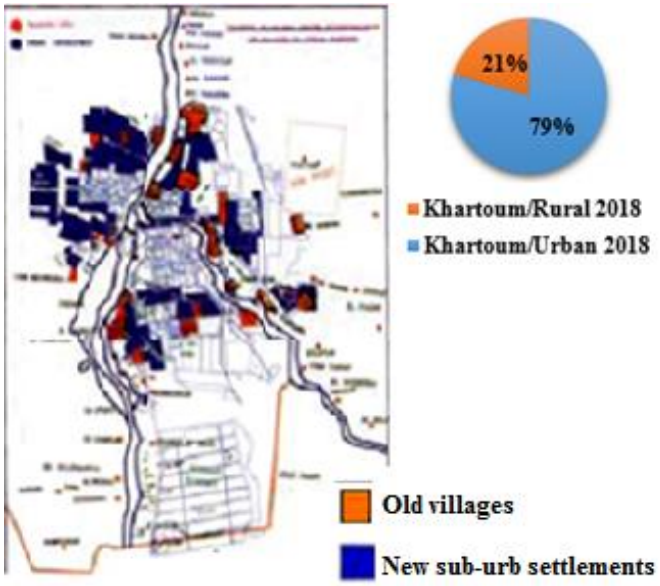


Map (8-36): *Khartoum* city- micro growth of land uses. (Ministry of physical planning and development- *Khartoum* State- (General Directorate of Surveying-GIS and Digital maps Center) –*Sudan*- Remote Sensing and Seismology Authority – *Sudan* -2018- with additions).

8.5.2.8 Macro-morphology:

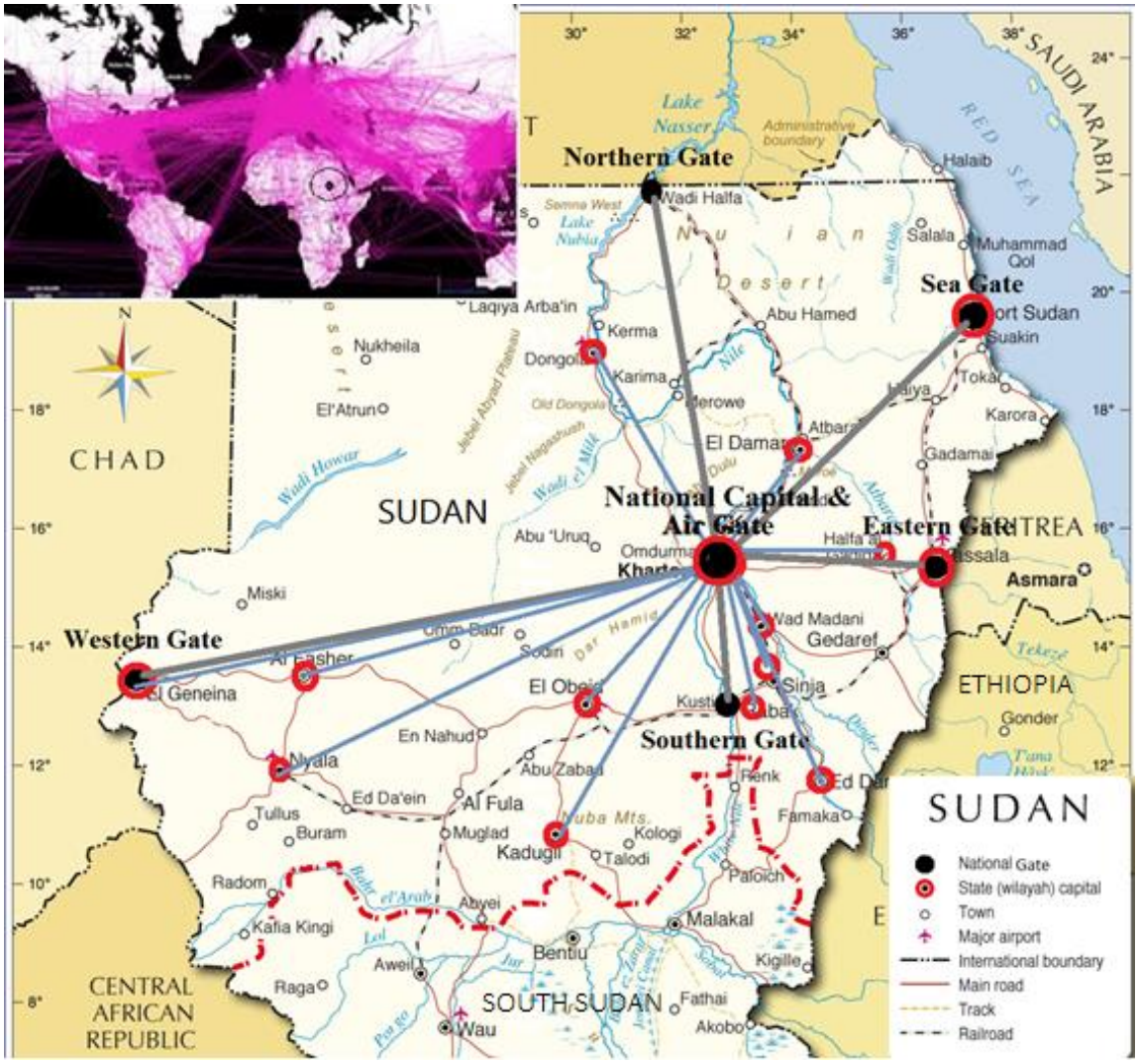
- In *Khartoum* state, the majority of population are urban with a percentage of 79%. See map (8-37) and figure (8-19). *Khartoum* is the central node of *Sudan* and links all its parts together via transportation, and infrastructural, governmental, political, cultural, and public services relations. It is considered as the main country global gate by having the international airport of the country. See map (8-38)[19]. The available capabilities of city to dominate this scale of influence, and to assemble the country fragmentation is not efficient and that affect the national urban system.

[19] *Sudan* land boundaries: total: 6,819 km. Border countries (7): Central African 174 km, Chad 1,403 km, Egypt 1,276 km, Eritrea 682 km, Ethiopia 744 km, Libya 382 km, South *Sudan* 2,158 km. The coastline: 853 km.



Map (8-37): *Khartoum* city- satellite cities and surrounding villages (1990-2008). (UN-HABITAT International-*Sudan*-National Consultant Team- 2008).

Figure (8-20): *Khartoum* state- mode of living urban/rural. (Central Bureau of Statistics- Ministry of Cabinet-*Sudan*- 5th Population Census 2008)

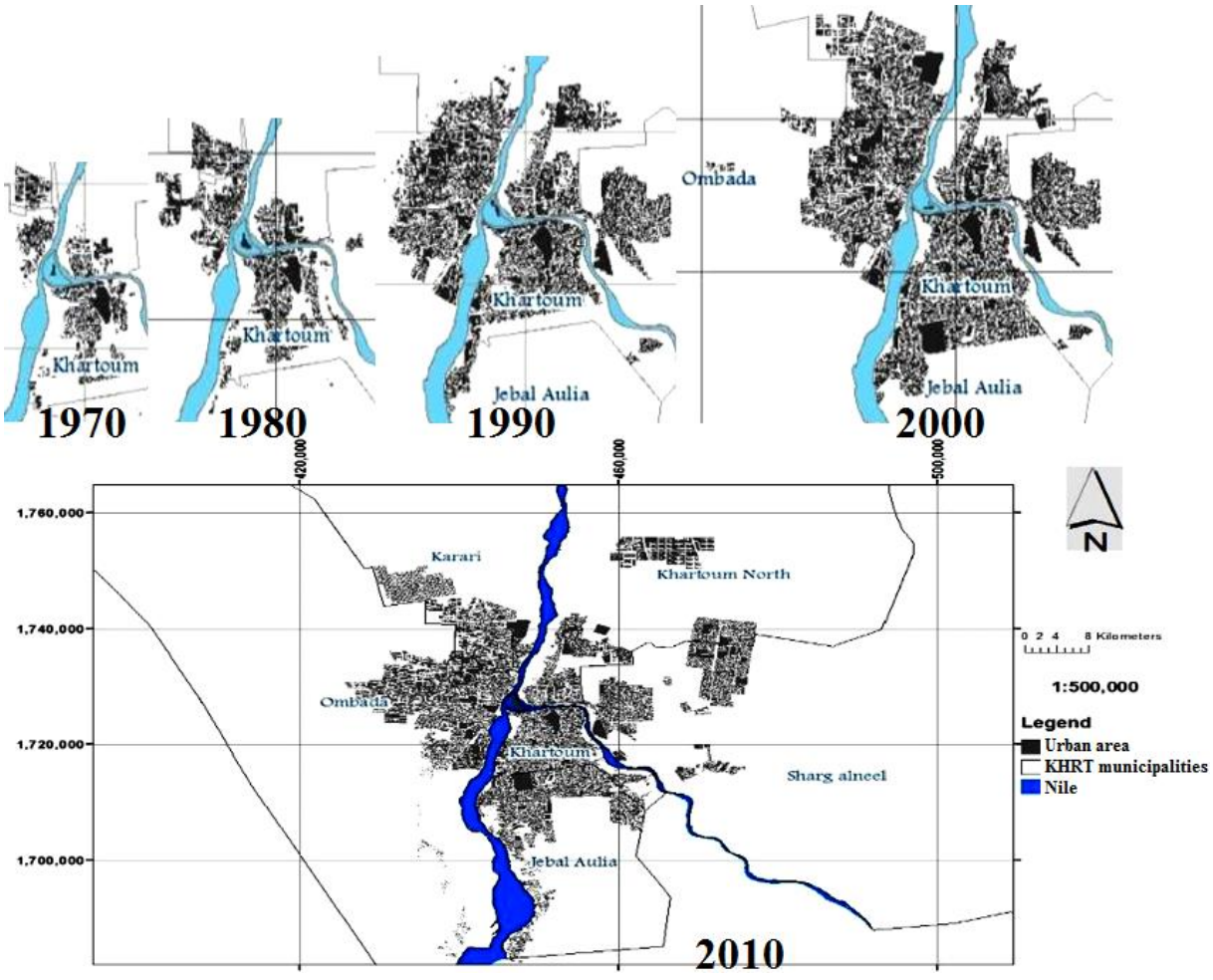


Map (8-38): *Khartoum* city- macro-morphology. (Google maps- 2018 with additions).

8.5.2.9 City macro-spatial growth:

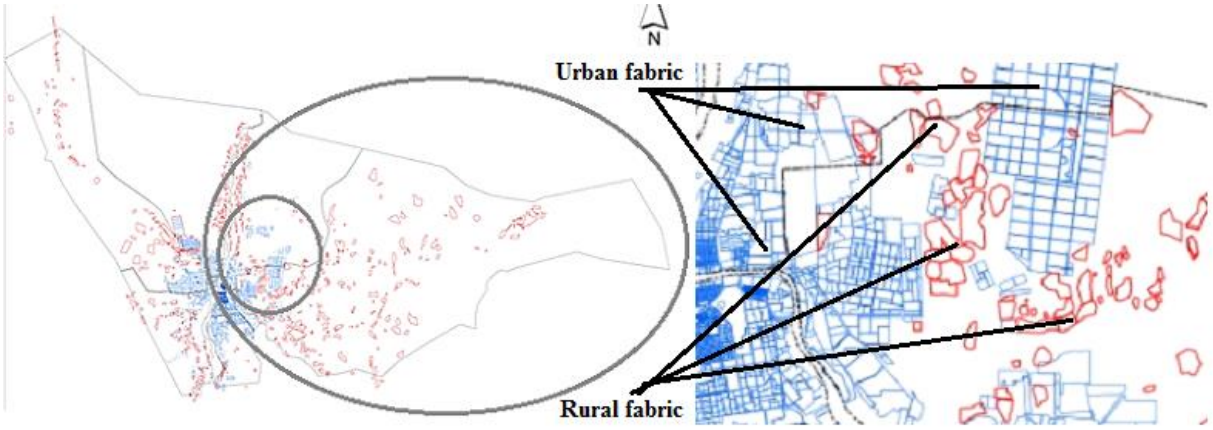
- *Khartoum* city was expanding quickly from 3,909 hectares in 1980 to 31,168 hectares in 2010. See table (8-6) and map (8-39). There is no natural or political boundaries constraint that huge expansion for more than this. The major problem faces city that its urban growth goes in a random pattern, not a regular fabric, sprawl with very low use of land, and with vacant areas in between. That represents unsustainable and inefficient growth, and creates economic and operational difficulties in planning and in implementing development programmes.

Table(8-6): *Khartoum*-spatial expansion from (1970-2010)-(Mahmoud and Al-Tayeb -2017)		
Year	Urban area(ha)	Spatial expansion(ha)
1970	5109.14	----
1980	9018.29	3909.15
1990	23573.26	14554.97
2000	34708.95	11135.69
2010	65877.10	31168.15

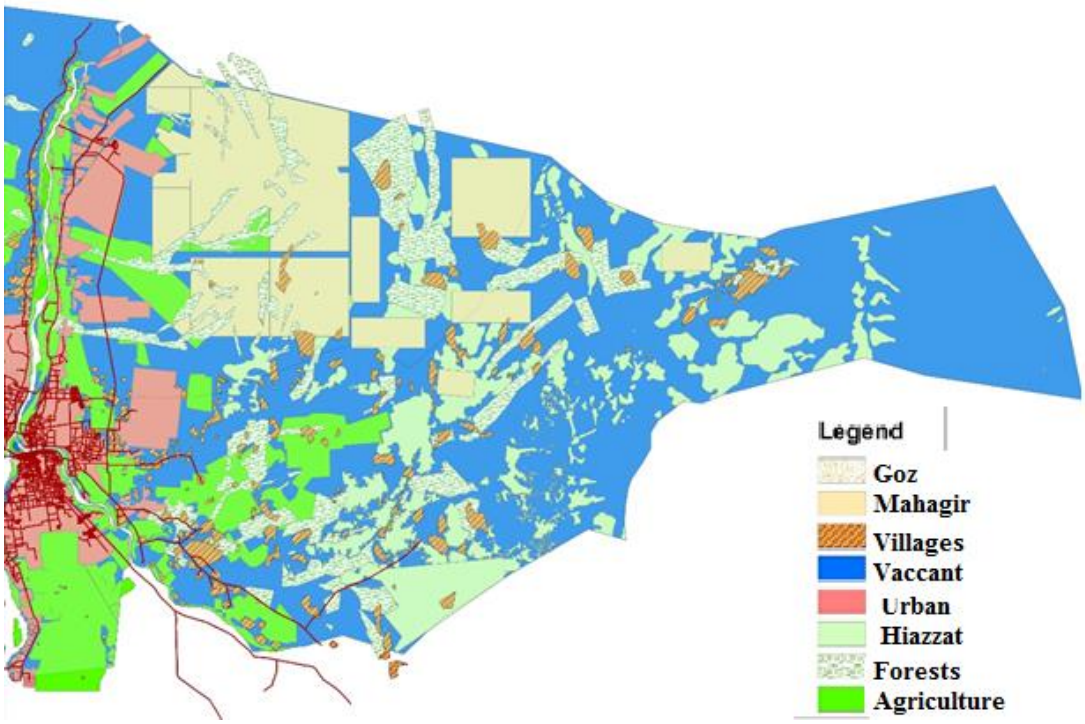


Map (8-39): *Khartoum* city- spatial expansion (1970-2010). (Mahmoud and Al-Tayeb -2017).

- The villages round the city are adding to be part from city lands related to the city horizontal expansion. These unplanned settlements affect city morphological composition and connectivity. The differentiation between urban and rural fabrics in their environmental, social and economic ecologies, creates contradictions upon a city morphology, but they link together in economic and public services. See maps (8-40), and (8-41).



Map (8-40): *Khartoum* state- the interpenetration between the urban and rural fabrics (*Khartoum North*). (Ministry of physical planning and development- *Khartoum* State- (General Directorate of Surveying- GIS and Digital maps Center) –*Sudan*- Remote Sensing and Seismology Authority – *Sudan* -2018)



Map (8-41): *Khartoum* state- urban-rural interface (*Khartoum North*). (Mahmoud-2014)

8.5.3 Judging the Diagram of *Khartoum* (CMM):

8.5.3.1 Acts modulating spatial growth in *Khartoum*:

(a)Nodes:

- *Khartoum*, is the capital, the main transportation node in the national urban system and it is main link with the global community. It plays an important economical, governmental, political and national roles. Its social context is characterized by complex ethnic and political diversity.
- In *Sudan*, the majority of population is distributed in few urban centres including *Khartoum*, the primer city. There is a wide gap of population size between Greater *Khartoum* and other urban centres (it includes about 63% of the total urban population in the country).

(b) Gravity:

- *Sudan*, like other developing countries faces problems related to high rate of urbanisation caused by migrations from rural areas. Rural pull factors include: high-incomes, greater employment opportunities, economic security, availability of a wide range of services and infrastructure. Rural push factors include: civil wars, tribe's conflicts, declining in productivity, low-income levels, a shift from subsistence to export farming, shortage of land and limited off-farm employment, drought in agriculture and livestock zones, dissertation, beside poverty.
- *Khartoum* in-migrants live in marginal zones within the city, in areas that are deprived of urban services and facilities, and that aggravates their poverty problem.
- High concentration of population in *Khartoum* city affects the habitation system of the country. Spreading of population in all country area is not balanced in spite of availability of natural resources. That causes inefficient national economy performance and weakness in country security.

(c) Domination:

- The impacts of the unbalance between urban and rural areas in the national scale extremely speed up urbanisation, result in high percentage of unemployment, variability of income levels, and low capabilities of community services and transportation and infrastructure.

- The capacity of *Khartoum* in terms of public services, transportation, infrastructure, and affordable houses is rather low. According to the city recent scale of urbanisation, there is a deterioration in the most of its capabilities. That results in miss planned areas, sprawl growth, slums, overcrowds roads, and environment deterioration, pollution, underemployment and poverty. *Khartoum* inner economic situations faces a combination of factors that include: inflation, reduction in foreign investments and exports, and increase of imported inputs and commodities.
- In *Khartoum,* there is a problem in defining and conserving local identity and this is related to two causes: the first is un-managed inner migration which is difficult to assimilate automatically and the second is related to the domination of globalisation.

(d) Agglomeration:

- *Sudan* is an agricultural country, depends on agriculture and livestock in its national income, and that means the number of population who are involved in those activities must be reached. However, *Khartoum* the main urban centre, has the highest concentration of economic activities in the country. Most national public services are concentrated in the centre, beside Khartoum state public services, in a high rate of agglomeration, and they expand daily by changing their surrounding land uses.
- The use of advanced digital and telecommunication technologies is still limited and has a weak impact on the spatial organisation.

8.5.3.2 Modulating spatial growth in *Khartoum*:

(a)Micro-morphology:

(a.1)Unsteady: Low density land uses in *Khartoum* city increase city scale in an inefficient and uneconomic ways. The result of this is unmanaged city land uses and high cost of provision of services and infrastructure. The city grows up beyond its boundary in an unsteady shape. The improvement in city infrastructure and transportation networks creates unsteady land prices that affect investments in real estates, and create a need to protect urban poor residential zones.

(a.2)Un-Homogeneous: There are differences and variation between city' districts and within each one, in the quality of life and city operation process. Connecting *Khartoum* city parts require strong transportation and infrastructure networks; that increases city performance, deceases city contradiction and connects isolated places.

(a.3) Zones in danger: Rapid sprawl urbanisation swallowed surrounding villages with their unprompted morphology. The re-planning process is confronted by land ownership and capitals' constraints. It's very difficult to decide on demolition or relocation of population. The huge pressure in city capabilities and consumption issues of resources leads to deterioration in city centre and inner city zones. The limited management of buildings in the site and services method of providing residences, affects city appearance and anatomy.

(b) Macro-morphology:

(b.1) New scale of urban development: *Khartoum city* has a very large area compared to the other cities of the World. The city has an abnormal volume comparable to other *Sudan*'s cities; and this challenges services provision and allocation of capitals at local, regional and national context. The expansion of the city, which does not follow by city centre extending, decreases the city centre influence over the urban area. The whole city influence over its hinterlands, and the city influence as a state and a country capital.

(b.2)Un-connected: The urban system in *Sudan* characterized by isolated parts, and faces the problem of inter relation between its components as administrational, economic relations or as transportation, in both formal and informal forms. The channels of communication and mobility are not sufficient and not appropriate.

(b.3)Un-managed urbanisation: Many urban centres in *Sudan* face problems of shortage in infrastructure, services, energy, and job opportunities. Droughts, civil wars, and poverty affect the national urban system, and results in waves of migration from impacted areas towards *Khartoum*.

(b.4)Not-global: *Sudan* internal situations limited the integration between its local economy and the global one. Parts of *Khartoum* are the most global areas in *Sudan* but still in need of improvement. To attract global firms and investments, that needs essential enhancement for city basic capabilities.

(b.5)Un-accompanied zones: There are huge differences between: *Khartoum* zones, the three towns which combine *Khartoum*, *Khartoum* and other Sudanese cities, *Khartoum* state and other states, and *Khartoum* and other global cities. Such unbalanced development causes social unrest and technical problems related to city performance, and investment potential.

8.6 Determination of the Challenges Facing *Khartoum* Morphological Development:

8.6.1 Projecting the Effects of Population Growth and Economic Activities in *Khartoum* (CMM) Development:

This study refers to table (7-3), which defines the aspects of *Khartoum* morphological development and modifiers as follows: First, spatial policies include: the concentration of population and spatial scale, and land uses returns. Second, resources management which includes: employment and productivity; and allocation of capitals, investments and resources. Third, conservation of natural environment includes: the urban environment, and economic activities environmental effects. Fourth, urban quality includes: living behaviours, and economic returns by urban quality. Fifth transportation and infrastructure pattern includes: need for transportation and infrastructure, and need for transportation and infrastructure for certain economic activity. Sixth, micro-influences and growth, include: micro- growth managing methods, and economic activities in city micro-morphology. And seventh, macro-influences and growth include: macro-growth managing methods, and economic activities in city macro-morphology.

All that, according to special characteristics of *Khartoum*, to determine the challenges facing the transformation of city to become a real time city. See table (8-7).

8.6.2 Relation between Urban Development Constraints and *Khartoum* (CMM) Development:

The urban development constraints include: basic necessities: suitable urban housing, social services, transportation and infrastructure; Dynamic effectiveness: sustainability and flexibility; urban poverty: alleviating the poverty of money, alleviating the poverty of access, and alleviating the poverty of power; Capitals: finance, labours, technologies; and Institutionalisation and partnerships: de\centralisation, institutionalisation, monitoring and evaluation mechanisms, and partnerships. Table (8-8), discusses the effects of these constraints on *Khartoum* (CMM) development. That depends on table (8-7) to link the concluding results with the effects of population growth and economic activities.

Table (8-7): The effects of population growth and economic activities upon *Khartoum* (CMM) development. (Researcher/ Alia- 2018)			
City morphological development aspects	**city modifiers aspects**	**City governing challenges**	**City morphological challenges**
Spatial policies	**-The concentration of population and spatial scale**	• The decisions of urban development face resistance. • Failure in the implementation of the previous plans, exhausts city available capabilities and aggravates the problems of city needs.	• Homogeneity of the country, regions, and even the city, create a need of implantation of multifaceted action plans. • There is a need to provide lots of choices in public supplies, to follow the differences in income (to serve different income groups), in education, culture and habits.
	-Land-use economics returns	• The system of supplying land and services for residence is a short time solution but is not valid in the long time. It affects city appearance, increase the cost of services provision and reduces living quality for residence.	• *Khartoum* land uses are not clearly separated in functions, and there is limited unity, accessibility and proximity in the city structure and form. • The main working zone is the services zone which employs the majority of government and services employees. The contribution of industries is less than that.
Resources management	**-Employment and productivity**	• Instability is the characteristic that dominate the performance of the Sudanese planning. Most of development projects/plans were not carried out properly. • Limitations in employment opportunities expose Sudanese cities to a problem of outer migration of qualified working force.	• The industrial and agricultural working sectors of the city need extension to follow the increase in the needs for jobs, but the economic situation restricts governmental efforts to covering the basic needs. • The cost of supplying public services is very high in comparison to the income levels.
	-Allocation of capitals, investments and resources	• Basically, *Khartoum* city, depends economically on providing the local and national population public services, and transportation and infrastructure which cannot create a profitable urban economy. • Site and services programmes create mixed zones between poor, affordable, and rich residence, it is healthy in social considerations but creates difficulties in organising services provision and welfare programmes. • City has a shortcoming visions in risk planning.	• The main economic sector is the service sector in *Khartoum* central area and that creates pressure on structure available capabilities of the urban and problems continuously increase with city growth. • There is a disorder in offering equal access to gains of economic development for the public, between states, within a state, between cities and within a city. • There are no problems of economic activities that affect and highly consume the environment. • The major natural disaster facing the city is the Nile flood which is possible to forecast and contain.

Conservation of natural environment	**-The urban environment**	• The conserving of natural resources is not a priority. • *Khartoum* sprawl outgrowth caused by unmanaged, uncoordinated and unplanned spatial growth leads to inefficient resource utilisation and also has bad environmental impacts.	• The manufacturing environment in the city does not support human physical health, behaviour and feelings. • City sprawl growth affects surrounding nature ecology. And causes environmental degradation in inner city parts. • The city temperature is increased, because of inappropriate building specifications and unsuitable building and finishing materials.
	-Economic activities environmental effects	• In the recent time industries have limited effects on the social and natural ecology, but their effects must be considered in strategic plans.	• There is visual and noise pollution, especially in the city centres and commercial areas. • Urban life ecology is not polluted by industrialisation, like in modern cities, *Khartoum* is mainly a services centre.
Urban quality	**-Living behaviours**	• Poor residential areas in the city lack essential public transportation and infrastructure, with people living in overcrowding conditions, at a high living cost, and suffer crime and illegal activities. • Introducing information and daily life technologies to residence life is essential but costly, related to per-capita income.	• The city heritage, diversity and individuality, are not visible in the city composition and that is because of disorder of functions, properties, and styles. • Planning faces problems of poverty and how to integrate differentiation in income of residences to provide affordable alternatives of, in price and quality, for public housing and services. • Information technology applications start to be part from city interaction systems.
	-Economic returns by urban quality	• Due to globalisation and socio-economic development, many privet and commercial activities moved to inner city, this increases the land value there, but affects the quality of residential zones. • Residential areas are distributed to planned and unplanned districts, and the planned districts are classified into three classes that complicates managing city density. • City growth and sprawl cause a need to extension in economic activities. That changes some lands from residential to commercial purposes.	• Lands in *Khartoum* city need improvement in infrastructure and services to attract investments. • The most expensive land is in and near the CBD, and zones neighbouring the Nile River and inner city. • Growth of population increases demand and cost of living in *Khartoum*. • Unplanned settlements are scattered all over the city not only in the margins but also in the middle. • There is a gap between population density, services provision and work opportunities in *Khartoum*. This causes inequity between different classes.

Transportation and infrastructure pattern	**-Need for transportation and infrastructure**	• Urban sprawl, is scattered urban development. The divergence and isolation of some districts increase the cost of supplying infrastructure in general and per-capita.	• The high cost of basic infrastructure leads people to settle informally in areas lacking services. This situation aggravates their serious poverty conditions.
	-Need for transportation and infrastructure for certain economic activity	• It is essential to apply smart management of city networks to solve problems of indenisation of the working institutions in the city centres and the existences of the River Nile as a natural constraints.	• Networks of supplies: clean water, electricity and roads, are good but the problem is in the quality of services; and the need for extensions. There is no gas network. Surface drainage and sanitation systems do not cover all the city.
Micro/ -influences and growth	**-Micro- growth managing methods**	• The dynamic horizontal expansion growth of *Khartoum* creates the biggest uncertainty of the planning of *Khartoum*. The change in city size changes the volume of city fundamental needs and affects city management applications. • The dynamic increase in the cost of real estate forces the poor out of the urban fabric, creating a clear duality between the "formal" parts and "informal" parts of the city. • Also the expansion of the city over the surrounding villages creates a mix between the urban organised fabric and rural organic fabric.	• Low density has negatively contributed to the efficiency of the city in terms of: increased travel costs, increased infrastructure costs and depletion of the hinterland and fragmentation. • Sprawl and rapid urbanisation followed with encroachment on agricultural land; scattered urban development; urban duality; segregation and fragmentation; scarcity of land; high cost of housing; unaffordable services and housing; lack of land ownership; high cost of renting in inner-city; high urban living cost; high percentage of inbuilt plots (lack funds+ speculation); increase in general poor and unaffordable habitat conditions.
	-Economic activities in city micro-morphology	• The cultural and ethnic factors play the biggest role in population distribution, community activities and planning process. • *Khartoum* is in the stage of shaping and reshaping its micro- morphology for economic aspects. • City land uses are under continuous changes and daily vulnerable.	• City efficiency faces problems in: accessibility, proximity and functional mix. There are formal areas count with roads and easy access, but some are difficult to access because of limited adequate roads and relatively expensive transportation facilities. • Unplanned urban growth has had a negative impact on life in the city, creating overcrowding of roads, air pollution and improper housing, spread of slums and unplanned housing, increase in unemployment rates. • The city metropolitan "mosaic", is fragmented and working by parts is extremely inefficient to perform socio-economic development.

Macro-influences and growth	**-Macro-growth managing methods**	• Cities in *Sudan* resemble major services points, with trading or political importance or with ethnic\ tribal loyalties. Many of them face the problems of shortage of transportation, infrastructure, services, energy and working opportunities. • The low per-capita income and weakness in the economic growth in *Sudan* cause: unbalance development, civil wars, affect local social relations, destroy the local administration, cause migration, affect the natural growth of population and disaffect countries resources.	• The urban system in *Sudan*, faces the problem of weak internal relations between its components as administration relations, economic relations or transportation connections. • The waves of migration to *Khartoum*; cause structural constraints on harmonious national development, inefficient spatial distribution, environmental deterioration, unbalance densities, a small proportion of land is inhabited , inefficient economic performance, unused natural resources, environmental degradation, increasing demand for resources, regional asymmetries in development, weak political integration, and poor urban environment.
	-Economic activities in city macro-morphology	• *Sudan* capital' *Khartoum*, serves as a political, cultural and commercial centre of the nation. It plays an important role as an engine of national economic development, institutional building, cultural progress and political integration. • The political and economic situations limit the integration between *Khartoum* local economy and the global one. • The villages surrounding *Khartoum* depend on it as a market for their raw products, service centre, and place to work.	• The city capabilities and infrastructure need more development to provide suitable environment to establish Global association. • *Khartoum* city has weak abilities to resist global economic forces from impacting its morphology. The inequitable regional development programmes, where some states obtain and other do not, creates a huge gap in the standard of living and incomes which prompts many people to emigrate from their states. • Many cities in *Sudan* declined as a result of out-going migration of the young population towards *Khartoum* state or abroad. • The rural migrants toward *Khartoum* create marginal jobs, and lives in poor informal settlements.

Table (8-8): Relation between urban development constraints and *Khartoum* (CMM) development. (Researcher/ Alia- 2018)		
Constraints		**Effects**
Basic necessities	**Suitable urban housing**	-Planning problems are exacerbated by high population growth rates and national economic problems. -Family has to depend on itself for housing with weak supports from the state. -There are increases in the cost of the land, building materials and taxes, related to income of individuals. -Expansion of squatter zones and indecent housing through the city which is malformation city. - The lands classification system affect city: layouts and sitting, densities; quality of life, social services and infrastructure supplies. -Indecent housing affects city image and tourism facilities.
	Social services	-There is public services insufficiency followed with high population growth rates and shortage of capitals. -Planning efforts fail in addressing existing sustainability needs. -The cost of public services does not match per-capita income.
	Transportation	- The city lacks efficient transportation networks and suffers weak accessibility. -The inefficient transportation network clearly imposes a negative effect aggravating city growth. -The high traffic congestion and the lack of parking in the city centre are obstacles weakening the performance of the city centre.
	Infrastructure	-Government support, in the provision of infrastructure, is not sufficient. -Low densities growth create economic and technical difficulties in provision of basic and essential services in new areas. -All city infrastructure networks are inadequate through the whole city and most of them are very old and insufficient.
Dynamic Effectiveness	**Sustainability**	- In comprehensive and sectorial planning; applications of sustainability is limited. -Plans do not achieve their time of implementation, with high uncertainty rates and sometimes they are a failure.
	Flexibility	-All facilities in *Khartoum* including houses and networks of roads and supplies are damaged annually in the rainy seasons. -Plans have limited flexibility in case of emergencies. -The local situations is very vulnerable towards global restructuring.
Urban Poverty	**Alleviating the poverty of money**	-The economy is characterised by low technology, domination of services with absence of natural resource assets. -The causes of urban poverty in *Khartoum* are: in-migration; weakness in: local economy, industry, employment, and city capabilities; failure of previous development plans; and global increase of prices of necessities.
	Alleviating the poverty of access	-Economy suffers limited supply of natural resources, poverty and unemployment. -Technical education and training in *Sudan* lacks specialized professional programmes to support development. -Financing capacity in shape of public or private assistance is very limited in relation to public needs.
	Alleviating the poverty of power	-The limitation in human development values causes low per-capita income, low performance of labour and low exploitation of resources. -Poor in *Khartoum* are unable to influence decision-making and build equitable partnerships with other actors in the society. -The democracy climate and public rights in *Sudan* are affected by the unstable political situations.

Capitals	**Finance**	- The majority of sources of funding or financing urban development are supplied by government. - Priorities of public funding go to basic necessities: food, health, education, transport, energy…. -Available foreign investments are very limited due to the political situations of the country. -The economy need directed plans to increase the local sources and decrease the loans constraints. -There is low the per-capita saving and investment due to low-income of the individuals. -The private sector contributes investments in infrastructure that increase efficiency but also increase the price of services.
	Labours	- City faces shortage problems of skilled and highly qualified labours which is essential for development projects. -Country faces problems of the outer migration of scientist and highly skilled labours.
	Technologies	- Imported technologies are not all suitable for local environment and capabilities. -Government allows bringing low cost and low quality technologies which have subsequent multiple problems.
Institutionalisation and Partnerships	**De\centralisation**	-There is high centralisation of government and weak relations with fringes. -The federal system faces the problem of low financing and weak connection system. -The decentralisation system is not settled yet with confliction in authorities and budget distribution. -*Khartoum* growth complicates its managing system that demands more integrated: planning, service delivery and urban decisions. -Political conflicts complicate city governing.
	Institutionalisation	-Institutionalisation faces limited financial resources and investments, not enough qualified experiences or highly skilled labours, and weakness in employing technologies to implement urban development plans. - Administration faces: weakness of applying policies, constitutions and regulations; corruption and fluctuation of policies; weakness in organisational structures; lack of adequate basic data; and lack of research, training and capacity building.
	Monitoring and evaluation mechanisms	- Urban planning practice in *Khartoum* is carried out through piece meal approach with limited integration relations. -The influence of the structural plans to guide and manage city development is very weak. -There is absent of a unified law and regulations for physical planning and lands using. -There are limited efforts to deal with current urban development issues or to follow up with the current matters.
	Partnerships	-There is limitation in private firms' role in urban development especially toward poor classes. -Absence of efficient role of local voluntary organisations and non-governmental organisations. - The country internal relations face poverty, low human development and deficiencies of transportation and infrastructures. -In the rural sector, there is a need to adopt policies to alleviate poverty and to increase agro-based industrial production. - Foreign relations in *Sudan* face problems of troubles with many of its neighbours and the international community. -*Khartoum* collaboration and agreements with some international cities and capitals are ineffective. -To enhance participation in the global issues and programmes, there is a strong need for capacity building.

8.7 Production of Strategy Frame for *Khartoum* City Morphological Development:

According to the projection of the effects of population growth and economic activities in Khartoum (CMM), and the relations between urban development constraints and *Khartoum* (CMM) development aspects. The study proposes recommendations for *Khartoum* city Morphological Development. These recommendations emphasise: basic necessities, dynamic effectiveness, urban poverty, capitals, de\centralisation, institutionalisation, monitoring and evaluation mechanisms, and partnerships. They discusses procedures to increase city efficient performance and enhance city quality of living to develop a real time city. The study provides a methodology to arrange these recommendations conducting cost and time, into implementation priorities.

8.7.1 Recommendations for *Khartoum* city Morphological Development:

With relevance to the previous study, the following recommendations are produced to *Khartoum* city to confront development constraints, to solve the dynamic effects of population growth and economic activities, and to transform the city into a real time city morphological form.

8.7.1.1 Challenges and Opportunities:

(a) Basic necessities

(a.1) Suitable urban housing:

1. The government should establish a mechanism to insure that a suitable housing form is provided to the public, by adopting the following procedures:
   I. Providing the population basic necessities in the form of: suitable housing, basic services (sanitation- clean water- drainage- electricity-communication), community's services (Health- education- security), transportation, and employment opportunities. All these should be within accepted standards and suitable cost to welfare the Sudanese population;

II. Expanding housing supply options to satisfy accumulated demand for each segment of the society; using a house purchasing model acceptable for all the well-to-do people while supporting weak social categories;
III. Removing all obstacles that lead to low efficiency in land and real estate market;
IV. Developing a housing planning model, that solves the recent problems of defining spaces and areas, secures good environmental solution, community services while providing imaginative visions for the improvement of the lives of poor residences.
V. Creating and support techniques that increase city liveability in an affordable manner; and
VI. Encouraging research institutes and universities, which are also important actors, to have a significant role in shelter design and improvements, training staff and tackling researches aiming to improve the existing housing stock.

2. Housing planning must consider:

I. The overall density should increase to reach 70 persons per hectare; Growth in densities should be around 150 persons per hectare; and net residential densities should reach 300 persons per hectare,
II. Vacant lands inside urban patterns must be places for new urban development projects, in a planned system of infill growth;
III. The intensification of the city must consider services hierarchy and serving diameter and infrastructure provision;
IV. The increasing demand for urban land and its growing importance in the planning of cities, must involve appropriate assessment of the present and future requirements for land for the different forms of human activities under specified community goals and objectives;
V. There is a need for residential projects to deliver built houses, developed in corporation with the private sectors in affordable prices to the poor people, while guaranteeing profit for the investors;
VI. It is important that mixed classes neighbourhoods benefit from the level of services provided and the economic abilities of some residents;
VII. The rural fabric, which became a part from the urban fabric as a result of city expansion, must be developed to harmonize with the city pattern and ecology,

VIII. Surrounding villages must be linked, with a clear system of transportation, with the city main centre.

IX. There is a need for the manifestation and conservation of local identities and architectural heritage. It is also regards as a low cost method that guarantees a decent image for the city;

X. Re-structuring transportation and infrastructure patterns to fit efficiency with the urban pattern;

XI. The ratio of urban open squares, green areas and open streets in-between building masses; and

XII. Relocation of urban functions that are not accommodated with the neighbouring functions and environment.

3. To manage city growth (in migration), this needs:

I. Decreasing *Khartoum* urban primacy by supporting other cities;

II. Supporting evolution of new intermediate satellite cities to accommodate city growth; and

III. Sustainable rural development; boosting revenues of rural production; and preservation of rural natural resources.

4. In order to upgrade squatter settlements, slums[20], in migrants marginal zones, and unplanned housing[21]of poor in cities:

I. Plan and integrate these settlements in the urban fabric and create new affordable districts to accommodate their population;

II. Identify squatter settlements and slums urban centres and establish associated market places;

III. Rebalancing population density with social engineering for different economic activities in absorbing energies of the poor to provide work and strengthen the economic base of the city; and

IV. Expansion to public transport lines to connect all city districts and surrounding villages with other parts of the city by roads and public services networks.

[20]The Government, in 1996, established new cities to accomdete slum residents in:(*Alsalam, Albasheer, Gabal Aulia, Maio Almazarea)*

[21]Old and unplanned communities: (*Bait Almal, Aboriuf, Shambar, Bahri, Alsaraha, Aleshra, Alremaila, Algreef West, Abosead, Allamab Naser, Helat Kooko, Kuber, Aumbada, Alshegra, Halfaia, Old Omdurman)*

(a.2) Social services (security, health, education and recreation):

There are a needs for the followings:

1. Integrating the different uses of lands in city micro-morphology;
2. Increasing volume, and improving efficiency and access to public services centres;
3. Providing services at suitable cost for all categories of residents;
4. Strengthen the role of intergovernmental regional and national cooperation;
5. Restructuring the current system of distribution of the public services;
6. Increasing intergovernmental and cross boundary coordination;
7. Increasing private investments in basic services;
8. Integrating global and local action plans especially in human development field; and
9. Accoutrement emergency services suitable for different situations.
10. The role of *Khartoum,* the capital city, as a national node of services, and a symbol of the country, must be enhanced:
    I. This needs increasing public awareness, protecting public rights and raising the national spirit;
    II. Informing the concept of developed capital and real time city; and
    III. Insisting to entering each category of global technologies and facilities; in a development plan does not consist all just the categories of residences now but with eventuality in the future.

(a.3) Transportation and infrastructure:

(a.3.1) Urban transport:

There are a needs for the followings:

1. Increasing the coherence of all transportation networks: International, national, regional and even local;
2. Increasing the number and capacity of bridges for connecting the three cities of *Khartoum* metropolitan and integrate them in the city local networks.
3. More trip-to-work opportunities; and decreasing trip time;
4. Increasing the efficiency of land, rail, river and air transports.
5. Fixing transportation cost at a suitable rate for the week classes;

6. Providing incentives for transportation sustainable solutions and for energy and fuel environmentally friendly substitution;
7. Increasing parking areas in city centre to ease flow of traffic and decrease the negative effects of cars through maximizing green areas and planting more trees;
8. New design and planning standards for urban roads, rail, etc., to cope with city warming and drainage problems;
9. Integrating pollution and climate change considerations into the transport policy; and
10. Encourage investments in transportation scientific research and development plans.

(a.3.2) Water supply and water resources management:

There are a needs for the followings:

1. Water-management related to hazards management (flood) to avoid disasters and losing of water;
2. Development techniques of managing, storage, supplying, conservation and extracting of surface and groundwater,
3. Development techniques of water reuse; water recycling; and desalination;
4. Increasing the efficiency of use of domestic and industrial water;
5. Public education and public participation; and
6. Investment in water supply systems.

(a.3.3) Energy supplies and resource management:

There are a needs for the followings:

1. Sustainable urban energy solutions, procedures; and regulations. Services to be provided at a reasonable cost to for all residents.
2. Strengthening networks of electricity by using advanced technology to increase energy efficiency use and the safety of residence;
3. Planning and implementing gas supply networks;
4. Incorporating climate change considerations in design standards and codes; and
5. Providing financial incentives to encourage use of green energy and buildings, supporting use of renewable sources (solar energy, etc.).

(a.3.4) Drainage, sanitation, and waste networks:

There are a needs for the followings:

1. Re-designing and relocating buffer zones and flood barriers against Nile river rise, and opening natural streams channel;
2. Preparing design standards codes, regulations, land uses procedures, and insurances and public education, regarding risk of living in hazard prone areas.
3. Giving financial incentives for sustainable transportation and infrastructure;
4. Developing new drainage system to replace the recent obsolete sewer system;
5. Improving sanitation networks;
6. Encouraging infiltration and increasing depression and street detention storage; and
7. Supporting plans of transportation and infrastructure, with future visions as a basis for any new development.

(b) Dynamic Effectiveness\

(b.1) Sustainability:

1. Sustainability at the national scale must consider the habitation system of the country, and the socio-economic relationships between diverse settlements of the country;
2. Sustain quality of city performance by the following:
    I. The decisions making process must increase levels of rationality;
    II. Developing solutions for natural resource management issues, to ensure long-term preservation of land for human use;
    III. Creating varied in economic activities to sustaining economy (e.g. industry, agriculture, and services), and also variations in their sub categories (e.g. multi types of industries).
3. For sustainable quality of life:
    I. Securing , as trustees of the environment, the rights of succeeding generations;
    II. Assuring, for all citizens safety, health, productivity e and aesthetically and culturally pleasing surroundings;
    III. Preserving important historic, cultural and natural heritage;

IV. Enhancing the quality of renewable resources, and targeting the maximum attainable levels of recycling of depleting resources;

V. Maintaining the environment, to support diversity and variety of individual choices, and balancing between population and resource use; and

VI. Urban and pre-urban agriculture, act as environmental tools in enhancing the ecology of the city.

(b.2) Flexibility:

1. City must create development capabilities with long-life durability. These decisions cost more in the short run but cost much lesser in the long run;
2. Plans, decisions and development programmes must consider unexpected factors or the high rate of uncertainty:
   I. The long run plans must be versatile and adaptable to different situations; and
   II. Short run planning programmes deal better with global; political, security, and economic instability and also with environmental changes.
3. Need for: solutions for bad effects of land uses, including urban sprawl, soil erosion, floods, desertification, beside air pollution; and
4. For protection of the environment, *Khartoum* city must be compacted, with highly performing centres together with integration of land uses; and enhancing social cohesion, equity and self-containment.

8.7.1.2 Poverty and resources\

(a) Poverty\

(a.1) Alleviating the poverty of money:

1. The industrial development is a necessity to assist agriculture production in rural areas and help stop migration toward *Khartoum*;
2. Opening *Khartoum* city to wide scale international investments needs appropriate city planning, redistributive mechanisms and protective labour laws;
3. Establishing investments in transportation and infrastructure to strengthen urban industry, which helps in developing city economy and employment opportunities;

4. There is a need for supporting, conservation and integrating the economies of the poor into the formal economy of the city; providing them access to credit; and developing their capabilities and skills;
5. Improve urban and pre-urban agriculture, as sources of income and platforms for food industries; and
6. Fundamental changes in the economic organisation of the country to decrease the rate of expenditure in basic commodities and increase the welfare standard.

(a.2) Alleviating the poverty of access:

1. The government must enact laws and initiate programmes that recognise and build upon investments that help the poor and equip then to build their own housing and settlements;
2. The government must assist residents to organize into community-based organisations and facilitate them by providing technical assistance for urban development;
3. Urban planners need to be equipped with satisfactory skills and knowledge of theories, principles, laws and regulations that formulate the planning system; and
4. Traditional methods, techniques and solutions, which proved to be successful in the local environment, must be supported and developed by planning.

(a.3) Alleviating the poverty of power:

1. There is essential need to develop an interactive and transparent information system in the decision-making process, acting between public and government;
2. Initiate capacity-building programmes, among organisations of the low-income people themselves and among the civil society organisations; and
3. Urban planning must focus on the reality of how people live, especially the unprivileged classes. The priorities of the government must be investments in transportation and infrastructure for the poorest to bridge the urban income divide and slum improvement or reduction.

(b) Capitals\

(b.1) Finance:

1. Activating multi- supply financial options, such as cooperative projects, public ownership, public funding, mortgage of real estate stock, and involving the private sector and other partners in the urban community;
2. Encourage savings and create more open conditions for private capital associations;
3. Strengthen international cooperation programmes; emphasising on grass-roots projects that secure the needs of the poor and that are economically feasible;
4. Encourage investments from local and international firms; and activate the private sector role in development plans;
5. restricted and continuously improved the sources and system of finance;
6. Reduce taxes, customs and excise duties, on basic necessities.

(b.2) Labours:

1. Improve human development values, to solve problems of labour performance and utilization of resources;
2. capacity buildings programmes to increase skilled and qualified labours;
3. Increasing education and training opportunities to improves the process of preparing and implementing urban development projects; and
4. Need for comprehensive balanced national economic and social development planning to facilitate substantial job opportunities and conducive environments for work, to reduce inner migration.

(b.3) Technologies:

1. High technologies increase productivity and quality. City must develop strategy for technological transition in manufacturing, possessing, information, training and adopting technologies, in all human life sides;
2. Country must support information technology which is essential in the real time digital community, to avoid solitude;
3. Strengthen and develop methods of selection and purchasing of technologies;

4. Create an affordable market to match public investment and regulations, with private and community investment. It is necessary to develop the local products and minimise depending on imported ones; and
5. The community transition procedures toward intelligent city management, includes: raising managerial awareness of teleworking /telecommuting with detailed understanding of the policy, strategy, management and human resource implications associated with that; developing a national strategic plan for teleworking, linking semi functions and services categories with intelligent networks for transferring information and experiences which are easy to manage by the authorities and which provide roles and regulations together with arranging teleworking to re-engineer corporation, changing product focus and production strategies and demands of the workforce for flexible work options.

8.7.1.3 Institutionalisation and partnerships\

(a) Decentralisation:

1. *Khartoum* metropolitan and regional governance structures must address fundamental challenges, such as territorial isolation, fragmentation of technical and political interests, the different legal structures of municipalities and different levels of functionality of the fiscal and administrative systems;
2. Fragmentation of urban system parts decreases by intelligent communication network and efficient transportation system and coordinating mechanisms;
3. To overcome social problems; there is need to mobilise social capital and make collective action more efficient. There is necessity of democratic renewal;
4. Efficient: leadership, financing, evaluation mechanisms, and forms of citizen participation and institutional reforms addressing multi-level and inter jurisdictional challenges, all necessary to better govern metropolitan areas;
5. The government must strength two types of organisations: internal organisations of residents, building up voluntary associations and strengthening families; and external connections of residents and organisations to outside actors and institutions, whether public or private: business firms, foundations, legislators, non-profit organisations, service programmes, government agencies and homebuyers;

6. In public participation, the future role of tenants' organisations is equally applied to other 'bottom up' social movements. At the national level where major policy decisions are made, it is necessary for individual groups to broaden their perspective and seek to form coalitions with other single-issue interest groups, such as state-level trade unions, senior citizens' organisations poor people, the environmental and women's organisations;
7. *Khartoum,* in the information age, should ensure access and adequate qualification of the population to communication networks. The information technology improves public participation in the planning process;
8. Decentralisation must remedy the metropolitan and regional imbalance by systematically transferring functions and resources from central to local governments, thereby improving the provision of services, transportation and infrastructure, to increase competitiveness and promote local economic growth;
9. Competitive cooperation between municipalities contributes to more balanced development between rich and poor and between the urban agglomeration and the hinterland and improvement of quality of the environment;
10. *Khartoum,* as a national capital city, is in need for enhancement of its historical centre, and reserving its deep cultural and heritage roots. Beside that providing real time requirements and amenities to insure efficient performance of the central parts of the city; and
11. *Khartoum* as a global capital city is in need of building new main centre and sub centres in the requirements of the modern needs of the real time global cities.

(b) Institutionalisation:

1. Institutional coordination and collaboration between national, provincial and local authorities, is achieved by defining territories and responsibilities to: solve conflicts and put forward legislation, adopt social and economic policies, and allocate budgets through a continuous dialogue with regional and local authorities to support the city growth;
2. Local authorities must set up good local governance structures and legal restrictions for efficient urban management and city development and improving coordination with the other two levels of the government (national and regional levels);

3. The role of the government needs to change from a provider of public goods and services to an enabler, facilitator and regulator of markets, in harmony with the culture and economies of the poor, such as community-based savings and credit groups;
4. Government officials also need to learn from the situation on the ground rather than develop policies that are based on imported models, theories and standards from developed countries;
5. Documenting and disseminating innovations, networking sources of information, and promoting exchange of experiences and information, among governmental, non-governmental and community-based organisations as well as research and training institutions on various aspects of urban development, to encourage learning from each other;
6. Improving the capacity of area-wide governing institutions to work together in systems relevant to each specific place, to convoy highly political and ethnic fragmentation;
7. Planning must adopt approaches that consider the socio-cultural differentiation between communities, or within a certain community, to avoid misunderstanding, dissatisfying, or disadvantaging of a community, a branch, a group, or a minority;
8. Deficiency in the intergovernmental channels of relations are in need for intensive transportation and communication systems; and
9. Planning bodies must be linked to the global urban system via developed information technologies to follow new planning matters.

(c) Monitoring and evaluation mechanisms:

1. Setting up monitoring and evaluation mechanisms, by setting up benchmarks, to help increasing the potential for efficient policy formulation and implementation, for local authorities and private sector;
2. There is a need for metropolitan monitoring institutions to conduct land-use planning in pri-urban areas and urban hinterlands, transport development and related infrastructure planning at urban and regional levels;
3. Social justice and welfare; is a determinate factors in evaluating urban development, if the government produces accurate normative concept concerned

with who should get what where and how. It also is concerned with the equitable allocation of society's benefits and burdens for all community individual persons, classes, and minorities.

4. Social integration, Local history, culture and ecology are among the most significant considerations shaping urban planning today. While globalisation has made it easier than ever for planners to exchange ideas and practices from places around the World, they work within local confines;
5. The neighbourhood approach to urban management is essential for local governments to develop and enhanced their ability to perceive and understand problem recognition and problem response. The neighbourhood area approach has the twin aims of: bringing local government closer to the people and tuning actions to the needs of particular areas within a city;
6. To manage urban growth, governments set economic and industrial policies, and related strategies of investments, which are further propelled by local authorities and the private sector. These policies should be more efficient and capable of meeting these challenges, in particular the poor: infrastructure; public services transportation, qualitative and quantitative shortages in housing; and environmental degradation; and
7. Efficient metropolitan governance efforts, for a more harmonious urban development, capable of evaluating responses to the following fundamental aspects:
   I. Spatial disparities, ensuring that government policies promote convergence of leading and lagging regions and cities;
   II. Increase the environmental costs, that affect quality of the environment without impairing economic growth;
   III. Ensuring that governments adopt pro-poor growth policies, procedures and reforms by designing interventions that fit to the poor people situations and living behaviours in the economic sectors and districts where poor people earn their living and residence;
   IV. And ensuring that governments adopt policies to protect intangible assets, such as cultural heritage and create social spaces that contribute to "humanising" cities.

(d) Partnerships:

Factors that increase associations and partnership with the global community corporations are:

1. Increase democracy, right of the city and the participation of the local population in the decision-making process;
2. The inadequate popular local representation processes, is in need for high public participation in the low level of public grouping. This includes exhibitions, public meetings, publication of surveys and reports, media publicity, ideas competitions, referendums and public inquiries;
3. Approaches, with more potential for citizen involvement, include area management and advocacy planning attempting to move citizens' participation forward, from merely reacting to agency plans, to proposing their own concepts of appropriate goals and future actions;
4. Improve collaborative exchange and discussion of information between planners and the public;
5. Increase the role of local governments by developing their capabilities;
6. All forms of researching, planning and programmes of international agencies must collaborate in providing solutions and development programmes.
7. Rate the role of the private sector and investment in the big projects of the countries like communication, electricity, transportation, …etc.; to consultation, implementation or even share owning other investment projects in services or other sectors;
8. Strengthen the local private sector to compete locally with the private sector in the developed world, which has existence in the whole Globe;
9. The economic and social policies need to address cities and regions, including urban-rural interfaces. The regional urban- urban and rural-urban interactions result in harmonious regional development outcomes, manage urbanisation, avoid poverty and reduce poor communities' vulnerability to the socio-economic, environmental and political shocks and stresses;
10. Rural development, and action-oriented programmes, are may be retarded by the natural environment, human factors and resources, and other factors like: geographical, ecological, economic, technological, political, socio-cultural and

institutional factors. *Khartoum* as a centre of the region; its planners must be aware of rural settlements and utilise them positively;

11. Participation with the globe needs finding ways to reduce emissions and improve performance in domains of equity, prosperity and harmony. Added to that reduction of environment emissions at the city level, in order to establish commercially viable developments that deliver the highest quality of living and working environments with the lowest possible ecological footprint.
12. Increase the relation between cities inner and out the country to transport capitals, assistances and experience;
13. Activate the role of international nongovernmental organisations to support planning by regulations, services, infrastructure, capitals and technical experiences; and
14. Transforming *Khartoum* to be a city with capabilities of global involvement is a difficult process that needs capitals and efforts. The advances in telecommunications are used to enhance urban life in at least two ways: to attract inward investment; and to overcome the economic, social and cultural fragmentation of contemporary urban life, thereby reinvigorating the local economy within a globalising world.

8.7.2 Recommendations' priorities of implementation:

Each strategy is implemented in a shape of development projects identified by assists volume, purpose and place. These projects are scheduled by making a programme controlling time and cost of implementation. Limitations of capitals and the interruption of other planning functions, create a need for determine principles to define which development project is essential and what needs to come first. The study suggests the followings criteria to determine planning priorities:

8.7.2.1. As a (LEC), *Khartoum* priorities to enhance city efficiency that deals with urban development constraints, is arranged related to:

1. Needs of cities: the issues related to providing adequate jobs opportunities; healthy shelter for all; sustainable public services, transport and infrastructure systems.
2. Characteristics of urban zones: this is important in terms of two issues: first relevant to providing a suitable environment that increases economic productivity; generates

diversities in the sources of public treasure; and influences investments. Second, relevant to protecting natural resources by controlling pollution and waste.

3. Urban design considerations: development projects must take into consideration the objectives of the city urban design.
4. City accentuation: after covering residence essential needs, development efforts must focus on the issues related to enhancement of city rank and influence.

8.7.2.2. In general, for all cities, to attempt creating the real time city, the major guides' lines of urban development used to arrange implementation priorities are:

1. Sustainable urban development: projects are arranged with the purpose of identifying current risks, and future consequence.
2. Human welfare: projects are arranged in relevance to issues related to human: first physiological needs, then safety, love and belonging, esteem and last self-actualization. The necessity of any project measures by the number of advantaged people and the volume of risk in case of delay.
3. Efficient spatial distribution: projects are arranged in relevance to city operations, policies and planning implementation tactical issues.
4. Efficient economic performance: projects are arranged in relevance to resources limits, allocation, and maximisation of economic capacities.

8.7.2.3. As a (LEC), the policies and procedures that apply to solving urban development constraints facing *Khartoum* city are necessary to come first before the policies and procedures of the transition to a real time city. But these are overlapping in some issues that create a necessity to link the two strategies together. This is to avoid repetition of issues or a need of replacement, especially in the case of establishing new development, or importing a non-existing facility, by fulfilment of the requirements and conditions of the real time needs.

8.8 Conclusion:

To understand *Khartoum* (CMM), this study began first with determining the role of the current formal frames, such as: the urban governance, public, interest groups, private investors, and globalisation, in the transition of *Khartoum* (CMM). After that the study explained *Khartoum* micro and macro-morphologies. Then analysed *Khartoum* (CMM) by defining its: land uses, resources levelling, detailed zoning, transportation and infrastructure pattern, land values, micro-morphology, micro-spatial growth, macro-morphology, and macro-spatial growth. Last judging the diagram of *Khartoum* (CMM) by studying the roles of its nodes, gravity, domination, and agglomeration relations in shaping its morphology.

Second: determination of the morphological development challenges facing *Khartoum*, in relations to the effects of population growth and economic activities in *Khartoum* (CMM). And third: production of strategy frame for *Khartoum* city morphological development, by defining the relations between urban development constraints and *Khartoum* (CMM) efficiency aspects to propose recommendations for *Khartoum* city morphological development, based on: basic necessities, dynamic effectiveness, urban poverty, capitals, de\centralisation, institutionalisation, monitoring and evaluation mechanisms, and partnerships. That includes also arrangement techniques for priorities of implementation.

To explain ideas, the case study uses qualitative tools in shapes of descriptions, discussions and comparisons; and quantitative tools in shapes of tables, figures and maps.

Chapter (9):

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Introduction:

The focus of this research is on the effects happening in city morphology due to population growth and economic activities and the impact of such effects on city morphological performance. The research provides a strategy frame to maintain city efficiency, considering these effects, city development situations, and the characteristics of the real time city as a utopian case. *Khartoum* metropolitan city is used as a case study to demonstrate the study findings.

9.2 Summary of the Study:

Urban-based economic activities represent more than 50 per cent of (GDP) of all countries. Cities gain from an abundant/ skilled labour force which activates the economy at the urban scale, and population agglomeration increases the demand for consumer's and intermediate goods. Urbanisation does not only positively impact urban areas but rural areas too, a part from being a market for farm products, urban settlements absorb surplus farm labour coupled with the remittances sent to rural-based families. The problems behind urbanisation lie in the issues related to population concentration, congestion, limited capacities of cities and deterioration of the living environment.

The real time civilisation visions is characterised by globalisation and information technology. Only the metropolitan areas with morphologies are characterised by good physical environments, adapt global economic trends and provide transportation, infrastructure and services that support knowledge-based and technology-driven industries and remain geographic nodes of the worldwide business transactions. Unfortunately, not all cities have such abilities, some of them have limited economy with deficiencies and limited capitals and inefficient institutionalisation systems, which affect their morphology performance in the local and global contexts.

A city population growth and economic activities act as the main modifiers affecting city morphology by making continuous changes in its composition. To preserve a city efficiency, planning must focus on these city modifiers, the rearranging matters introduced by the real time civilisations, and city development situations.

Sudan is a Developing Country which faces physical, economic and institutional development constraints. The capital, *Khartoum* city, the driving force for its national economy where most urban economic activities are concentrated, faces high speed urbanisation which affects its morphological efficiency. That makes *Khartoum* an ideal case for this study.

9.3 Study Projections:

A according to the methodology applied in this research to deal with research hypotheses and variables, the projections of this study as presented as following:

1. Analysis for the followings: city morphology and its evaluation factors, city modifiers (population growth and economic activities) and the relationships between them and morphology development process.
2. Formulation of: a complexity science-based model of the city morphology-(CMM-City Morphological Model).
3. Diagramming of: the model of city morphology, real time city micro-morphology, real time city macro-morphology, micro and macro-morphologies model in the (LECs) and (LERs), and the effects of population growth and economic activities upon a city morphology.
4. Discussion of: the relationships between city modifiers, factors intervening (CMM), (CMM)’s efficiency measurements, real time city (CMM), and cities in limited economy (LEC’s CMM).
5. Deduction of: the effect of population growth and economic activities within (CMM), proposing a strategy frame to build a real time city and contain the effects of population growth and economic activities upon a city morphology, urban development constraints in (LERs), and propose a strategy frame to confront urban development constraints in (LECs).
6. Application of the findings in *Khartoum* city case study.

9.4 Researching Process:

The study process is shaped by the answering of the key questions of the study:

9.4.1.How Do Population Growth and Economic Activities Make Changes in City Morphology?

- A city morphology is the city landscape structure. The benefits of a good-morphological pattern of a city are: functional efficiency and proper form. Modulation of city morphology is a useful tool that evaluates and explains how a city morphology works and is changed. A complex, science-based, model acts as a method of data collection tool and analysis for the city diagram, this helps to evaluate changes/interventions made by population growth and economic activities, links city components with city transition process, helps in guiding city development policies and procedures, creates a method of transition from city macro-to micro-scales or vice-versa, includes actions and sub actions; and helps to project a city future needs and perspectives.
- Designing of a city morphological model (CMM) bases on the relation between four factors in a sequence: activities (human needs, their volumes and nature of doings), interactions (relations between different kinds of doings), networks (acts of those relations) and influences (expanse of those acts). The (CMM) result is a city plan by determining city system processes: city land uses with resources levelling determine city detailed zoning, transportation and infrastructure skeletons and the land values; and all of them determine city relations flows and external entities by defining its micro and macro morphologies. Those factors have different capacities related to development situations of a country.
- Urban growth is considered as a change in population densities or spatial scale of a city that witnesses increase or decrease over time. That, in two main ways as a result of micro-spatial growth (related to city urban areas) and macro-spatial growth (related to total urban areas of the region, country, and the Globe). Aspects of city micro and macro population growth, related to city morphology include: concentration of population and spatial scale, employment and productivity, the urban environment, living behaviours, the need for transportation and infrastructure and urban spatial growth controlling methods.

- The city economic system is directly reflected on its composition, it is important to put it under direct formal/government supervision. Scale wise, city economy is divided into two categories: micro-economics deals with the local economy and macro-economic deals with the economy at all regional, national and global levels. Aspects of city micro and macro-economies, related to city morphology include: land-use economics return, allocation of capitals, investments and resources, the environmental effects, economic returns by urban quality, need for transportation and infrastructure for certain economic activity, and activity necessities and city macro-morphology.
- City modifiers are linked to city development, there are relation between: population growth and economic activities; city development and population growth; and economic activities and city development. Aspects which relate city modifiers to micro and macro-levels of urban development in a national urban policy include: spatial policies, resource management, conservation of natural environment, urban quality, transportation and infrastructure pattern and micro/macro influences and growth.

9.4.2. What is the Effect of such Morphological Changes on a City Efficiency?

- The (CMM) acts as an abstract relation for the process of determining a city morphology. It is a tool to convoy the continuous changes intervening and inducing transition of human civilisation and circumstances of different cities. This also measure the effects of any new policies, decisions or matters in city morphology. Developing a model for a real time city in utopianism form, is a necessity to understand the ideal form of the current morphological transition process of cities, and that is considered as a high standard quality of cities to be achieved by planning.
- City efficiency is used as a tool to judge (CMM), it refers to aspects of performance of a city and its' possibilities to satisfy its citizen's needs and wants. Efficiency is measured in (CMM) related to: Process, city activities by city needs, Store, city interactions by characters of urban zones; Flow, City micro- influences/ internal

networks by city design considerations and city macro- influences/ external networks by city accentuation.

- The city today is described in relation to its activities: as mega in accordance to the number of dwellers, metropolis due to concentration of economic activities, compact or not for population densities; and public or capitalist for its economic system. The city is described in relation to its interactions: as a harmonious city related to the population social characteristics; sustainable city according to the relation to the ecology system; and intelligent if it follows high technologies. The city is described in relation to its micro-influences/ internal networks: as network city if it has developed transportation and infrastructure systems. The city is described in relation to its macro-influences: as capital or noncapital city; and global if it has developed contact and efficient position with the World. Diagramming the real time city in a shape of micro and macro-morphologies, depends on the network relations acting in the (CMM) as flow and external entity: nodes, domination, gravity and agglomeration.
- The main evaluation method employed in the (CMM) is related to the problems of cause-and-effect relationship in planning, concerning the differentiation of a city from the other cities. That includes investigations related to the city physical performance and rationality of development decisions. To add a realistic vision, this needs first studying: a global perspective in urban development, the global urban growth, and the global urban economy, and second explaining cities situations in (LERs). The investigation of the effects of city modifiers, i.e. population growth and economic activities, in the (CMM), by application of each one of them in the (CMM) individually. Making a diagram is a useful method to describe these effects in relation to spatial relations of city morphology.

9.4.3. What are the Factors that Contribute to, and Maintain, a City Efficiency?

- Urban development is strategic planning that involves setting goals, determining actions to achieve these goals and mobilising resources to execute the actions. (CMM) is shaped to describe how ends (goals) will be achieved by means (resources) in a definite process. It includes analysing the sources, patterns and

causes, of change and stability, in an attempt to develop foresight and to map possible urban morphological development. It identifies and describes alternatives procedures to solve problems that have happened or will happen. The major guides of urban development, which include city morphological development, are: sustainable urban development, human welfare, efficient spatial distribution, and efficient economic performance.

- Planning for urban development interventions is formulated at the macro-level (regional, national and global) in shapes of comprehensive policies, and is translated at micro (local) levels in shape of interventions such as orders, rules and regulations made to implement development. To orient urban planning to real time city concept, the study explains the real time transitional characteristics in city morphological judging factors: city land uses, resources levelling, detailed zoning, transportation and infrastructure skeletons, land values, the city micro-morphology, micro-spatial growth, the city macro-morphology and macro- spatial growth.
- The exercise of identifying alternative future interventions includes collecting quantitative and qualitative data about the possibility, probability and desirability of change. The (CMM) is a tool for analysing data, evaluating phenomena, to make decisions and strategy frame, and is capable of back feeding. In planning, re-planning or any development decisions, the (CMM) helps in providing the framework for directing planning interventions and providing a tool that helps formulating city policies. Current formal frames, urban governance, public powers, interest groups, private investors and globalisation; all are purposely decide changes in (CMM), each has: limits, rules and feedback on the city morphology planning.
- There are three factors that constraint development in (LERs) Limited Economy Regions: the physical capacity constraints: "Challenges and Opportunities", economic capacity constraints: "Poverty and Resources" and the political and institutional capacity constraints: "Institutionalisation and Partnerships". The proposed strategy frame for morphological development is designed, first to confront urban development constraints in the limited economy city, to improve (LEC) capabilities and solve spatial growth and poverty problems related to the

development constraints. And second, to convoy the characteristics of the real time city. This is globally generalised, to all cities, to achieve the utopian real time (CMM), whatever a city development situation is.

- The strategy frame for the transition to real time city is distributed by subject to: the first, focus on developing rational real time city management in urban planning devices at all levels and in all categories or sectors; and introducing comprehensive planning session curriculum in the development. And the second: is to influence development in the city operation processes to consider the problems generated by investigation analysis of the effects of city modifiers with real time city planning considerations. The policies and procedures are addressed by studying the challenges facing an ordinary city to be a real time city.

9.5 Research Conclusions:

The research findings, as detailed below, include: effects of population growth and economic activities upon city morphology, strategy towards the real time city, focusing on the effects of population growth and economic activities upon a city morphology, strategy to confront urban development constraints in (LERs), and in *Khartoum* city, the case study.

9.5.1 Effects of Population Growth and Economic Activities upon a City Morphology:

The study finds that the effects of population growth and economic activities upon the city morphology are:

9.5.1.1 Population growth effects upon a city morphology:

- **Activities:** the shapes of city land uses spatial growth are infill or expansion. Sprawl city growth is regarded as low density unplanned pattern, and shrinking city growth characterised by a decrease in the city volume and citizens. City growth affects city functional diagram as areas and spatial relations, also the capacity and structure of services, transportation, and infrastructure distribution. Over urbanisation implies that economic growth is unable to keep pace with urban population growth. Shrinking of cities is bad, in economic concerns, and is considered as waste of existing city capabilities because of under advantage. To achieve “Equity” in the

distribution of the gains of economic development, besides city growth, this means equal access for the public, between regions, cities and within each of them.

- **Interactions:** planned urban growth pattern is based on strategic decisions that add to city ecology. Still, more likely it is to live and work in the capital and central areas, but cities growth causes increase in rents, and public services cost. Urbanisation causes underinvestment in infrastructure, increases commuting trips; and creates a need for low-cost residences. Sprawl gives a probability of lowering land prices, but affects the value of exurban lands. Three levels of urban systems are identified: national, regional, and local, their growth needs to follow strong channels of interaction between their components.
- **Internal networks:** The compact city has environmental, economic and social benefits. Polycentric cities are the outcome of urbanisation. They reduce traffic congestion at the city-centre, reduce the travel time and decentralise economic activities, but also cause segregation between communities. 'Stages' of urban dynamic growth model are: urbanisation, sub-urbanisation, counter-urbanisation and re-urbanisation. The decline of cities causes: wasted housing units and industrial areas, deterioration of the inner-city and raising the cost of infrastructure.
- **External networks:** Different forms of urbanised regions: as mono-centric urban areas; multi-nodal functional urban units dominated by the largest city, and a core urban area and hinterland of population. Urban system cohesiveness depends on the existence of communication and transportation facilities. A considerable number of small and intermediate cities grew round primate cities, depending economically on them, as satellite cities, offering the amenities of urban life. Urban growth causes problems in cities influence related to city new volume. From the other side, the other urban and rural parts of the region which have economic and strategic importance are affected with the shrinking of their population.

9.5.1.2 Economic activities effects upon a city morphology:

- **Activities:** Cities economic activities affect their zoning, dominate the landscape of populated areas, and define economic districts, inner-city spatial relations, and the relations with surrounding settlements. Economy determines private property and ownership, taxes, profits, revenues, relation between the national income and the per-capita income, classifies businesses that participates in the economic sector and

divides the economy into functions related to markets or industries. Achieving economic profitability means more production with less capitals.

- **Interactions:** The economic system provides patterns of: distribution of economic and social capitals, land values and human behaviours. Cities must follow the changes in technology and communication systems which affect all human doings. The economic activities increase or decrease land values according to their effects. Increases in land values also encourage further development and increase rent prices and tax revenue from local government. Cities are key elements in the spatial organisation of regions and nations. The networks of services, production, transportation and infrastructure must consider their catchment areas; frequency choice according to class, income, and technological changes in the firms system.
- **Micro-influence/Internal networks:** The economic factors that affect city micro structure are relations between: spatial distribution of the economic firms, informal and formal firms, small and biggest firms, semi industries, needed capitals, services and production firms, industry and market, residence and job, infrastructure and public services needed, and the time and cost of transportation. Economic firms and industries collective together, create special land uses within city diagram. Economy growth needs availability of good quality, transportation and infrastructure. Liveability challenges facing cities, should be studied by economics to define their results in human behavioural and economic productivity efficiencies. The relations between firms and work-residence journey determine transportation lines which control urban growth. There are evidences of new patterns of return migration from urban to rural areas as a result of high costs of urban living, unemployment and development in communication technology. Shrinking cities are experiencing a decline in their economic and social bases.
- **Macro-influence/External networks:** Settlements exist because certain economic activities need to be clustered together rather than dispersed. There is an emergence of networks of cities and towns, the economic functions of which relate them to each other. Information industries and the growth of a global economy make new geography of centres and margins; global cities are command centres in a global economy and are sites for immense concentrations of economic power. Traditional geographical borders decline due to developments in transportation and

communications that create, distinctions such as between urban and rural, or centres and peripheries and change even boundaries between countries.

9.5.2 Strategy toward the Real Time City Focuses on the Effects of Population Growth and Economic Activities upon a City Morphology:

9.5.2.1 The policies and procedures related to city needs:

- **Policies toward the utopian form of the real time city:** Public services and the human security are state social responsibilities. The political ideology of the ruling party must not influence identification of needs for public-services. Planning efforts should address issues of poverty, social exclusion, and solve the economic difficulties to support the welfare state concept. The private resources in the cities must be activated. The city government has to assist community organisations and adopt ecological approach to deal with land uses plans. The urban surrounding wild life, farmland, and environment, must be reserved in all development aspects. Planning for urban development has to include scenarios for possible disasters.
- **Procedures of interventions toward the utopian form of the real time city**: The provision of urban amenities must consider empowering municipalities, promoting local economic growth, reinforcing metropolitan governance in the long-term, improving the provision of transportation and infrastructure, connecting regional settling system by provision of basic needs and infrastructure, and supporting global association. Using satellite cities, as a solution in case of cities inability to changes. Making compact live-able urban neighbourhood to keep city efficiency. Increasing participation abilities of urban public to influence decision-making. Preparing predetermined economic methods to decrease disasters expense and damages.

9.5.2.2 The policies and procedures related to characters of urban zones:

- **Policies toward the utopian form of the real time city**: Cities should adopt solutions to avoid and solve the results of daily urban life in natural resources and the environment risks, and introduce modern intelligent methods to manage and improve the city liveability. Providing all citizens suitable and adequate access to transportation, infrastructure and public services. Creating an urban environment that attracts global and local investments. Cities must provide efficient public

transport system that addresses all income levels. Cities must adopt partial smart management systems for each district alone and another integrated management system for all the city.

- **Procedures of interventions toward the utopian form of the real time city**: Assuring, for all citizens, safe, hygienic, healthy, productive and aesthetically and culturally pleasing surroundings. Providing solutions to conserving the natural resources, and using systems of resource-use reduction. Conducting industries with regulations. Using new technological practice to manage, organise and serve the increased urban areas and scale of population. Planning to everyone in both comprehensive and sophisticated ways. Creating an efficient transport system and efficient services and infrastructure system linked with the global, regional and local one. Providing differ degrees of design control ranging from maximum control in the main city centre diffusing to the other sub-centres, and taking the triple relations between work, residence and public services as the main guide in city diagram.

9.5.2.3 The policies and procedures related to city design considerations:

- **Policies toward the utopian form of the real time city**: Equal information technology access for all population and advances in telecommunications to control economic, social and cultural fragmentation. Planning new satellite towns and compacting city to accommodate city micro growth. The economical capacities of the cities must guide controlling efforts for population movement. Governments have to support investments in housing, infrastructure, public services, and conservation of urban quality. Governments have to provide continuous enhancement efforts for city liveability. The economic bases of competitive metropolitan areas must be designed to serve in the global scale. Importance of making diversity of activities that generates economic growth in close proximity.
- **Procedures of interventions toward the utopian form of the real time:** Putting priorities to increase efficiency of all city networks. Using polycentric distribution of public services and supporting efficiency of land uses distribution. Mixing of uses and activities is essential to all city districts economic and social well-being. Creating a human sense of place. Equalising public services access and ensuring closer proximities between where all people are. Creating image ability and vitality to enhance of the visual, aesthetic city experience. Influencing the ecological

principles. Adopting socio-spatial physical structure of cities, that results from multiple webs of relations. The virtual electronic public spaces, should be considered as a part of the social networks.

9.5.2.4 The policies and procedures related to city accentuation:

- **Policies toward the utopian form of the real time city**: National and regional authorities must support capitals with high degrees of communication and transportation to increase their centrality. The national and regional urban composition must be supported by growth of 'corridor cities' linked by movement of information and capitals. The national federal system of states governing authorities must be fixable to restructures by global economies. Reshaping metropolitan areas to remain as competitive locations in the global economy. Creating sustainable regional rural/urban economic development, as a rational solution to inner migration problems.
- **Procedures of interventions toward the utopian form of the real time city**: Reinforcing the centrality of cities with communications and transportation networks in their regional context. Connectivity and development of infrastructure within and between main urban centres. Adding separate link (sub centre) to connect global cities with the national governing system. Developing the technologies and skills that people need to participate in the global economy. Increasing international trade and investment. Increasing demand for high-quality goods and services. Enhancing production and trade between rural and urban areas. Promoting scattered urbanisation through resettlement policies. Promotion of small and medium-sized towns to attract migrants, as new spatial growth poles.

9.5.3 Strategy to Confront Urban Development Constraints in (LERs):

The negative effects of development constraints in the (LECs) (challenges and opportunities, poverty and resources and institutionalisation and partnerships) are distributed to first, horizontal effects related to city development quantity. These include: existing of unbalanced polarisation which causes inefficient spatial distribution and inefficient economic performance, increasing the expectations from and expenses of the government and partnerships relation in the development, leading to inefficient

urban development programmes, and waste of resources. Second, vertical effects related to city development quality, which include: existing of poor quality of life, and decreasing in available capabilities of urban areas. All the constraints are linked together and poverty is the main reflection of them in (LERs).

For (LECs) the relationship between urban development constraints and city morphology efficiency aspects, store by affecting the ability of city in providing: sustainable good quality living environment, high performance, cover for different requirements, abundance of national treasury, resistance for urban poverty, human welfare, efficient physical planning mechanism, and rational planning decisions.

The national urban systems in the limited economy cities (LECs), is unconnected due to the absence of middle tier cities. (LECs), suffer from: shortage in provision of public needs, variation in population income levels, and the majority of population are poor. In (LECs), high rate of growth of urban areas is a direct result of the country's poverty and limitation in the productivity of major economic activities. This decreases, day by day, the quality of urban capabilities. The efficiency of a government intervention system is weak with delay in all plans, high uncertainty and without flexibility for fixing. Limited experience and qualifications of staff, and adopting unsuitable solutions complicates the previous problems.

The strategy made to deal with urban development constraints in this study, is distributed to three concerns related to development constrains, in shape of policies and procedures in table (7-2). These include:

9.5.3.1 The policies and procedures related to (LEC)'s challenges and opportunities, include: Priority to housing sector in city development emphasis: approaches and methods of housing provision, supporting demand and supply in housing, upgrading poor housing, and controlling city growth (in migration). Covering the basic social services with welfare consideration. Efficient and secure transportation networks. Covering the infrastructure needs with sustainability consideration including: water supply and resources management, energy supplies and resources managements, drainage, sanitation and wastes disposal networks. Sustainable development and flexible plans.

9.5.3.2 The policies and procedures related to (LEC)'s poverty and resources, include: Alleviating urban poverty including: alleviating the poverty of money, alleviating the poverty of access, and alleviating the poverty of power. Increasing financing sources and efficiency of using them. Increasing labours qualifications, situations and employment rate. Increasing technologies, useful adaptations and decreasing using cost.

9.5.3.3 The policies and procedures related to (LEC)'s institutionalisation and partnerships, include: Developing very simple and flexible hierarchy of transforming authority. Deal with uncertainty situations and economise in labour, materials and equipment by: Institutional change, human resources development in the government or public sector, and making actions at the regional level. Protecting resources and insuring increasing in productivity. Efficient and beneficial partnerships relations.

9.5.4 *Khartoum* City Case Study:

Sudan is a (LER) country that faces many problems, among them: unsettled political conditions causing civil wars and local conflicts; internally displaced people; a large number of local and foreign refugees; low human development index; high poverty rate; high rate of inequality; low employment rate; huge internal and external deficits; mounting debts; high inflation rate; low (GDP) growth; lack of basic infrastructure; weak investments; unused natural resources; weak industries; and very limited association in the global relations.

The metropolitan *Khartoum*, is the capital and the largest city in *Sudan*, centre of its national urban system, one of its states, the prime city and the major area of polarisation with 40% of total rate of urbanisation. *Khartoum* state has the largest economy in *Sudan,* it depends basically on: being the main transportation gate and node, providing the main and top hierarchical public services and being an international exporting and importing point with 60% from Sudanese total industries. Its service sector includes 48% from the economically active population, most of them are governmental employees.

The effects of population growth and economic activities within *Khartoum* (CMM) determined in this study are: First: related to city governing: problem in city management system related to the volume of city needs and the inequity in services

provision in the city districts; the political and economic situations limit the integration in the micro and macro urban scales. Second: related to city morphology: *Khartoum* land uses are not clearly separated in functions, and there are limited unity, accessibility and proximity in the city structure and form; the concentration of services in different levels exerts pressure on the city structure, and that increases continuously by its expansion growth; lands in *Khartoum* city need improvement in infrastructure and public services to attract investments; the city has no visible identity, and its local environment does not treat to support human needs; sprawl affects city natural contact with environment; city faces pollution especially in the city centres and commercial areas; the information technology does not reach the limit of being a part of the city interaction systems; unplanned settlements are scattered all over the city, not only in the margins but also in the middle of the city; the urban system in *Sudan* which centralizes by *Khartoum* and faces the problem of fragmentation and weak inter relations between its components.

The effects of urban development constraints on *Khartoum* (CMM) development include: weakness in covering the basic necessities of residences, because of failure of previous development plans added to exacerbation by high population growth rates and national economic problems; the low densities and sprawl expansion of the city create difficulties in supplying infrastructure and services and affect the efficiency of the current logistic networks. The dynamic effectiveness of city development faces failure in addressing sustainability considerations; also city plans with high uncertainty rates and sometimes they are a failure. According to the problem of urban poverty, there are increases in the costs of the land, building materials, supplies and taxes, in relation to the income of individuals; that creates Increase in the zones of indecent housing through the city and malformation of the city. The capitals city capabilities in activating the development are limited, city has low human development values and per-capita income, weak performance of labour and using of resources. In the national institutionalization perspective there is highly centralisation of government in *Khartoum* with weak relations to fringes, low rate of public expenditures and weak connectivity. Making successful partnerships for development hindered by obstacles such as: low capabilities of private sector and local communities, low supports to attract investments, and weak global relationships.

According to the projection of the effects of population growth and economic activities in *Khartoum* (CMM), and the relations between urban development constraints and *Khartoum* (CMM) development aspects. The study proposes recommendations for *Khartoum* city Morphological Development. They discusses procedures to transform the city towards being real time city (See Ps: (202-215)). The study provides a methodology to arrange these recommendations, in accordance to cost and time, into implementation priorities that are relevance to the guides of urban development and the enhancement of city efficiency (See Ps: 216-217).

9.6 Research Recommendations:

The study induces the following recommendations for city morphological development guided by the effects of population growth and economic activities:

- Cities have to support dynamic development processes to their morphologies to achieve and maintain efficient performance. To establish a 'good morphology city' needs checking the state of its nodes, domination, gravity, and agglomeration relations.
- To start any development efforts needs a system of data collecting and analysis to evaluate recent situations, find causes and effects of related phenomena, and investigate future consequences. Data related to city morphology includes: city land uses, resources levelling, detailed zoning, transportation and infrastructure skeletons, land values, the city micro-morphology, micro-spatial growth, the city macro-morphology and macro- spatial growth.
- Containing the effects of population growth and economic activities upon the city morphology requires dealing with: concentration of population and spatial scale relative to land-use economics return; employment and productivity relative to allocation of capitals, investments and resources; the urban environment relative to the environmental effects; living behaviours relative to economic returns by urban quality; the need for transportation and infrastructure relative to this need for certain economic activity; and urban spatial growth controlling methods relative to activity necessities and city macro-morphology.
- The city morphological planning has to include policies and regulations related to: spatial policies, resource management, conservation of natural environment, urban

quality, transportation and infrastructure pattern, micro influences and growth, and macro influences and growth.

- Planning for morphology development should essentially be long-term planning, linked to the central comprehensive planning activity of nations that facilitates intervention in all micro and macro levels of planning.
- Enacting rational morphological development needs linking it as a procedure, spatially in the physical environment, with other city activities and networks, and as a decision with the visions of other city morphology intervening powers.
- Transforming a city to be a real time city needs consideration of its: number of dwellers, concentration of economic activities, densification of population; economic system, population social characteristics, relation to natural ecology system; adopted technologies, internal networks of transportation, infrastructure and public services provision, and external centrality. The strategy frame for city morphological development towards real time city, needs to be distributed by subject into: developing rational city management and operations.
- The development situation of a country reflects on its cities morphological development planning as planning constraints. To deal with the negative effects of those constraints in the limited economy city (LEC), human poor quality of life must be dealt with, together with:, the decrease in available capabilities, unbalanced polarisation and inefficient spatial distribution of population, inefficient economic performance, increase in the role of the government and partnerships relations in the development, inefficient urban development programmes, and waste of resources.
- The strategy frame for morphological development in limited economy city (LECs) related to population growth and economic activities, must focus first on solving problems related to urban development constraints. It's necessary to link between the two strategies (urban development constraints, and real time city) to control resources and time limits. That also helps in making a tactical scenarios for plans' implementation easy to adopt and implement and also fixable for the uncontrolled situations and future risks.

9.7 Proposals for Further Research:

This research is multilateral in information; the researcher focuses on discussing and solving the effects of the population growth and economic activities upon city morphology. But this research is opening other up other issues fir discussion. The researcher suggests the following topics for further investigations:

1. Computerised quantitative model to study city growth related to city sustainability vision;
2. Proposal for more efficient spatial allocation of economic activities within the city diagram; and
3. Developing an efficient perspective for city networks related to the recent characteristics of the micro and macro influences and defining territorialisation composition of cities.

Table (9-1): The study classification for the quantitative data used to support analysis in the case study. (Researcher/ Alia- 2018)			
Data per purpose		**Micro scale (city, district)**	**Macro scale (the world, country, state)**
Data related to physical capacity	Nominating:	- City: administration divisions, neighbours, land uses, and twin relationships.	- The world development regions. - Country and state: administration divisions, neighbours, imports-partners
	Calculating:	- City: total areas and spatial expansion per time, and areas of: administration divisions, surrounding villages and shanty towns, land uses and their change per time, and residential plots. - City length of: river coast, and main roads. - City covering percentage of: water network, drainage system, sewer system, and using pit latrines or basic systems. - City transportation infrastructure expansion per time. - City: precipitation per year and city temperatures routinely exceeded in mid-summer.	- Country, state, urban –rural and municipalities' areas. - Country length of: surrounding boundaries, gas pipelines, refined products, railways, roadways, paved and unpaved ways. - Country: numbers of total airports with paved runways, annual international registered: air carriers and passengers, flight traffic, and merchant marine cargo. - Country: inequity adjusted human development index, human security and percentages of international integration related to the World development regions. - Country: carbon dioxide emissions, and sustainable environment development related to the World development regions.
	Mapping:	- City: location, satellite cities and surrounding villages, natural features, and green cover. - City: historical transition stages and recent structure plans. - City: micro-morphology, and CBD- detailed zoning. - City: traffic, and network of public services. - City: micro growth, land uses changes, transportation network and spatial expansion per time.	- The World percentage of urban and location of urban agglomerations with at least 500,000 inhabitants. - Country: geographical location, environmental characteristics. - States: administration units, and hydrological map. - State: interpenetration between urban and rural fabrics. - City macro-morphology.
Data related to community characteristics	Nominating:	- City: ethnic groups and minorities	- Country: refugees and asylum seekers per origin countries.
	Calculating:	- City population: total, per municipality, urban- rural, female-male, annual growth rate, changes in population number and densities per time. - City: poverty rate and residences of unauthorized settlements.	- The World: total population, growth rates per time and urban-rural population by development groups. - The World proportion of cities and country states experiencing accelerated, rapid, moderate, slow and negative growth rates. - Country and states population: total, growth rates per time, urban-rural, female-male, in and out migration, and density. - Country: crude death and literacy rate, and number of ethnic groups.

			- Country: displaced people, refugees and asylum seekers per origin countries, and homeless people. - Country: inequality rate in health, education, and life expectancy. Country mobile cellular users.
	Mapping:	- City population: densification and changes in population densities per time - City economic and social harmony. - City poor population distribution in number and areas by the mode of living.	- The world percentage of urban and location of urban agglomerations. - Country- population concentration related to the world and the environment's characteristics. - State densification of population.
Data related to economic system	Nominating:	- City economic sectors.	- Country: economic sectors, imports-partners, international assistance and loans donors.
	Calculating:	- City total percentage of economically active population and employment per economic sectors. - City population: total poor, and urban poor distribution in number and areas by the mode of living. - City income's shares of services, industries, and agriculture. - City total markets number.	- Country: development situation related to the world countries, GDP, external debts, international assistance levels, and imports-partners per percentage. - Country: employment characteristics and economic sectors percentages with production growth rate. - Country: human development index, (GNI), poverty index, and governmental expenditure in basic commodities related to the world development groups. - Country: irrigated land and percentages of uses. - Country- sustainable economic development related to the world development regions. - States: regional revenue and expenditure. - State: governmental expenses by: municipalities, and purposes. - State: economic activities percentage share in country economy.
	Mapping:	- City economic land uses: services, industries, and agriculture. - City land values. - City poverty map	- State economic sectors: agricultural, industrial and services zones. - State urban-rural interface.

APPENDICES

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