Distribution of Densities within Metropolitan Cities:

The Case Of Greater Cairo Region

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Abstract

Population density is one key factor in describing how cities live, operate and develop. Its distribution and change over time can be one of the most revealing aspects of its attributes. This paper analyzes the distribution of densities in the main agglomeration of Cairo, which is somehow a specific case in the physical development and growth of a city. Cairo developed until the early 19th century around its original city boundaries, but starting from then it followed a clearly different approach by having piecemeal additions that are not necessarily adjacent to the existing agglomeration. This was followed by various flows of migration and attack.

The paper aims to attain a better understanding of the city development. It does so by reviewing different models of Distribution of Density in Cities. It then moves to further exploring the specific Factors affecting densities changes and population movement from the inner city in the Metropolitans. These two sections aim at drawing on previous experience and theories of population change in other contexts and cities.

The paper then presents the analysis of densities in Cairo, physically divided into 23 zones linked to the population database. It starts with a Descriptive analysis of the chronological change of zone density. Then it illustrates the Spatial Disruption of Densities on the years from 1976, 1986, 1996 and 2006 when the last consensus was conducted.

Then it presents the findings of the Cluster analysis of District densities which helped in drawing conclusions and understanding the common attributes of the different districts and the impact of the different factors on the density of each district. Finally the Cluster Analysis of Change in Density Rates is discussed which gives more insight on the impact of different factors on the development of population density of different districts over time.

The paper finally concludes with the main findings of the review and analysis giving insights on the factors affecting the population density in different parts of the city and its relation to various urban, social and economic attributes. It further recommends on specific areas of research that requires more exploration in order to understand the situation in Cairo more. Specific recommendations for Cairo future plans are also being proposed as a trial from this paper to contribute to the development of Cairo 2050 plans for the Greater Cairo Region.

Keywords: *population movement, density distribution, city development, Cairo.*

1. Introduction

Greater Cairo Region, Egypt (including governorates of Cairo, Giza, Qaliobeya, Helwan and 6 of October) is well known for its high-density form of development. The main urban agglomeration of the Cairo Metropolitan city is 521 km2, and its average density is 397 persons/Hectare (World Urban Forum 2010). The annual urban growth rate of the main GCR is 3.7%. Many development plans since 1982 has been proposed to build new communities and cities around the capital that was defined by a ring road. From such proposals a common idea of laminating growth of the capital and adding new urban corridors in the east and the west is dominating.

A strategic plan for Cairo 2050 is currently prepared. Many projects to improve economy and investments and to enhance transportation are proposed, in order to realize the new strategy that main concept is the Redistribution of population within the region Limiting further residential units in the Capital and opening new access roads, and providing new residential zones within the Region.

Accordingly, it is important to understand the way the Cairo metropolitan city operates and identify factors affecting the change in density from one place in the city to the other over time and with specific reference to its location within the city. The complex economic and social relations that gave rise to the emergence of large cities produce a physical outcome – the urban built-up space – which can be mapped and measured. This paper will help in reaching more realistic impacts of each actions/projects proposed to contribute in the new strategy of Cairo.

The recently developed technologies such as satellite imagery, digital mapping and geographical information systems make it possible to have a much better knowledge of the urban shape than was the case in the past. At the same time, monitoring and managing the spatial expansion is much more complex than what it used to be.

2. Distribution of Densities in Cities

Urban structure is the arrangement of land use in urban areas. Sociologists, economists, and geographers have developed several models, explaining where different types of people and businesses end to exist within the urban setting. Various theories focusing on the distribution of densities within cities are presented and discussed. The **Monocentric model** assumes that there is one mode of transportation and the cost per unit distance is constant. Smith [14] conclude that density gradients have flattened for a large number of countries over long time periods, and are higher in the CBD than on the city boundary as conclud by Rodwin, L. [15]

Moreover, the 1970s and 1980s have seen the formation of "**Edge Cities**" as described by Mills, Edwin S. [12] and clarified by Garreau [7]. These cities are to be understood as collections of employment and surrounding residential areas which are located in the suburbs-often distant suburbs-of large urban areas. The explanations of variations in the density gradient among metropolitan areas were not successful in determining the relative importance of the natural evolution and the "**flight from blight**" explanations of suburbanization.

Hoyt [11] in his model, published in 1939, attempts to state a broad principle of urban organization. He theorized that cities tend to grow in **wedge-shaped patterns** – or sectors – emanating from the central business district and centered on major transportation routes. Residential functions would grow in wedge-shaped patterns with a sector of low-income housing bordering manufacturing/industrial sectors (traffic, noise, and pollution makes these areas the least desirable) while sectors of middle- and high-income households were located furthest away from these functions. This occurred in Calgary in the 1930s when many near-slums were

established outside the city but close to the termini of the street car lines. These are now incorporated into the city boundary but are pockets of low cost housing in medium cost areas. Carter [6]

Following Hoyt development model, Harris and Ullman [10] introduced **the Polycentric Model** which is more effective generalization of urban land uses large cities do not grow around one CBD, but are formed by the progressive integration of a number of separate nuclei in the urban pattern. These nodes become specialized and differentiated in the growth process.

Trip pattern will therefore depend on the relative location of residences and meeting places within the metropolitan area. In a Monocentric city the location of the majority of these meeting places is heavily concentrated in a central area. In a polycentric city, the majority of the meeting places are distributed in clusters around the metropolitan areas. Therefore, polycentric cities have a negatively sloped density gradient, not necessarily centered on the CBD but on the geometric center of gravity of the urbanized area. The slope of the gradient should be flatter, as the proximity to the center of gravity confers an accessibility advantage that is not as large as in a Monocentric city. The existence of a flatter but negatively sloped density gradient in Polycentric cities can be observed in cities that are obviously polycentric.

"No city is ever 100% Monocentric, and it is seldom 100% Polycentric (i.e. with no discernable "downtown" Bertaud, Alain [4]

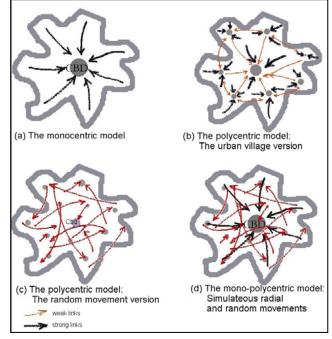Some cities are dominantly Monocentric, others dominantly Polycentric and many are in between. Some circumstances tend to accelerate the mutation toward poly-centricity – historical business center with low level of amenities, high private car ownership, cheap land, flat topography, grid street design –; others tend to retard it – historical center with high level of amenities, rail based public transport, radial primary road network, and difficult topography preventing communication between suburbs.

FIGURE 1 SHOWS MODELS OF CITIES STRUCTURE

3. Movements from Inner City towards Peripheries

The "**natural evolution theory**" happens while the land in the central city becomes filled in, development moves to open tracts of land in the suburbs on the peripheries. When the cost of moving goods and people within cities was high, and urban areas were dense. Then, small, high income groups located at the center moved to the periphery. The older, smaller housing units, which were centrally located, were left down to lower income groups. This natural working of the housing market leads to income stratified neighborhoods, and there is a tendency for low income groups to live in central locations and for affluent households to reside in outlying suburban areas. The tendency of the middle class to live in the suburbs has been reinforced by transportation innovations and travel time considerations. This theory is also ensured by the growth of urban sprawl as takled by Brueckner, J. and Hyun-A Kim [5]

In contrast, "**The flight from blight theory"** Isaac Bayoh [3] stresses fiscal and social problems of inner cities: high taxes, low quality public schools and other government services, racial tensions, crime, congestion and low environmental quality. These problems lead affluent central city residents to migrate to the suburbs, which leads to a further deterioration of the quality of life and the fiscal situation of central areas, which induces further outmigration.

The two theories have a number of interactions and interrelations, Peter Mieszkowski and Edwin S. Mills [13] and consequently, it is difficult to distinguish between them empirically. For example, the "flight from blight" theory implies that important externalities are involved between income groups: positive externalities from the affluent to the poor, and negative externalities running the other way. But the other theory based on income changes and is technology, consistent with the same externalities.'

The population movement within the city can be a result of the **Improvements in transportation and telecommunications.** The urban land use pattern thus tends to be far less coherent, more specialized and dispersed.

In addition, movements follow **Activities** that have spatial locations creating a land use pattern, which is influenced by the existing urban form and spatial structure. This form is strongly related to the types of activities that can roughly be divided in three major classes:

FIGURE 2: URBAN PATTERN FOLLOWING

- Routine Activities. This class of activities is occurring regularly and is thus predictable. They involve journey to work (residential to industrial / commercial / administrative) and shopping (residential to retailing).
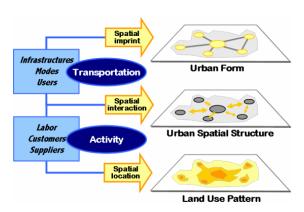- Institutional Activities. Most institutions are located at specific points and generally have links with individuals (Students, sports, leisure, etc.) or special needs (health).
- Production Activities. This involves a complex network of relationships between firms, such as control, distribution, warehousing and sub-contracting.

Some activities are strongly linked to the local urban area, while others are far more linked to the global economy as Rod Burgess [2]. The land use pattern of an activity may thus be linked to an external (international) process. These activity systems underline the importance of linkages between land uses, which require movements of people, freight and information.

4. Factor Affecting Densities Changes

4.1 Density versus Land Value

According to Bertaud [4] the Cities urban structures have been shaped by economic forces, they have been very seldom the result of design. As the raison of being large cities is the size of their labor and consumer markets

The land economics are concerned about how the price of urban land is fixed and how this price will influence the nature, pattern and distribution of land uses. ther is some basic relationships between the quantity of land and its price. This mechanism follows the standard market relationship between supply and demand, where an equilibrium price is reached.

Obviously, not every type of activities is willing to pay a price P1. Some may even need a price lower than P3. High land values impose a more intensive usage of space so the highest number of activities can benefit from a central location. The logic behind the construction of skyscrapers is therefore obvious and takes place at optimal locations of competition for land.

Value of Land use is determined by the rent-paying ability of different economic functions in urban areas, such as retailing, industry and residence. The optimal location, where accessibility is optimal, is the central business district. **Density and land value** are closely related. Bertaud [4] had concluded that the downtown area is not necessarily the most accessible location. The rapid extension of metropolitan areas involves new locations far from the CBD, notably in suburbia (E). This has favored the emergence of sub-centers (D) having a concentration of retailing, commercial, distribution and industrial activitie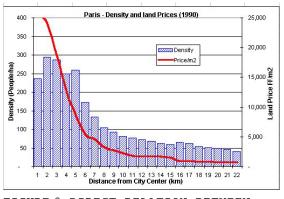s, mainly aimed at servicing a growing population. A significant share of the land, notably nearby central areas, is captured and not available on the real estate markets. Governments, institutions, parks, industries and transport infrastructures occupy a large part of most central areas and this ownership can last for several decades (if not several centuries for historical landmarks). This caused an imbalance in the price fixing mechanism in central areas with less land available (thus higher prices) that has favored urban sprawl.

FIGURE 3 DIRECT RELATION BETWEEN LAND VALUE AND DENSITIES CHANGES, PARIS METROPOLITAN CITY. BERTAUD [4]

Bertaud [4] presented graphically spatial distribution of the population by combining census data and land use maps to construct a 3 dimensional object where the map of the built-up area is in the XY plane and the population density within the built-up area is shown in the Z dimension.

As C. C. Acioly, Jr. and F. Davidson [1], the center of gravity will be the point to which the average distance per person is the shortest. He also identified on this 3 dimensional object special areas of the city like for instance its central business district (CBD and then calculate what is the average distance per person to the CBD and whether the CBD and center of gravity coincide.

Figure (3) shows the spatial distribution of the population of Paris metropolitan. The profile of densities is the key to understanding a city's structure and its livability and Cities where the land market works reasonably well have a common structure.

4.2 Densities vs. Land Use Regulations, Poverty & Metropolitan Structure

Bertaud [4] cited that Land-use regulations have 2 contradictory effects on densities and land price:

> "(1) direct effect is to decrease densities and land price: minimum lot size, maximum floor area ratio, minimum road width; all contribute to a decrease of densities and price. (2) But an indirect effect of regulations could increase densities: some regulations might decrease the supply of land, therefore pushing land price up and as a consequence densities."

He concluded that: (1) Land is always affordable to all income groups. Different income group will adjust their consumption of land (and therefore density). (2)Land use regulations always implies establishing maximum density thresholds in specific locations, these thresholds are typically lower than the one reached by an unregulated market.

Land use regulations, when not enforced, fragment land markets into two sectors: the formal and the informal market. According to UN-HABITAT 2009 [17] and UN-Habitat, 2010 [18] poor households pushed by regulations into the informal market loose the normal contractual guarantees given by the State to its citizens. As a consequence, they have to pay more for land and infrastructure for a lower level of service, and they do not have access to the formal financial markets.

4.3 Factors Affecting Densities Changes & Movements in Metropolitans

It can be concluded from the literature review done previously that main factor affecting densities and it distribution in the city are as shown in the following table:

Natural growth (While the land in the central city (first area to be built) becomes filled in, development moves to open tracts of land in the suburbs on the peripheries. Therefore it can be concluded from the above discussion that many factors are affecting population distribution and the densities changes in metropolitan cities from following the natural growth theory:

Social problem and income group displacement of inner cities ("the flight from blight" theories) cause the decline in densities of the inner city.

Land values (Moving towards the downtown the demand rises, land becomes scarcer and the price goes up but the rapid extension of metropolitan areas involves new locations far from the CBD that caused the movement towards the periphery, where more land is available, the prices drops.

Planning status and regulations, (some regulations might decrease the supply of land, therefore pushing land price up and as a consequence densities). By consequences can segregate market by formal and informal. Population densities in informal markets are higher and costs of dwelling are more affordable for low income groups than population densities in formal market where land have regulations for planning or building.

Transportation and activities distribution: a strong and direct relationship between densities changes and transportation improvement or activity location

The following table is summarizing main findings as derived from previous sections:

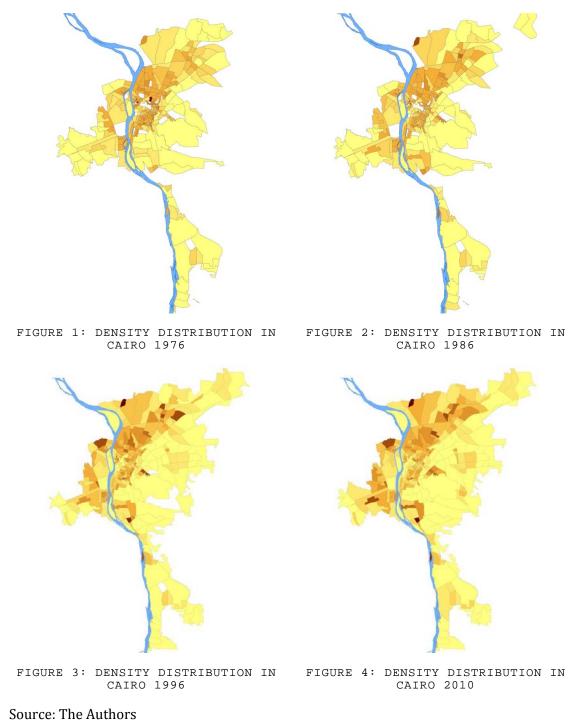| Factors affecting densities	Social stratum	Planning status	Land value	transportation	Activities
Effects	indirect	indirect	direct	direct	direct

TABLE 1 FACTORS AFFECTING DENSITIES IN CITIES

Source: The authors

5. Analysis of Densities in Greater Cairo Region (GCR)

5.1 Spatial Disruption of Densities:

According to the result of Urban Survey 2007 [16] for the main agglomeration of Greater Cairo Region (GCR) done in the favor of Cairo 2050 project and declared at GOPP publication 2009, the research traced the development of population density in all Shiakhas[1] of GCR (smallest administrative boundary which is a subdivision of the direct level) over the four census records available for the years 1976, 1986, 1996 and 2006. The last was used to project a predictive population density for 2010 using historical records, and this is shown in figures (4, 5, 6 and 7)

FIGURE 1: DENSITY DISTRIBUTION IN CAIRO 1976

FIGURE 2: DENSITY DISTRIBUTION IN CAIRO 1986

FIGURE 3: DENSITY DISTRIBUTION IN CAIRO 1996

FIGURE 4: DENSITY DISTRIBUTION IN CAIRO 2010

Source: The Authors

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[1] Shiakha is the smallest administrative boundary which is a subdivision of the direct level.

By describing densities changes from the year 1976 to 2010, two major movements can be identified as follows:

The first movement was between the periods of 1976 to 1986. It was the movement of the population from the CBD to the surrounding area. This phenomena, is explained by the natural growth in section 2 and applied in the Cairo case. Cairo city tended to grow in wedge-shaped patterns emanating from the central business district and centered on major transportation routes from the north to south and from the CBD to the west going to the pyramids of Giza. This phenomenon was limited by the existing of natural feature i.e. The MOKATAM hill in the east and the agricultural land in the west.

The second movement was happened within the last 20 years, where the downtown area is not necessarily to most accessible location. The rapid extension of Cairo metropolitan areas involves new locations far from the CBD. This has favored the emergence of sub-centers having a concentration of retailing and commercial activities, mainly aimed at servicing the growing informal settlements on the peripheries the natural growth as shown in the figures.

5.2 Descriptive Analysis of District Densities:

In this analysis and the following ones the research worked on a higher geographical level which is the homogenous zones developed within the Cairo 2050 plan as seen in the figure 13. This will help in avoiding possible bias due to the granularity of the Shiakha level which might also result from errors resulting from census surveys. Working at this level will also help to understand the situation of these homogenous zones better so as to support the efforts of Cairo 2050 and to benefit from the wealth of information developed within this study which is the most updated and comprehensive.
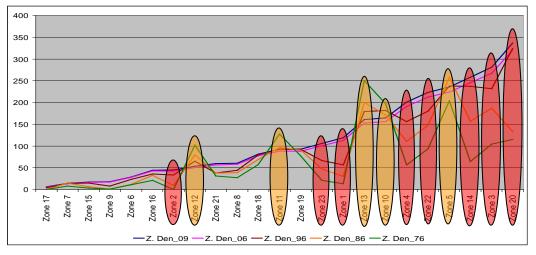

FIGURE 8: ANALYSIS OF POPULATION DENSITIES PER ZONES SET BY GOPP

Source: The Authors 2010

This was done by Sorting the population density of the 23 zones ascending according to 2009 densities and then checking the chronological change of each zone on the four time points of 1976, 1986, 1996 and 2006. This shows the following observations:

Highest population density rates exit in 20-Imbaba, 3-Ain Shams, 14-Dar El-Salam, and 5-El-Waily respectively. Despite the fact that they are all popular areas, only the latest is historically dense zone and the other three they gained most of their density within the twenty years 1976-1996. Other districts like 22-Haram, 4-Shobra El-Khaima, 1-Marg, and 23-Omrania are signifi-

cantly increasing their density, yet with tendency to continue increasing as the rate of increase does not change in 1996 but rather significantly increased between 1996 and 2006.

On the other hand very few zones which experienced decrease in population density especially if a continuous decrease is considered. Only three are worth mentioning and these are 13-Old Cairo, 12-Downtown and 11-Daher & Abbasia. These are the central districts of Cairo and which points clearly to the tendency of these districts to accommodate more business uses over their historic and existing residential uses. Finally it was noted that there are several zones with significantly low population density but this is due to the inclusion of wide areas of expansion opportunities and which are also planned but not fully developed and populated such as 15 May, West NC, Maadi, Eastern Expansion desert and Helwan.

5.3 Cluster Analysis of District Densities:

In this analysis the density of the 23 zones over the four time periods 1976-2006 and 2009 projection were analyzed using SPSS. The analysis relied on testing the hierarchical Cluster analysis using Average Linkage (Within Groups) method and the measure is the simple Euclidian Distance. The resulting clustering of the zones of Cairo shows some interesting outcomes.
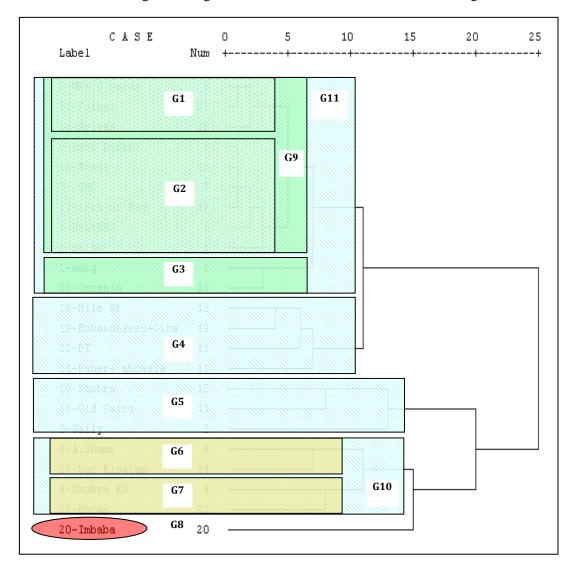

FIGURE 9: ANALYSIS THE DENSITY OF THE 23 ZONES OVER THE FOUR TIME PERIODS 1976-2006 AND 2010

Zone characteristics:

The four main characteristics of each zone which are initially assumed to have an impact on the development of zone density are: social class, land use, location, and planning history. *Social Class* is defined as the prevailing (over 50% of the full population) economic level of residents which is divided into (low; middle and High). *Land Use* is the prevailing (around 25% for non-residential) land use character and was found to be one of Six types [residential; formal business; tourism/historical; mixed use; industrial/residential; and informal business/residential]. *Location* could be one of three central, peripheral or intermediate. Finally the *Planning History* is a character which describes the initiative behind the establishment of each zone.

This was found to be one of four categories Historic (until 1867); Informal (following 1952); Modern (governmentally planned after 1867) and Transitional (1867-1952) and the latest are areas that were self developed between central and peripherally planned areas but following systematic planning rules and regulations. This is because Cairo did not follow a circular expansion but rather a distant patchy form of additions which resulted in massive undeveloped intermediate areas that were left to experience various forces of pressure and tension that shaped its .

Clustering Level			Z. #	Zone Name	Zone Characteristics			
3	2	1			Social stratum	Activities	Location from CBD	Planning Status
G11	G9	G1	8	Manshiet Nasser & Graveyards	Low	Inf. Bus./Res.	Intermediate	Informal
			21	Faisal	Middle	Inf. Bus./Res.	Peripheral	Transitional
			16	Helwan	Middle to low	Industrial /Residential	Peripheral	Early planned
		G2	6	Heliopolis & Eastern NC	Middle to high	Formal Business	Peripheral	Early planned
			9	Eastern Desert	Middle	Residential	Peripheral	Newly planned
			15	Maadi	High	Mixed use	Peripheral	Early planned
			17	15th of May	low	Residential	Peripheral	Newly planned
			7	Western NC	Low	Residential	Intermediate	Newly planned
			2	El-salam	Low	Industrial/ Residential	Peripheral	Informal
	G3		23	El-Omrania	Low	Residential	Peripheral	Informal
			1	El-marg	Low	Residential	Peripheral	Informal
G4			11	El-Daher & El-Abbasia	Middle	Formal Business	Central	Historic
			12	Downtown	Middle to high	Formal Business	Central	Historic
			18	Nile Water Front	High	Tourism/Historical	Central	Informal
			19	Mohandeseen & Giza	High	Formal Business	Central	Early planned
G5			10	Shobra	Middle to low	Mixed use	Central	Historic
			13	Old Cairo	Middle to low	Tourism/Historical	Central	Historic
			5	El-Waily	Low	Industrial/ Residential	Central	Transitional
G10	G6		14	Dar El-salam	Low	Residential	Intermediate	Informal
			3	Ain Shams	Middle to low	Residential	Intermediate	Transitional
	G7		4	Shobra El-Khaima	Low	Industrial/ Residential	Peripheral	Informal
			22	El-Haram	Middle	Industrial/ Residential	Peripheral	Transitional
G8			20	Imbaba	Low	Residential	Peripheral	Informal

TABLE 2 REPRESENT THE ANALYSIS OF ZONE CLUSTERS OF SIMILAR DENSITIES IN CAIRO METROPOLITAN VERSUS SOCIAL STRATUM, ACTIVITIES, LOCATION AND PLANNING STATUS

Transitional: unplanned but upgraded area that was initially informal
Historic: area planned before 50s
Early planned: area planned from 50s to 70s
Newly planned: area planned after 70s

The analysis above shows that the main attribute which leads to differentiation and development of the zone density is its location as it is quite significant that the groups and subgroups which resulted from the cluster analysis of the 23 zones and their density development since 1976 till current days. Social class on the other hand did not show any significant consistence with the group formation and division.

5.4 Cluster Analysis of Change in Density Rates:

In this analysis the study traces the possible clustering of Zones of Cairo based on the change in the rate of change in their population density. This takes the analysis a step further by investigating the attractiveness/repulsiveness levels of each zone. This clustering reveals even more four distinct groups of Cairo districts.

1) Central zones: these are the areas that have been experiencing a continuous decrease in their density. This decrease is the result of the migration of the residents of the central areas such as Downtown, Old Cairo, Daher & Abbasia for the favor of increase in business uses. Others are in this group for having reached a high level of saturation during the late seventies/early eighties when the first census was conducted on 1976. These districts are Shobra, Waily, Mohandeseen & Giza and finally the Nile front.

2) Saturated zones: these are informal areas that have started 30-40 years ago but currently have reached a high level of density that it cannot increase significantly any more. The areas in this group are Faisal, Imbaba and finally many informal areas such as Haggana which is located in Heliopolis & East Nasr City (early planned zone).
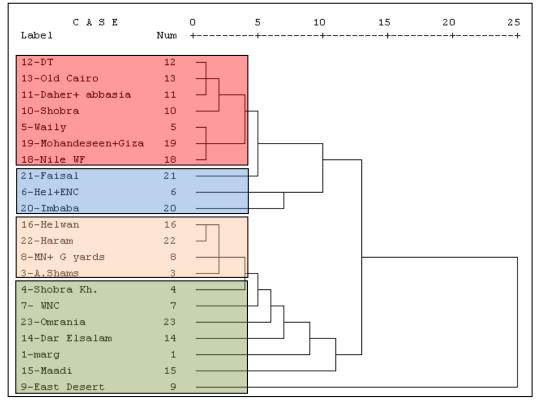

FIGURE 10: CLUSTERING OF ZONES OF CAIRO BASED ON THE CHANGE IN THE RATE OF CHANGE IN THEIR POPULATION DENSITY

Source: The authors

3) Inner zones: These are the transitional and the early planned areas which emerged on the edge of the city (at one point of time) but now are inner areas given the massive expansion of the city beyond their limits. These areas are still experiencing densification with additional floors or the complete replacement of short buildings with others which can reach the maximum height possible. These are Helwan, Haram, Manshiet Nasser and Ain Shams.

4) The peripheral zones: These are zones which include transitional and early planned areas that still not completely enclosed with mature expansion of the city. These areas are experiencing horizontal expansion on its surroundings. These are shobra Khaima, West Nasr City, Omrania, Dar Elsalam, Marg, Maadi and Eastern Desert areas.

5.5 City Sections:

A 3D model was built for all Shiakhas in Cairo and from this model various sections were developed. Among these sections the following three sections were found more representative and revealing for the forces shaping the density of different areas of the city based on their location within the city as well as other interpreting aspects.

- Section A-A runs South-East to North-West. It crosses the Nile passing through Zamalek Island.

- Section B-B Runs North South with an angle passing through Port Said Street which is the longest vertically running straight street in Cairo.

- Section C-C runs North-East to South-West. It crosses the Nile through Manial street and
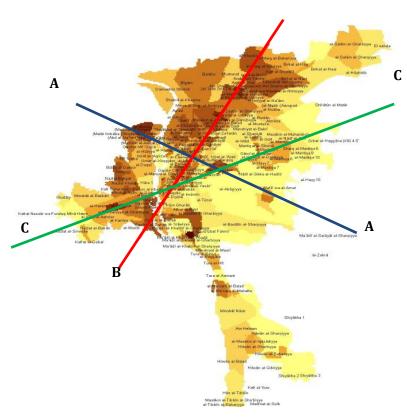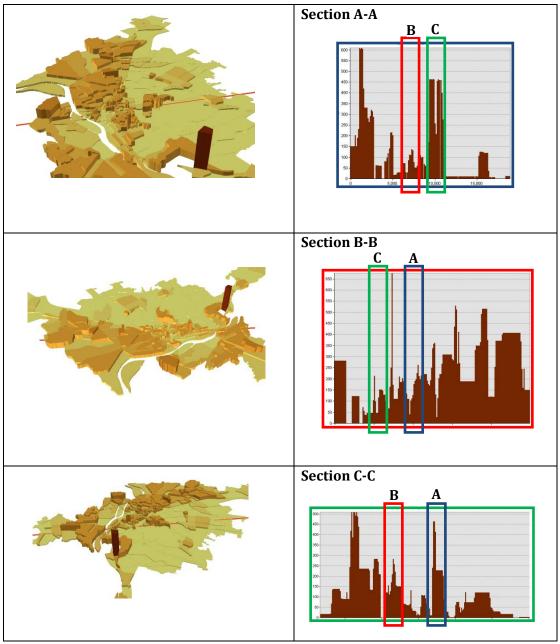

FIGURE 11: CITY SECTIONS SHOWING DITRIBUTION OF DENSITIES

goes further West through Haram Axis leading to the Pyramids.

FIGURE5 DISTRIBUTION OF DENSITIRES IN CAIRO SHOWN BY SECTIONS

6. CONCLUSION

The paper concludes through the analysis done and the understanding of the Cairo Metropolitan with the following:

Tracking the distribution of densities in Cairo Metropolitan Area over time reveals its dynamic change. Density decline changes reflect the death of the main CBD, but at the same time its significant increase in other peripheral areas point to the emergence of new sub centers at the edge of the agglomeration. This is a commonly acknowledged pattern in modern metropolitans. This in turn opens the chance to build analogies with future changes at both the inner city and the outer areas comparing to similar cases. This kind of city development was revealed in city sections AA and CC, and can be explained by the theories of **natural evolution theory.** There-

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fore, the CBD of Cairo is not only an old center of a metropolitan city; but also, it contains many historical, esthetic, and social aspects. So this natural phenomenon cannot be over looked without an action to control this decline, and also reuse such zone.

Informal zones which are initially zones without regulations were easily identified as they have reached a high level of density. The tendency of the population to concentrate in these areas can be justified by the lack of land use regulations, thus the low value of land, and the agglomeration of lower income groups to live there. This phenomenon is explained by the theory of Bertaud 2001, and can be applied in Cairo case study. However, lately this explanation that could be valid till the 90s, is no longer valid, till 2010.

The emergence of significant and overwhelming increase of the density of zones located in the north-south direction, as shown in section BB, is tracked and has shown their tendency to continue increasing as the rate of increase does not change in 1996 but rather significantly increased between 1996 till 2010. This movement cannot be explained by the natural evolution anymore (i.e. no emergence of new centers) but the linear shape of change can be justified by the construction of the underground Metro line that easily links the peripheries to the downtown with the same cost even if the distance is longer. This fact directs planner to rethink the location of new planned metro lines: to really realize the objective of easily link without causing new problems of densities and overconcentration.

When informal zones in the inner city reached their maximum capacity and became saturated, other peripheral zones experienced vertical and/or horizontal expansion on its surroundings and are forming new informal pockets. This shows that the process of informality in Cairo is a continuous process that is initially led by suitable physical location and urban context, but also goes beyond that to other less attractive and suitable locations. Controlling this process should deal with the routes and causes for the process and not its immediate and apparent symptoms shown at existing informal areas.

Although the state exerted many efforts to decrease densities by upgrading informal zones and/or by developing new planned areas especially in the east, , these efforts did not achieve their goals because:
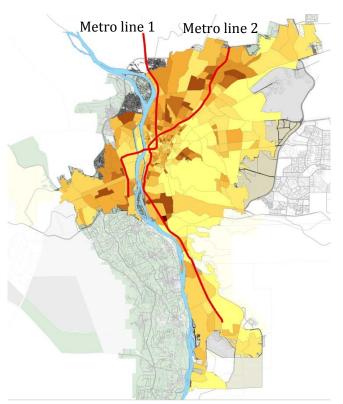

FIGURE6 : CAIRO EXISTING UNDERGROUD METRO LINES ONE AND TWO

1- The upgrading policy may encourage the successive formation of new informal zones.

2- The development policy of new lands especially in the east does not provide affordable housing for low income group.

Such observation and understanding may direct the decisions taken towards the future of Cairo metropolitan to redistribute population, accordingly to determine suitable actions needed for each zone not only physically, but also socially and economically.

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