

Urban System and Primate City in Oman

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Abstract

Urban system is the arrangement of interconnecting cities in a definite region, territory or state. Such arrangement, or spatial structure, depends on the rank that each city occupies within the urban spectrum. In developed societies, this system reflects the dynamism and the compactness of the national territory. As the country develops, as its urban system strengthens. But usually, in developing countries in particular, a single larger center (Primate City) develops and polarizes the territory creating an unbalanced spatial organization. This paper aims to analyze the Omani urban system, its evolution between 1970 and 2010 and the phenomenon of primate city. It's an attempt to concretize the spatial distribution of people and activities and to detect majors factors in the origin of unbalanced spatial shape. Hierarchical graphs and Rank-Size Rule are used to measure some primacy parameters at national and regional scales. The study shows that the Omani space is polarized by a single primate city and two regional metropolises. It appears that the disproportion between cities is augmenting despite a particular dynamism in the tail of the system. The spatial configuration evolution is determined by different phases of development strategy. Omani spatial scheme need further public intervention to enhance sustainability.

Keywords: Urban system, Hierarchy, Primate City, Urban growth, Spatial pattern.

Introduction

Online Oxford Dictionary defines a system as “ a set of things working together as parts of a mechanism or an interconnecting network; a complex whole”. It is also “ a set of principles or procedures according to which something is done; an organized scheme or method”

Thus, an urban system could be defined as the arrangement of interconnecting cities in a definite region, territory or state. Such arrangement depends on the rank that each city occupies within the urban spectrum. This creates a certain urban hierarchy in which different settlements are ranked respectively to their demographic size, urban functions and sphere of administrative or economic influence. Usually, cities of larger population are placed on the top of the urban hierarchy. In most cases, the rival between big settlements leads to the predominance of a single city (monocephalic or unipolar system with a primate city). But in some countries two cities or more contribute almost equally in structuring the space leading to the emergence of a bipolar system or a multipolar system. “*The context in which urbanization and urban growth modalities are made strongly marks the urban system in its configuration, its hierarchy and the spatial distribution of its elements*” (Belhadi, 2007, 2).

The articulation of cities to hierarchical space passes through the flows of people, goods, money and administrative commands. Thus, cities of more developed urban functions get the prominent places in the network hierarchy. This means that the nature of the urban system expresses the degree of development of a given territory and the dynamism of its major cities. As the country develops, as its urban system strengthens and cities compete. The regional development policy is, in the matter, of primordial effect.

In the sultanate of Oman, a Bedouin and rural settlement pattern and lifestyle prevailed until late 1960's. The proportion of rural was about 75 % of the total population and the other quarter of inhabitants was dispersed throughout a multitude of small towns. Because of their small size and geographical seclusion, none of these towns was able to attract people or to interact or polarize the space. The county did not the slightest spatial organization or centers' hierarchy with big similarity to John Friedmann's type of preindustrial spatial structure.

With the radical political change of the year 1970 and the increase of oil exports revenues, Oman has witnessed a flourishing economic development and a hasty urbanization movement. An intense construction activity has transformed the territory into a structured national space. All cities became linked by modern administrative, economic and infrastructures networks. However, in the first phase of development, public investments have been unequally distributed. Priority had been given to Muscat Capital Area (M.C.A) and, later, to the major coastal metropolises. This strategy marked the spatial configuration and led to the emergence of an urban primacy. The Omani space is henceforth dominated by a single urban agglomeration disproportionately large comparing to other major cities.

This paper aims to analyze the Omani urban system, its evolution between 1970 and 2010 and the phenomenon of primate city in an oil-producing Gulf country. It's an attempt to concretize the spatial distribution of people and the urbanization trend. Inhabitants mobility could, in this case, shed light on the forthcoming spatial changes.

Methodology

In the Sultanate of Oman the definition of urban area is a little vague. It's considered “City (urban area) the entire Governorate of Muscatxi, all Wilayat(s)centersxii and every named and permanent Human settlement of 2,500 or more inhabitants provided that it contains at least three of following basic services.: preparatory or secondary school, public electricity network, health center, telephone services. Any other Human settlement is

considered village” (Census Directorate, 2010, 159). This multi-criteria definition of urban area makes difficult or impossible to determine the number and sizes of urban settlements because of lack of adequate data in quantity and quality. The National Center for Statistics and Information (NCSI) used to estimate the urban population on the basis of the demographic criterion, which is the minimum number of 2,500 inhabitants, and the administrative status of center of Wilaya. However, many Wilayat(s) centers have less population than this demographic threshold. Insofar as the number of inhabitants in the Wilayat(s) centers represents approximately 60% of the total population and most cities of over than 2,500 inhabitants are center of Wilaya, this study adopts the administrative criterion: the basis of analysis will be the 61 Wilayat(s) centers in Oman. Insofar M.C.A is constituted of 5 compact Wilayat(s), it will be considered as one center. (See note infra)

The study uses official data of the three population censuses that took place in 1993, 2003 and 2010. There is no data for the period prior to 1993 except an estimation of the population in the whole country and in the emerging vague Capital area. Available statistics are used to draw an hierarchical urban graph for the three stages (1993, 2003, 2010) in purpose to analyze the evolution of the urban system (Figure 1). In this graph, cities are classified in order of decreasing size on the vertical axis and their rank on the horizontal axis. Parameters such as slope and trends are calculated for each period to demonstrate spatial configuration and cities rival. The slope, as used in Excel software, is the vertical distance divided by the horizontal distance between any two points on the regression line. It shows the relationship between cities basis on their sizes and ranks. A regular slope (r^2) equals (0.5) and appears on the graph as straight diagonal trend line. It means that the population of the second city is exactly half of the first's, the third's is half of the second's and so on. If more than (0.5), r^2 indicates the concentration of people in some cities, sign of special polarization and unequal growth rates (Table 1). Urban growth rates are calculated to explain the urbanization trend in the 61 Wilayat(s) during the period 1993-2010 (Figure 2).

To evaluate the extent of the primate city phenomenon, the study uses the Rank-Size rule in its various formulations. Rank-Size Rule has been developed by Mark Jefferson (1939) and slightly revised by George Zipf (1949). For Jefferson, the primate city is at least twice as large as the second largest city ($J \text{ index} = P1/P2$). Zipf added that the second city would have half as many as the first and the third city would contain the third of the first's population, and so on. To compare the first city to the three following cities the study employs Stewart's index ($S = P1/(P2+P3+P4)$). In the same trend, the primate city could be compared to many smaller cities to assess the extent of its primacy and its spatial polarizing power. The primacy degree is apprehended by calculating the proportion of the largest city out of the total urban population ($p1 = P1/\Sigma P$) in different periods and by comparing the real size and the theoretical size of the first city (primacy ratio $p2 = P1/b$ where $p2$ is the index, $P1$ is the real size and b the theoretical size) (Table 2). To compare between the national spatial configuration and the regional urban sub-systems, the same indexes are used to evaluate the primacy of regional metropolises (Table 3).

Results

1. Three spatial patterns

The curves in the diagram of urban hierarchy in the Sultanate of Oman for the years 1993, 2003 and 2010 (Figure 1) show a steep slope at the top, some regularity at the middle and manifest changes at bottom. Despite some exception in the diagram basis, the arrangement of almost all cities has not changed during the two last decades. The apparent ranking stability could not however hide differences subsequent to dissimilar population growth rates and size's category. The disproportion between cities is augmenting regularly as

indicated by the slope's degree which passes from 1.165 in 1993 to 1.199 in 2010. The slope that represents the rate of change between any two points along the curve, becomes sheerer indicating higher concentration in some cities rather in others and an accentuation of the spatial polarization.

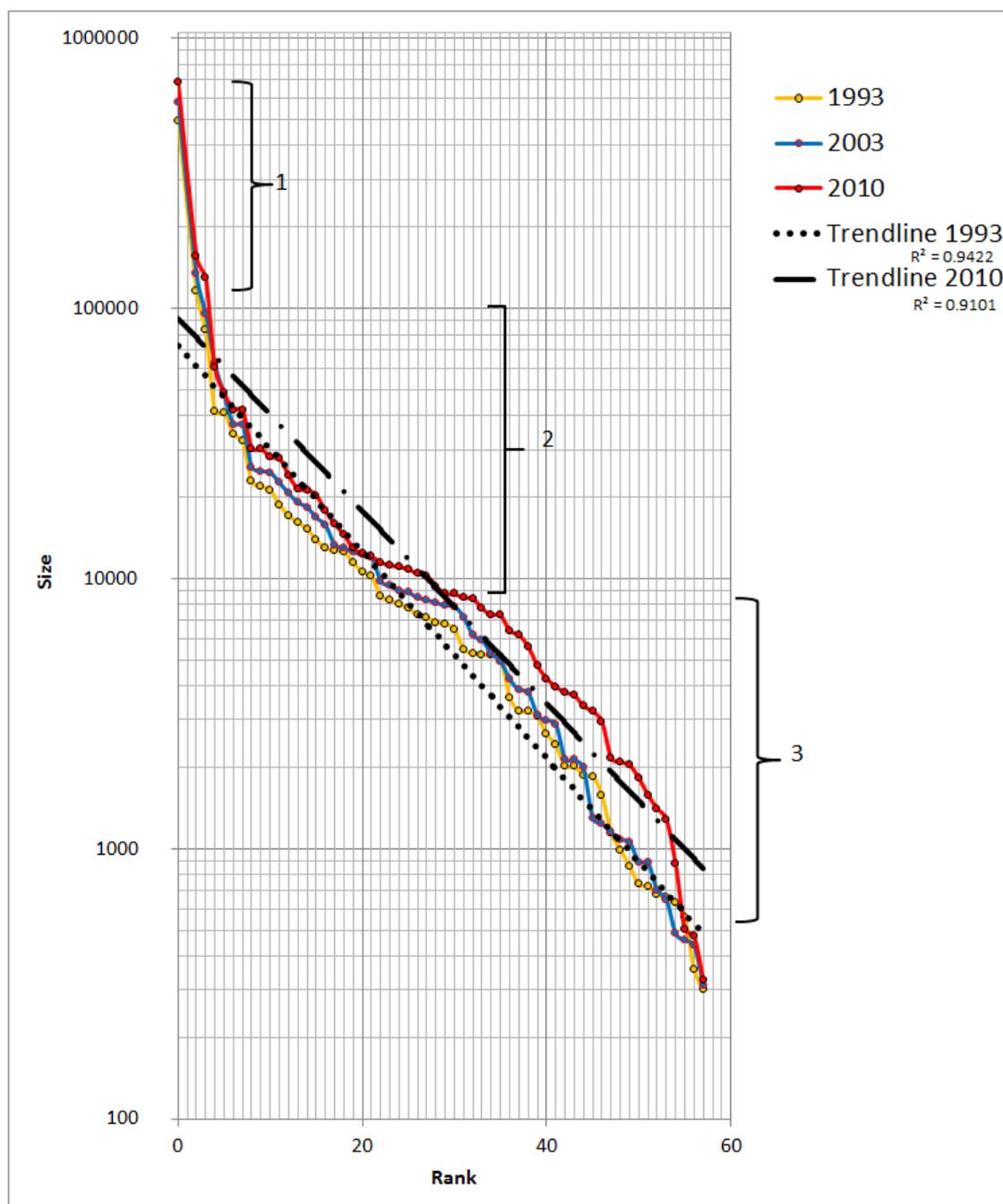


Figure 1. Evolution of urban hierarchy in the Sultanate of Oman, 1993 – 2010

Sources:

1. Ministry of Development, 1995, Localities, Housing Units. Households and Population in the Sultanate of Oman According to the Results of the General Census of Population, Housing and Establishments 1993.

2. Ministry of National Economy (MoNE), 2005, Population Settlements in the Sultanate, Results of 2003 Census, Muscat.

3. National Center for Statistics and Information (NCSI) 2012, 2010 Census Data by localities, Muscat.

Own calculation

Basis on the urban behavior of different cities along the period 1993- 2010, the diagram could be divided into three sections as enumerated on the graph. The first (1) appears as straight segment at the top. It concerns the primate city and the two following metropolises. The second is the concave section (2) of the curve relating to cities ranked from 4 to 29 or 30. The third (3) is the convex section corresponding to the other 24 Wilayat(s) centers. The last three cities that constitute an exception indicating a particular fact proper to peripheral new Wilayat(s) are ignored at this stage of analysis. These sections found three types of spatial relationships amongst the national urban structure.

Compared to trend lines of 1993 and 2010, curves of each type are of same tendency but of opposing directions. In the first and third types they are above the trend lines both in 1993 and 2010, however in the middle one they are beneath. The correlation between change in size and drift in ranking order is very height for the second and third types and much less in the first. The correlation is marked by uneven urban growth rates as shown in the following table.

Table 1. Some characteristics of Wilayat(s) urban centers in Oman.

		Type 1	Type 2	Type 3
Number of cities in 2010		3	27	24
Urban Size in thousand in 2010		100- 700	10 -100	< 10
Total population in 2010		976,204	547,476	112,019
Annual Urban Growth Rate 1993 - 2010 (%)		2	1.6	2.7
Rank-Size Correlation	1993	0.885	0.964	0.977
	2003	0.884	0.949	0.987
	2010	0.830	0.956	0.910

Sources:

1. Ministry of Development, 1995, Localities, Housing Units. Households and Population in the Sultanate of Oman According to the Results of the General Census of Population, Housing and Establishments 1993.

2. Ministry of National Economy (MoNE), 2005, Population Settlements in the Sultanate, Results of 2003 Census, Muscat.

3. NCSI, 2012, 2010 Census Data by localities, Muscat.

Own calculation

The structure of Omani urban system, as described above, involves at least three deductions:

- A clear system stability at the top of the hierarchy because of the large difference between the first city and the two following metropolises. The competition does not reduce the gap despite a high growth rate (2% per year)
- A manifest slow vertical mobility of medium cities (less than 100,000 inhabitants) crowding thus in the medium ranks. But the low rate of growth (1.6% per year) does not constitute a risk of competition from smaller agglomerations that stay far in size. The concave shape of curves means that medium cities occupy their relative ranks although less population growth.
- A noticeable dynamism at the level of small centers (less than 10,000 inhabitants) either in size or in ranking rival. The convex outline of the curve indicates a fast growing population and the interferences reveal a strong rival between these centers. Smallest cities are growing faster (Figure 2) and some have moved their rank up or down. The spatial reconfiguration is thus led not only by the top but also by the bottom of the system.

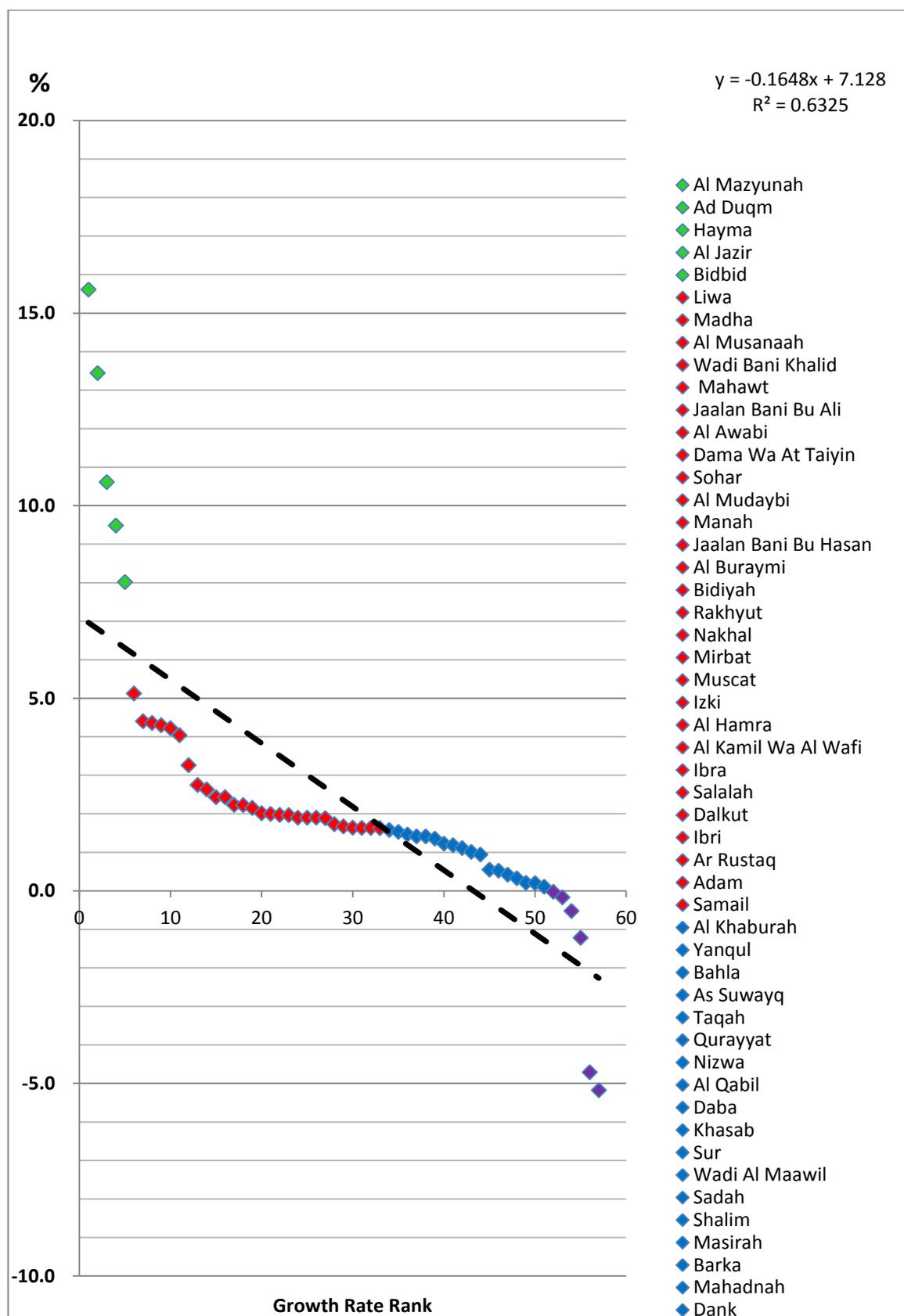


Figure 2. Patterns of annual growth rates. 1993- 2010

Source: NCSI, 2012, 2010 Census Data by localities, Muscat.

Own calculation

2. Polarized National space

The diagram shows that the Omani space is very polarized by the first city. In the diagram's curve, the segment between the first city and the second is very steep. The superposition of the three segments demonstrates the stability of the system at the top of the hierarchy on one hand and the buttressing of the first city primacy on the other hand.

Furthermore, the abrupt slope in the top of the curves is almost of same degree during the three times (1993, 2003, 2010). In 2010, M.C.A cumulates 41.8 % of Wilayat(s) centers population, 33.03 % of all urban inhabitants and 24.9 % of national population. Although the noticeable increase of two major regional metropolises during the last decade, M.C.A remains far positioned from the second and third cities which are, respectively, Salalah in the south and Sohar in the north. The cumulative number of inhabitants in these latter metropolises represents only 41.3 % of the Capital area residents. Furthermore, the urban population of the first city (690,697 inhabitants) is larger than the total urbanites of the 54 last Wilayat(s) (676,390). Table 2 shows that although the proportional decrease of M.C.A urban population share between 1993 and 2010, the first city remains a powerful center of attraction. Its demographic weight augments steadily and the proportion of its urban population is ever-growing.

Table 2. Demographic primacy of Muscat Capital Area. 1993-2010 (%)

	1993	2003	2010
Of total population	24.5	24.6	24.9
Of all urban population	35.9	34.9	33.0
Of Wilayat(s) centers population	41.6	41.5	41.8

Sources:

1. Ministry of Development, 1995, Localities, Housing Units. Households and Population in the Sultanate of Oman According to the Results of the General Census of Population, Housing and Establishments 1993.

2. Ministry of National Economy (MoNE), 2005, Population Settlements in the Sultanate, Results of 2003 Census, Muscat.

3. NCSI, 2012, 2010 Census Data by localities, Muscat.

Own calculation

All parameters confirm the Capital Area primacy (Table 3). In all dates the primate city is more than four times the second largest metropolis with an augmenting index. J index ($P1/P2$) passes from 4.26 in 1993 to 4.43 in 2010. It is more than twice the theoretical value. Compared to the 4 following cities (Stewart index), Muscat Capital Area has an index of 2. It is also more than twice the normal theoretical level (0.926). Thus, the real size of the primate city is 2.22 times its theoretical one.

Table 3. some parameters of Muscat Capital Area primacy.

Index	Formula	1993	2003	2010	Theoretical value
Jefferson Index	$J= P1/P2$	4.26	4.31	4.43	2
Stewart Index	$s= P1/(P2+P3+P4)$	2.06	1.97	2.00	0.926
P1 index	$p1= P1/\sum P$	0.42	0.42	0.42	
P2 index	$p2= P1/b$	2.13	2.15	2.22	1

Sources:

1. Ministry of Development, 1995, Localities, Housing Units. Households and Population in the Sultanate of Oman According to the Results of the General Census of Population, Housing and Establishments 1993.

2. Ministry of National Economy (MoNE), 2005, Population Settlements in the Sultanate, Results of 2003 Census, Muscat.

3. NCSI, 2012, 2010 Census Data by localities, Muscat.

Own calculation

3. Very polarized Regional Spaces

The second and third cities in Oman (Salalah and Sohar) constitute two major metropolises structuring their respective regions. They are in that order the metropolis of “Dhofar ” and “Al Batinah North” Governorates. They play the same role than M.C.A does at the national level but with more powerful attraction. The population of Salalah city represents 83.3 % of total urbanites in Wilayat(s) centers of the Governorate of Dhofar and Sohar’s has 58 % of its Governorate urban population. The primacy ratio as calculated by J index (P1/P2) is respectively of 17.78 and 29.11. The regional center of Sohar is 29 times larger than the second city. The primacy of the two cities in their respective regions is absolute (Table 4).

Table 4. Parameters of primacy in major regional metropolises: Salalah and Sohar in 2010.

Index	Formula	2010		Theoretical value
		Salalah	Sohar	
Jefferson Index	$J= P1/P2$	17.78	29.11	2
Stewart Index	$s= P1/(P2+P3+P4)$	9.40	5.37	0.926
P1 index	$p1= P1/\sum P$	83.34	57.96	
P2 index	$p2= P1/b$	8.89	14.56	1

Source: NCSI, 2012, 2010 Census Data by localities, Muscat.

Own calculation

The primacy ratio, which should be 1 in theory, is almost 9 for Salalah and above 14.5 for Sohar. Such concentration of people and primacy of metropolises are perceptible in other Governorates such as “Ash sharqiyah South” polarized by “Sur” and “Ad dakhliyah” by “Nizwa”.

Discussion

The structure of the urban system prior to 1970 has been similar to John Friedmann’s preindustrial model. All cities were enclosed and isolated. In such stage we can’t speak about hierarchy or system because “ the volume of interregional relations is generally small...[with] the existence, in relative isolation from each other, of a number of largely self-sufficient economies” (Friedmann, 1966, 35).

The process of development has rapidly changed the Omani territory into a dynamic structured space. However, the new urban hierarchy is marked by the absolute position of primate cities which are Muscat Capital Area at the national level and major metropolises at the regional one. It is certain that harsh natural settings in the interior of the country have determined human settlements location and participated to the concentration of people and activities near the coast, but the phenomenon of primacy could be explained either by history, development strategy or recent urban functions. For a long time, the three major cities have been famous active harbors on the Indian Ocean cost and Muscat became capital of the Sultanate at 1784.

Since 1970, a rapid process of development started and priority has been given first to the construction of the new national capital and later to regional development poles. In the first three five-year plans (1976-1980, 1981-1985, 1986-1990), M.C.A acquired the biggest share of public investments and since the fourth plan which started in 1991, most investments have been oriented to other governorates. Al Batinah monopolizes more than a half of public investments since the sixth plan of 2001-2005. (Table 5).

Table 5. Distribution of Public Development Investments in Oman 1976- 2010
(%) of total investments.

Region	First plan 1977-1980	Second plan 1981-1985	Third plan 1986-1990	Fourth plan 1991- 1995	Fifth plan 1996-2000	Sixth plan 2001-2005	Seventh plan 2006-2010
Muscat	42.4	56.1	48.9	20.4	18.4	10.2	19.3
Al Batinah	39.8	31.8	40.7	13.5	16.8	48.5	65.7
Dhofar	17.8	9.7	9.5	10.1	9.7	9.2	6.9
Other regions	0	2.4	0.9	56	55.1	32.1	8.1

Source: Al Hajri, 2010, Evolution of Omani Economy during four decades, 1970-2010, Arrayan Press, Muscat, pp. 77 and 114. (In Arabic)

This development strategy has led to the concentration of people and economic activities in these cities. In 2010, “Muscat governorate acquired the first position in number of profit operating establishments totaling (24363) representing (32.1%) of the total... Al Batinah north governorate came second with (11330) establishments representing (14.9%)” (NCSI, 2012, 7). Muscat currently monopolizes almost half of the economic establishments (Table 6), Salalah and Sohar have big shares as well, whereas, the other eight governorates cumulate approximately the third of the establishments only. In addition, the primate city capitalizes more than 36% of national labor-force and all the decision centers in matter of economy, finance, public policy, education and so.

The imbalanced distribution of people and activities reflects the insufficiency of spatial organization and control, however the dynamism of small cities indicates that the process is still on. The changes in the bottom of the system are due to decentralization in matter of development and services supply inaugurating, thus, a new era of spatial organization.

Table 6. Geographical distribution of Profit Establishments in Oman. 2010.

	National	Muscat	Salalah	Sohar	Total of 3 Metropolises	All other Governorates
Transport, storage and communication	1382	54.3	11.5	10.6	76.5	23.5
Education	679	45.8	6.2	13.7	65.7	34.3
Real-estate and business activities	4092	45.7	11.3	12.8	69.7	30.3
Health and social work	721	44.4	6.5	19.0	69.9	30.1
Financial intermediation	962	43.8	9.4	13.0	66.1	33.9
Construction	3749	38.5	11.3	14.3	64.1	35.9
Hotels and restaurants	6065	32.3	16.8	12.6	61.7	38.3
Whole sale and retail	35580	32.2	12.4	14.6	59.2	40.8

Source: NCSI, 2012, Establishments Census 2010.

Conclusion

The evolution of Omani urban hierarchy is tidily linked to the adopted development strategy. In the first stage, the priority given to the construction of the national capital has led to the overgrowth of Muscat. Demographic and functional primacy parameters show that the first city is disproportionately large and its predominance is ever strengthening. The second phase, that started with the sixth plan in 1996, witnessed the development of regional metropolises creating regional sub-systems of same nature than the national one. In each

region a monocephalic hierarchy has born. In the third and current phase of development strategy, small cities are benefiting of larger investments. They are growing faster and confirming their sizes and functions.

The current spatial configuration, seen in its historical and economic context, appears unavoidable in the process of national construction . Nevertheless, the current spatial structure should be moderated by more decentralization and local development in medium and small centers. Sustainable development requires more spatial equity.

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x . Muscat Capital Area is different of old Muscat. It's the entire Wilayat(s) of Mutrah, Muscat, Al Amrat, Baoshar and A'seeb.

xi . The administrative division of the Sultanate of Oman endorsed by Royal Decree N^o. 114/2011 divides the country (309500 km²) into eleven administrative division called Governorates.

3 . Wilayat, plural of Wilaya, represent the units constituting Governorates (Sub-Governorate). There are 61 Wilayats ranging from 10 Wilayats in Dhofar Governorate, in extreme south, to 3 in the Governorates of Al Buraymi and Adh Dhahira Governorates in the north. The boundaries of these Wilayat have not been officially determined. (NCSI, 2012, 9)

Bio profile.

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