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Will Distance to the Capital City Matter When Supplying New Cities in Egypt?

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Abstract: Unlike other developing countries, the housing market in Egypt is characterized by densely populated urban areas in old cities and the peripheral urban agglomeration. In contrast, a high rate of vacancy along most of the new cities that have been established since the 1980s is seen. Regardless of such high rate of vacancies, still the variation in occupancy rates among those new cities is notable. Questions arising include: Does proximity to old cities or Greater Cairo affect the size of the population of the new cities? Is the size of the city or the year of establishment plays roles in attracting more inhabitants? The factors of spatial characteristics of new cities in Egypt remain questionable. This research aims to reveal the association between occupancy rate and six factors related to the spatial characteristics of new cities and their geographical locations, such as; current inhabitants, the estimated size of the target group, the size of new cities, total number of housing units, distance to nearby old city, and distance to Greater Cairo.

Key words: Egyptian new cities, spatial analysis, distance to the capital city, population change

Highlights for public administration, management and planning:
- Occupancy rates of new cities established after 1990 are associated with city size.
- Proximity to the nearby old city, or to Greater Cairo has no association with occupancy rate.
- Central approach in planning new cities in Greater Cairo agglomeration is questioned.

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1. Introduction

Not only the purpose of building new cities is similar in most cases worldwide, but the observed vacancy rates of those new cities are similar in most cases. In Egypt, the establishment of new urban communities and cities since late the 1970s, according to law 59 (1979), is a twofold approach (NUCA 2016b; Sims 2015). On one hand, it aims to meet the rising demands of housing and to give the people an opportunity to move outside the narrow Nile valley. On the other hand, it aims to overcome the phenomena of informality and slums areas in the crowded old cities (El Kafrawy 2012; NUCA 2016b). Indeed, the Ministry of Housing, Utilities, and Urban Development in Egypt (MHUUD) has indicated that the vacancy rates in most of the new cities

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are higher than 40 percent. Thus, it represents a higher value than the vacancy rate of the whole nationwide, which does not exceed 31.6 percent (World Bank 2008). Hence, this is not too far from what happened in Iran in 1981, in which the government adopted a similar program of establishing new cities as a way out of urban sprawl containment around large cities and to enhance the economic situation. Some new towns were characterized by population growth while others still struggle from a high rate of vacancy (Ajza et al. 2012). Similarly, many new cities and communities were built in China to provide living areas that can accommodate 175 million inhabitants by 2010. The population growth was only 75 million, leaving high rate of vacancy in those new cities (Moreno & Blanco 2014; Xue et al. 2013).

"What distinguishes new cities and communities is that all development aspects are defined in the planning phase" (Insa-Ciriza 1974, p. 1). The Egyptian government has dealt with the idea of developing new cities not too far from the definition of new community defined by Eichler & Kaplan (1967) and Griffin (1974). They stated that the community is a developed single master plan that covers a land above 1000 Hectares that integrates diverse uses and activities, nevertheless, it accommodates inhabitants of different social groups. The new towns are designed either as an independent or so-called standalone city in which it contains the job and services for their inhabitants, or defined as a satellite or so-called twin city in which portion of the inhabitants commute to the nearby urban agglomeration (Abdel-Kader & Sayed 2009; Insa-Ciriza 1974). *"Development of New Towns is expensive, particularly the provision of their infrastructure"* (Insa-Ciriza 1974, p. 1). According to UNICEF (2010) over the past three decades, the newly built cities in Egypt have shown a great failure in attracting the estimated target group, despite wasting a large amount of budget in infrastructure. The population of Egypt is still growing, which has reached 85 million in 2014. Consequently, the housing market is expanding as well, with an estimated two percent increase in 2014 (CAHF 2014). The new urban communities and towns were planned to solve the housing problem and attract the increased population. Indeed, these new towns are characterized by a high vacancy rate, while informal areas are intensively occupied. In fact, informality represents homes for at least 45 percent of the newly built housing units in Egypt from the period of 1996-2006 (World Bank 2008).

Regardless of the size, location, estimated target group, incentives that the government offers, and/or how different these new cities physically are, the common factor of most of them is the high rate of vacancy. One can easily urge either these cities are not built for the majority of Egyptians that are mostly the middle and low-income classes as it attracts few of them, or built for this target group but without knowing the characteristics of how those people select their residential locations. The Egyptian law no. 59 (1979) in the subject of new urban communities in the article no. (7) shows the entitlement of NUCA in selecting the geographical location of new cities and deliver the master and detailed plans based on the national vision. In fact, the location of new cities in Egypt to a higher degree is selected based on different criteria, including; proximity to old cities, topography feature, soil characteristics, the source of energy and water, along with economic and strategic factors (Abdel-Kader & Sayed 2009). However, the selection process of the exact geographical location and the procedures involved are still ambiguous. Is the current population of the new cities affected by the area of the new cities? Or is the current population influenced by the proximity to Greater Cairo, or to nearby old cities? Is the older the city, the more chances to attract more inhabitants? It is clear that each new city has its own challenges that need to be analyzed thoroughly, however, what still questionable is the vision that needs to be adopted in any new development in Egypt. Yet, still five new Egyptian cities is under construction (TADAMUN 2015). Which trends of urban development should these new cities follow? Unequivocally, there are different physical and no-physical factors that influence the residential mobility of inhabitants and consequently affect the individual behaviors towards selecting a certain housing location. For instance, housing market conditions plays a

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significant role in housing allocation (Caldera Sánchez & Andrews 2011). Moreover, non-material factors such as proximity to family and friends, and sense of community have shown significance impact when it comes to making a decision of housing allocation (Sims et al. 2008). On the other hand, age and social attributes may influence the process of housing location choice (Nasr Eldin et al. 2014; Zegras et al. 2007). Furthermore, travel behavior and availability of commuting modes are another way to look at the individual behaviors toward housing allocations (Boarnet & Crane 2001; Hammond 2005). Hence, this research aims to focus on highlighting the effect of the physical spatial characteristics; represented in the geographical location, the size of new cities, target population, and proximity to nearby cities or to the capital city to the current population on the number of inhabitants and the occupancy rates of the new cities. The observation done on Egyptian new cities is intended to contribute to the international efforts towards planning new cities for the purpose of a better distribution of population and infrastructures. Nevertheless, the geographical target mainly includes emerging countries.

2. Methodology

Hypothetically, regardless of the low occupancy of the new cities in Egypt, current population of the new cities is influenced by the spatial characteristics of new cities- geographical orientation- in term of size of the new city, distance to the nearby old city, and distance to Greater Cairo. Moreover, it is pre-assumed that new cities nearby Great Cairo attracts relatively more inhabitants than other distant new cities. Thus, it raises various questions in order to respond to the stated issues using a methodological approach. First, do cities nearby Greater Cairo attract more inhabitants, regardless to their number? Second, will the shorter the distance between the old and new cities influence current population? Third, does the age of the new cities influence their occupancy rates? Fourth, will the supplied number of dwellings mean more inhabitants in the respective city?

This research is based on library studies. It aims to test the stated hypothesis whether if the spatial characteristics of the new cities affect current population. Figure 1 illustrates the geographical locations of the new cities studied in this research. Moreover, it visualizes their proximities to the neighboring historical cities and to Greater Cairo. It is worth mentioning that the relative variation between the linear distance and the actual circulation distance between new cities and neighboring historical cities, or Greater Cairo are nearly constant. Thus, it gives the research a flexibility to estimate the linear distances and the limited data existing in the official census. Eight variables are used in this method for 21 new cities in Egypt. Six variables are collected from the official online portal of the New Urban Communities Authority in Egypt (NUCA 2016b). These variables are; a) Current inhabitants, b) target population, c) establishment year, d) area of New City, e) the total number of housing units, and d) distance to the nearby old city. While the other two variables were estimated; occupancy rate, and distance to Greater Cairo. First, Occupancy rate is estimated as the ratio between the current inhabitants to the target population in each new city. Second, linear distance from Greater Cairo is measured geographically using Google Earth software. Multivariate linear regression is employed to test the degree of association between the current inhabitants and the occupancy rate among the other variables. SPSS Statistics software is used to analyze the collected data with a confidence level of 95 percent, the significance level is taken for this study is 0.05. It worth to mention that this data may differ from the actual reality, especially in the case of the New Aswan city, however, the data represent the exclusive official data source for new cities in Egypt.

Four multivariate regression models are stimulated. Model one relies on the absolute number of the 2015 inhabitants of each new city as the dependent variable. While in model two, the occupancy rate of each new city is used as the dependent variable. Nevertheless, the remaining six variables are used as common independent variables for the two models. The main reason for using two models of two

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different dependent variables is to show not only the significance of the different variables, but also illustrates the difference between looking at the new cities from the perspective of the actual number of inhabitants living in these new cities and the perspective of their occupancy rates in relation to the previously mentioned six independent variables.

Table 1 – Spatial Characteristics of New Cities in Egypt (Source: Compiled by the Authors based on census from official website of New cities in Egypt; NUCA, 2016b)

ID	New Cities	POP in ´000 (2015)	Occupancy Rate [%]	EST. by decree	Target POP in ´000	Area [acres]	NHU	Nearby old city	DNC [km]	DGC [km]
1	10th Ramadan	480	22.85	1977	2,100	94800	146283	Cairo	49	49
2	15th May	200	40.00	1978	500	12231	59150	Cairo	35	35
3	Al-Sadat	150	10.00	1978	1,500	121000	32100	Cairo	93	93
4	6th October	1500	25.00	1979	6,000	119200	527000	Cairo	32	32
5	New Borg El Arab	150	26.31	1979	570	47403	25150	Alexandria	60	230
6	New Damietta	150	30.00	1980	500	6500	44648	Damietta	4.5	200
7	New Salhia	40	50.00	1982	80	1617	5472	Ismailia	40	170
8	Obour	550	91.66	1982	600	16000	91806	Cairo	26	26
9	Shrouk	120	24.00	1995	500	11900	39000	Cairo	37	37
10	New Cairo	1.3	0.02	2000	6,000	70000	187000	Cairo	15	15
11	Sheikh Zayed	233	35.19	1995	662	10400	72942	Cairo	38	38
12	New Beni suef	67	25.00	1986	268	37900	16599	Cairo	5	124
13	Al Nubaria	22	27.5	1986	80	1816	6692	Alexandria	79	120
14	New Mina	40	6.26	1991	638	24600	30972	Menya	10	250
15	New Assiut	30	4.00	2000	750	30300	29802	Assiut	15	361
16	Tiba	19	9.74	2000	195	9495	3302	Luxor	14	510
17	New Sohag	.	0.00	2000	420	30800	686	Sohag	18	392
18	New Fayoum	.	0.00	2000	.	13500	.	Fayoum	15	100
19	New Aswan	150	10.00	1978	1,500	121000	32100	Aswan	10	684
20	New Qena	.	0.00	2000	130	24200	1689	Qena	8	582
21	Badr	140	16.66	1982	840	18500	18997	Cairo	47	47

Note: POP – population; EST. – established in year; DNC – distance to nearby city; DGC – distance to Greater Cairo.

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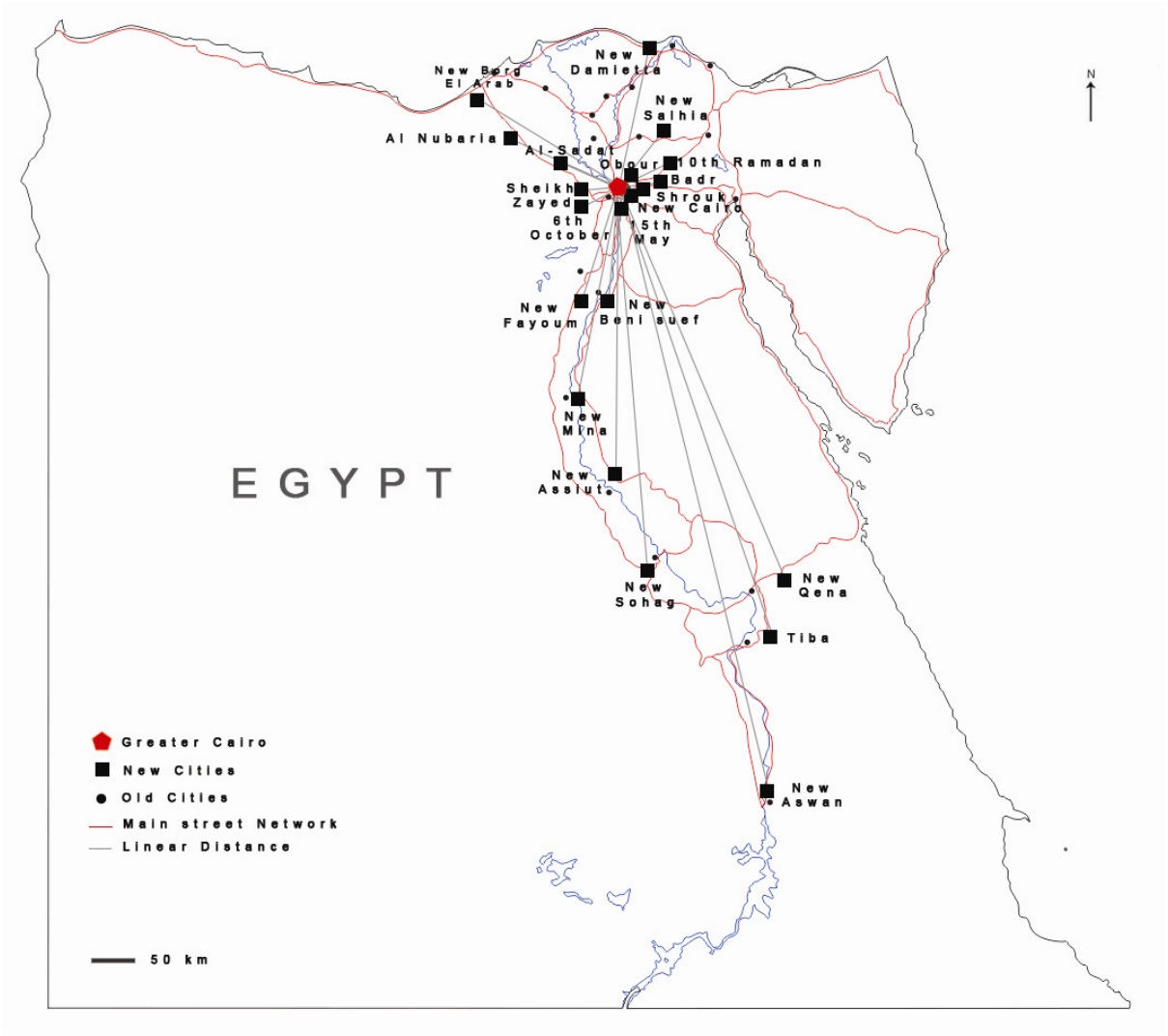

Fig. 1 – Egyptian new cities locations (source: Compiled by the authors based on NUCA, 2016a; OpenStreetMap, 2016)

On the other hand, the remaining two models are conducted to further elaborate on the outcomes of the previous ones. Multivariate linear regression has been widely applied in geographical studies, including in studying land use change and land expansion (Li et al. 2007; Liu et al. 2016; Soares-Filho et al. 2013; Xian & Homer 2010), air temperature measurement (Mann & Schmidt 2003), soil studies and degradation (Gomez et al. 2013; Luo et al. 2016; Rayegani et al. 2016; Sun et al. 2013), air pollution (Fischer et al. 2007; Sozanska et al. 2002; Vallius et al. 2003; Zhou et al. 2014) and urban development and urban studies (Akpinar 2016a, 2016b; Farrell et al. 2015; Onishi et al. 2010; Tran 2016). It is also combined with other geographical imagery and analysis methods such as remote sensing (Ahmad et al. 2010; García et al. 2008; Hou et al. 2011; Isenstein & Park 2014; Liu et al. 2010; Ma et al. 2014; Rayegani et al. 2016; Tian et al. 2012a, 2012b; Yu et al. 2015) and geographical information systems (GIS) (Howard et al. 2012; Lee et al. 2016; Sozanska et al. 2002). Thus, it has been broadly trusted by scholars for examining geographical phenomena.

Table 1 illustrates the data applied in the models explained above. The data related to 21 new Egyptian cities established between 1977 and 2000 (decree year) are gathered and used for simulation in the above-mentioned models. Thus, the youngest cities have an age of 15 years at the time of the study. Despite the year of

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establishment, there are different noticeable variation in their size, the number of current inhabitants, estimated target population and the number of the provided housing units. Consequently, occupation rates are affected. Nonetheless, the distances either to their nearby cities and/or the capital city remain variants that their impacts are not yet associated with the failure or the success of these new cities in term of attracting the estimated target groups.

Table 2 – Bivariate Correlation using Pearson coefficient (source: Compiled by the authors)

		Year of est.	Target population	POP	Occupancy Rate	Total Area	DCS	NHU	DGC
Year of est.	Pearson	1	-.056	-.386	-.502*	-.404	-.453*	-.307	.276
	Sig. (2-tailed)		.814	.114	.021	.069	.039	.188	.227
	N	21	20	18	21	21	21	20	21
Target population	Pearson	-.056	1	.583*	-.196	.646**	-.031	.121	-.306
	Sig. (2-tailed)	.814		.011	.409	.002	.897	.611	.190
	N	20	20	18	20	20	20	20	20
POP	Pearson	-.386	.583*	1	.273	.469*	.039	.441	-.303
	Sig. (2-tailed)	.114	.011		.273	.050	.879	.067	.221
	N	18	18	18	18	18	18	18	18
Occupancy Rate	Pearson	-.502*	-.196	.273	1	-.254	.187	.649**	-.433*
	Sig. (2-tailed)	.021	.409	.273		.266	.417	.002	.050
	N	21	20	18	21	21	21	20	21
Total Area	Pearson	-.404	.646**	.469*	-.254	1	.207	.012	.076
	Sig. (2-tailed)	.069	.002	.050	.266		.368	.960	.742
	N	21	20	18	21	21	21	20	21
DCS	Pearson	-.453*	-.031	.039	.187	.207	1	-.005	-.422
	Sig. (2-tailed)	.039	.897	.879	.417	.368		.983	.057
	N	21	20	18	21	21	21	20	21
NHU	Pearson	-.307	.121	.441	.649**	.012	-.005	1	-.443
	Sig. (2-tailed)	.188	.611	.067	.002	.960	.983		.051
	N	20	20	18	20	20	20	20	20
DGC	Pearson	.276	-.306	-.303	-.433*	.076	-.422	-.443	1
	Sig. (2-tailed)	.227	.190	.221	.050	.742	.057	.051	
	N	21	20	18	21	21	21	20	21

Note: POP – population; DNC – distance to nearby city; DGC – distance to Greater Cairo; DCS - Distance to the corresponding old city. *Correlation is significant at the 0.05 level (2-tailed), **Correlation is significant at the 0.01 level (2-tailed).

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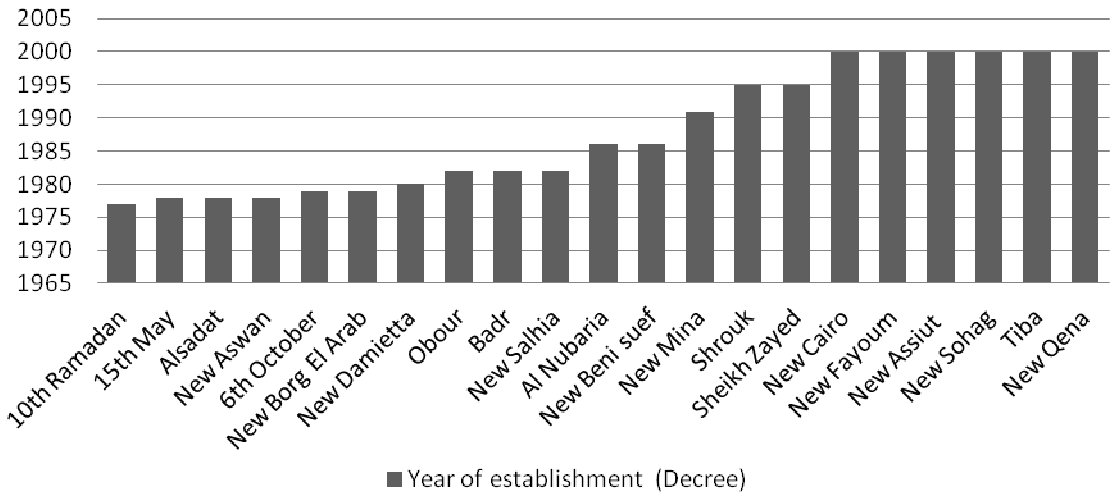

Fig. 2 – Year of the establishments of new cities by decree (source: Compiled by the authors based on (NUCA, 2016b)

As a step before conducting a multivariate regression models, bivariate correlation has been conducted to illustrate association between the variables addressed above. Pearson correlation method is used to illustrate the association and the different variations between the variables (see Table 2). Based on SPSS simulation, there is a strong correlation between the first independent variable "Current inhabitants" with the target population, and total area of the city, with p-values of 0.011 and 0.05 respectively. On the other hand, the second independent variable "occupancy rate" is correlated with year of establishment, number of housing units in new city, and distance to Greater Cairo, with p-values of 0.021, 0.002, 0.05. Nevertheless, there are different associations among the addressed independent variables. Accordingly, besides the distribution of the variables, these outcomes strongly encouraged the research to move further and search for collinearity.

3. Results

3.1 Descriptive Data Analysis

The year of establishment of new cities by their respective laws can be categorized into two main clusters. The first cluster has comprised cities planned to be established since the end of the 1970s until the beginning of the 1990s. While the other cluster of cities planned to be built since the beginning of the 2000s. Figure 2 illustrates the year of establishment of each new city, according to first issued law concerning the development of each respective new city.

In the last four decades, the newly built cities were targeted to home 23,833,000 inhabitants. Yet, they are home for only 4,042,000 inhabitants since the establishment of the first generation in 1979. Thus, it represents 15 percent of the whole capacity of the new cities while the majority -85 percent- is not yet there (see Figure 3). After analyzing the relation between the estimated target groups for each new city and the current inhabitants who have already moved to those cities in 2015, the results show that approximately 15 percent only of the estimated target population who actually moved to the respective new cities, leaving the majority of the target population, 85 percent, are seen as a future target group.

However, after analyzing each new city individually based on the previous relation, it is found that most of the mid-size new cities, in which their target group less than one million inhabitants, are succeeded in targeting the estimated population. For instance, Obour city was planned to target population size of 600,000 inhabitants. In 2015, it was succeeded in attracting 550,000 inhabitants. In contrast, Cities such as 6th of October despite that it attracted

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1.5 million inhabitants to reside within its boundary, still 4.5 million inhabitants remain as the missing target population to live within the boundary of the 6th October new city. Thus, it raised a lot of debates whether if these large-size new cities would reach such large urban agglomeration in the near future relative to the nearby cities, Greater Cairo, that most of the population are driven from them (see Figure 4 and Figure 5).

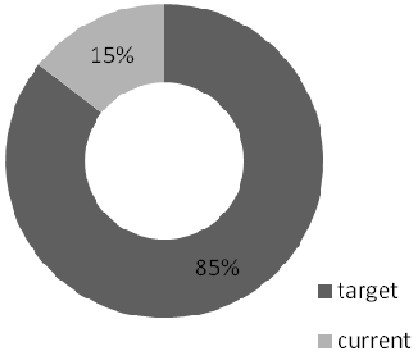

Fig. 3 – Relation between current and target population (2015) of the 21 new cities (source: Compiled by the authors based on NUCA, 2016b)

Residential location choice and travel behavior are two-way relation where it is obscure to predict which variable has created the other. According to Hammond research (Hammond 2005) in Cardiff, UK, it was concluded that 18 percent of surveyed people tend to choose their commuting mode before choosing their residential location. While 39 percent simultaneously choose their residential location and travel mode together. As a result, more than half of the people consider travel behavior while choosing where to live either directly or conditionally. Thus, it influences the choice of the geographical locations of those new cities to be within a reasonable distance that can allow residents to commute between the old and new cities. However, a wide variation is noticed. Eight cities were built within a distance less than 20 km away from the nearby old cities. While six cities were built within a linear distance varies from 20 to 40 km. While the remaining 6 cities were built at distances longer than 40 km to reach the maximum of 90 km away from old urban agglomeration areas. Factors for selecting such locations from a city to city may differ but what remains questionable is the impact of the selected location and proximity to old urban agglomeration on the number of the inhabitants targeted to live in these new cities.

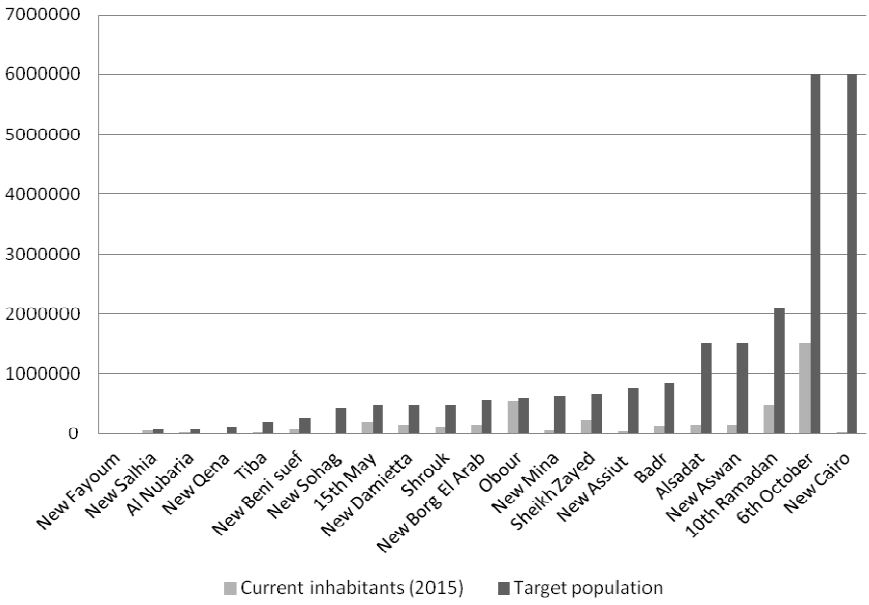

Fig. 4 – Relation between current and target population of each new city in 2015 (source: Compiled by the authors based on NUCA 2016b)

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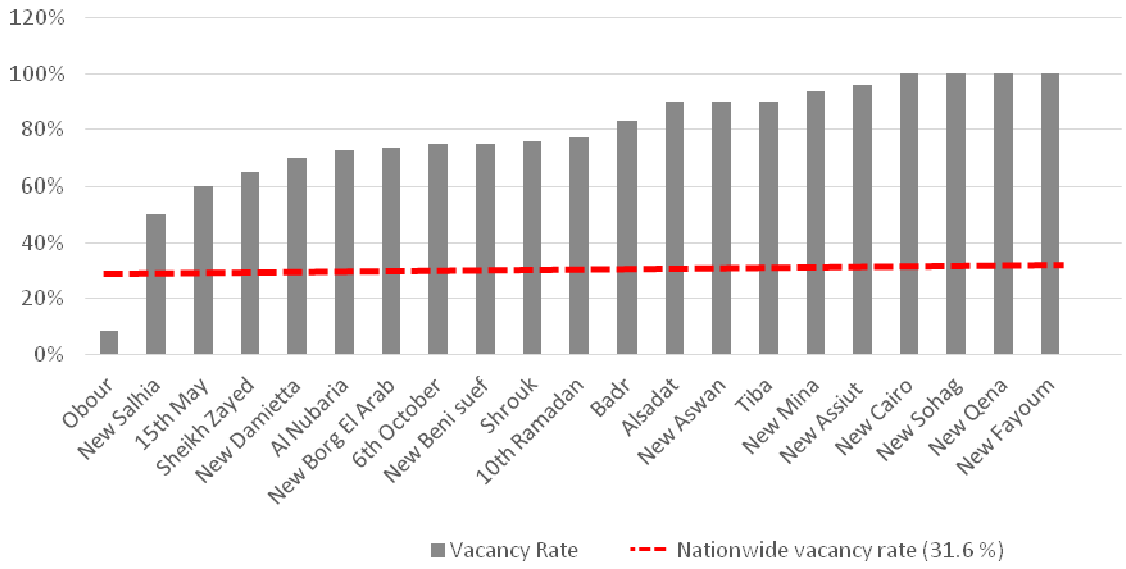

Fig. 5 – Vacancy rates for each new city based on the relation between current and targeted population in 2015

Source: compiled by the authors based on NUCA 2016b)

Based on the nature of the centralized administrative system of Egypt, distance to the capital city "Cairo" remains a valid point of discussion that plays an influential role in selecting where the most of the Egyptians would likely to live. Although many new cities were established as industrial regions, such as 6th of October, 15th of May, Sadat, that provides job opportunities for their inhabitants, however, the centralization of the administrative and government related jobs in Greater Cairo drawback the quality of the provided jobs in these new cities. Nevertheless, these distances add challenges for those who choose to live in new cities while commuting to their workplaces in Cairo. There are eight new cities that built to act as counter pole cities around Greater Cairo (Metwally & Abdalla, n.d.). While most of the new cities are established in the vicinity of the other old cities in the delta region and along the Nile valley. In respect of the linear distances between new cities and the city center of Greater Cairo, 13 new cities are within a distance less than 200 km away from Greater Cairo. Thus, still give a chance for people to commute to Cairo based on day trips. Despite the efficiency of the external accessibility of these cities to Greater Cairo, the impact of the variation of the physical distances remains an unobserved factor.

3.2 Model Fit

3.2.1 Step one: defining interdependencies

In model 1, *current inhabitants in the new cities* is used as dependent variable while the above mentioned six variables were used as independent variables. The explanatory power of the model (R square value) is equal to 63.1 percent, which means that this model can explain 63.1 percent of the variation in the dependent variable *current inhabitants* (see Table 3). From the result of the linear regression, the P-value of all the six variables are higher than 0.05. It means that the null hypothesis is accepted, and these 6 variables have no statistically significant effect on the current inhabitants of new cities (see Table 4).

In model 2, *occupancy rate for the new cities* is used as a dependent variable. It is calculated as the ratio between the current inhabitants existing in each new city to the target population. Nevertheless, the different 6 variables that were used previously remain as independent variables in this model. While R-square for this model is 71.3 percent, which shows how powerful is this

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model (see Table 5). As a result, from the linear regression, the P-value is less than 0.05 in the case of *year of establishment*, and *the number of the housing units*. While it is higher than 0.05 for the rest, thus, only for these two variables, there is a statistically significant linear effect on the dependent variable (see Table 6). First, "year of establishment" has negative Beta value, which means the older the city is, the lower the vacancy rate is. This value is equal to -0.488 which also means one year older is estimated with an effect of 0.5 increase in the rate of occupancy. Second, "The number of the housing value is a positive value which means it is directly proportional to the rate of occupancy. This value is equal to 0.481, which also relates to an increase of the housing units with one unit will be accompanied by an increase of 0.481 in the occupancy rate. In fact, the distance to the nearby old city, the distance to Greater Cairo, the size of the new town, nor the target group have any significant linear effect on the occupancy rate of the new cities.

3.2.2 Step two: clustering new cities according to their age

The new cities program is established since late 1970s, it is unequivocal that some cities hold different features than those who have recently established. Nevertheless, based on the sample distribution in accordance to the establishment year (see Figure 2), it is unequivocal that the data set is normally distributed with median of value 1986. Furthermore, model 2 shows that occupancy rate is statistically in line with the age of the city. Put together, model 3 and model 4 aims to further investigate the dependence of the occupancy rates on the variables for the cities built before the 1990s, and similarly, for those who are established during 1990s or after.

In model 3, model 2 is stimulated only for the cases, where the year of establishments are before 1990. In this case, the model does not show statistically significance results, except for the variable of “the number of the housing” where there is a partially significance results of p-value equal to 0.6 (see Table 7 and Table 8).

On the other hand, in model 4, model 2 is re-stimulated for the cases that established in 1990 or after. Interestingly, the models show a negative collinearity between the occupancy rate of the new cities and their size, with a p-value equal to 0.33, and beta value of -0.875. In different words, the smaller the city by one acre, a predicted increase in occupancy rate with the value of 0.875. Moreover, the model shows partially correlation between the occupancy rate and the target population, number of housing units, and the distance to the corresponding old city respectively (see Table 9 and Table 10).

Table 3 – Multivariate linear regression model 1 summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.794[a]	.631	.429	265703.317

a. Predictors: (Constant), Distance to Greater Cairo(km), Year of establishment, Target population, Number of housing units in the new city, Distance to the corresponding old city(km), Total Area of the new city(acres)

b. Dependent Variable: Current inhabitants

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Table 4 – Multivariate linear regression model 1 summary

	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (P-value)	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	31432986.806	19863816.192		1.582	.142	-12286977.855	75152951.467
Target POP	.128	.072	.652	1.790	.101	-.029	.286
EST	-15887.256	9993.035	-.384	-1.590	.140	-37881.777	6107.265
NHU	5.383	3.082	.366	1.747	.108	-1.400	12.167
Total Area of the new city	-.765	3.093	-.095	-.247	.809	-7.572	6.041
DCS	466.269	3615.765	.033	.129	.900	-7491.977	8424.515
DGC	97.296	576.592	.051	.169	.869	-1171.774	1366.366

a. Dependent Variable: Current inhabitants

Note: POP – population; EST. – established in year; DCS - Distance to the corresponding old city; DGC – distance to Greater Cairo.

Table 5 – Multivariate linear regression model 2 summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.844[a]	.713	.581	13.931

a. Predictors: (Constant), Distance to Greater Cairo(km), Total Area of the new city(acres), Number of housing units in the new city, Year of establishment, Distance to the corresponding old city(km), Target population

b. Dependent Variable: Occupancy Rate

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Table 6 – Multivariate linear regression model 2 summary

	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (P-value)	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	2307.349	981.078		2.352	.035	187.860	4426.839
Target POP	5.310E-07	.000	.043	.144	.888	.000	.000
EST	-1.151	.493	-.488	-2.333	.036	-2.216	-.085
NHU	.000	.000	.481	2.649	.020	.000	.001
Total Area of the new city	.000	.000	-.521	-1.699	.113	-.001	.000
DCS	.026	.189	.030	.138	.893	-.382	.434
DGC	-.005	.029	-.044	-.161	.874	-.068	.058

a. Dependent Variable: Occupancy Rate

Note: POP – population; EST. – established in year; DCS - Distance to the corresponding old city; DGC – distance to Greater Cairo.

Table 7 – Multivariate linear regression model 3 summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
3	.817a	.924	.668	.391

a. Predictors: (Constant), Distance to Greater Cairo(km), Target population, Number of housing units in the new city, Distance to the corresponding old city(km), Total Area of the new city(acres)

b. Unless noted otherwise, statistics are based only on cases for which Year of establishment < 1990.

c. Dependent Variable: Occupancy Rate

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Table 8 – Multivariate linear regression model 3 summary

	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (P-value)	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	26.390	17.997		1.466	.193	-17.647	70.428
Target POP	-1.010E-006	.000	-.074	-.175	.867	.000	.000
EST	.001	.000	.616	2.308	.060	.000	.001
NHU	.000	.000	-.449	-.976	.367	-.001	.000
Total Area of the new city	.000	.246	.000	-.002	.999	-.603	.602
DCS	-.013	.043	-.104	-.296	.777	-.118	.093
DGC	26.390	17.997		1.466	.193	-17.647	70.428

a. Dependent Variable: Occupancy Rate

b. Selecting only cases for which Year of establishment < 1990

Note: POP – population; EST. – established in year; DCS - Distance to the corresponding old city; DGC – distance to Greater Cairo.

Table 9 – Multivariate linear regression model 4 summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
4	.998a	.545	.995	.983

a. Predictors: (Constant), Distance to Greater Cairo(km), Total Area of the new city (acres), Number of housing units in the new city, Distance to the corresponding old city(km), Target population

b. Unless noted otherwise, statistics are based only on cases for which Year of establishment >= 1990.

c. Dependent Variable: Occupancy Rate

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Table 10 – Multivariate linear regression model 4 summary

	Unstandardized Coefficients		Standardized Coefficients	t	Sig. (P-value)	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	3.575	7.066		.506	.663	-26.827	33.978
Target POP	4.274E-006	.000	.650	3.916	.059	.000	.000
EST	.000	.000	.414	4.021	.057	.000	.000
NHU	-.001	.000	-.875	-5.377	.033	-.001	.000
Total Area of the new city	.459	.134	.412	3.428	.076	-.117	1.035
DCS	.009	.010	.148	.882	.471	-.033	.050
DGC	3.575	7.066		.506	.663	-26.827	33.978

a. Dependent Variable: Occupancy Rate

b. Selecting only cases for which Year of establishment >= 1990

Note: POP – population; EST. – established in year; DCS - Distance to the corresponding old city; DGC – distance to Greater Cairo.

4. Discussion and conclusion

Regardless of the low rate of occupancy in the new cities, after testing the spatial characteristics variables in different multivariate linear regression models, crucial results have been observed. The first model shows that the current population in the new cities is not statistically associated with the spatial characteristics of the new cities. These independent variables are: target group, year of establishment, number of housing units, distance to nearby old city, and proximity to Greater Cairo. They are tested in 21 existing new cities. Furthermore, the results show no statistically significant effect on the absolute value of the current inhabitants in each city. However, the second model of multivariate regression using occupancy rate as a dependent variable shows that only the value of occupancy rate is associated with two variables - year of establishment, and the number of housing units. This model shows that occupancy rate is inversely proportional to the year of establishment of the new cities. Nevertheless, it is directly proportional to the estimated number of housing units in each city. Indeed, proximity to the nearby old city, or to Greater Cairo has no associated effect to occupancy rate, nor the number of the current inhabitants of the new cities. On the other hand, after clustering the new cities into two different clusters, those established before 1990s and the rest either established on 1990s or later, new findings are observed. The size of the new cities significantly influences the occupancy rates of those new cities that are established in 1990s or later.

These findings considered to be surprising, nevertheless, contrasting with many deeply assumed facts in the Egyptian society among practitioners, and/or policy makers who are affiliated with the task of planning new cities in Egypt. On one hand, it reveals the notion of the geographical location of the new cities affects the number of their current inhabitants. While on the other hand, it questions the centrality approach in planning new cities around the agglomeration of Greater Cairo, even though there is non-parametric association between the occupancy rates of the new cities and the Distance to Greater Cairo that maybe a result of other socioeconomic or political factors Accordingly, these findings open the door to further investigation of the factors that affect the

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decision of residential location in Egypt. Moreover, although distance to old urban agglomeration areas does not show a statistically significant impact on targeting inhabitants, this physical distance can also been observed from a different perspective represented in proximity to family and friends, and proximity to workplaces in which they are to a higher degree influence the self-selection of residential locations in Egypt as explained by (Sims et al. 2008, p. 2). On the contrary, mass allocation of inhabitants to certain new cities due to natural risks or by law remains non-constant factors that may misleadingly influenced the relationship between the occupancy rate and the other studied variables.

With a nationwide observation of 21 new cities in Egypt, it has become unequivocal that the year of establishment of the cities, as well as the number of units within the new city, has a significant impact on the occupancy rates of the new cities. The establishment year corresponds to the city age, which seems a logical and expected result. The older the new city is, the more infrastructure and local amenities such as local centers, public transportation, neighborhood facilities, etc. have been planned and implemented in it. Such infrastructure can act as attractions for the potential inhabitants. The unpublished studies of the authors confirm that Egyptian city dwellers give importance to mobility facilities as well as accessibility to public transport and informal modes of transport (paratransit modes) in their residential self-selections. Nevertheless, the city age is not the only influential factor; since there are several examples in the Egyptian new cities sample that show the very low occupancy rate for roughly old cities, i.e. the occupancy rate of New Minia reached to only 6.26 percent in 24 years after establishment. Similarly, Al-Sadat and 6th of October reached occupancy rates of 10 and 25 percent after being established in 1978 and 1979 respectively. There are other examples in the international context that show being an old new city does not lead to high occupancy rates.

According to Shaw (1995) questioning what has gone wrong with planning new cities in India, particularly "New Bombay". Even though this city is built from scratch to attract the estimated target population and provide a good means of external accessibility to the old city Bombay, it is found that the economic bases and related activities are the main triggers that were missing. Thus, it affects the success of the new city to attract its target population. While according to Graves et al. (2009) defining the phenomena of the "ghost cities" in U.S.A. as the communities who lack completely their inhabitants, leaving vacant housing behind. Consequently, it is in line with the situation of the most of the new cities in Egypt is defined as ghost cities (TADAMUN 2015). Furthermore, their research explains the relation between the investment in housing and labor market towards attracting inhabitants. Nonetheless, the study explained that those cities of a strong economic situation which can provide large investment in the sector of infrastructure and housing can lead to unique patterns of local development which it is the main obstacle of the ghost cities. Subsequently, this research in line with the significant result of the number of housing in each new city in Egypt with occupation rate. On the other hand, as mentioned by Sánchez-Vidal et al. (2014) analyzing the association between the distribution of the size of New U.S. cities in the twentieth century, it is found that the growth of the cities is associated with lifespan and the age of the city. In different words, Cities tend to attract more inhabitants in the early stages of their establishment while their growth rates stabilize or decline when time passes. Thus, it can explain the significant result between the occupancy rate of new cities in Egypt with the year of establishment as an effective factor.

More factors must be effective, one of which is the number of the planned housing units, according to the outcomes of the models presented in this paper. This variable seems to be under the influence of local culture. The attitude of people in different countries towards living in large cities may largely differ. This can be illustrated by the urban primacy rates of countries, which is relatively high in Egypt like in many emerging countries (Abou-Korin 2014). In other words, social, economic, and demographic phenomena encourage people to live in private and large cities. Privacy may vary in different emerging and developing countries, the effects of which on the occupancy rate of the small new

cities deserves more studies. Furthermore, it is not obvious how the people of different cultures decide to live in small or large new cities, i.e. attitude-based decisions regarding living in a small new city in China may be different from living in the same size of the city in Egypt. In addition to culture, environment and geography may also be influential in choosing different size of new cities for living. Such considerations can be a part of future studies related to ghost cities.

Apart from the above-mentioned idea of the research, there are other variables not studied in this research, whose mechanisms of effecting on a residence in new cities are not clear. Examples are factors related to accessibility to transportation modes, particularly public transportation as well as car ownership. Furthermore, perceptions of people about their old city and the new target city may have influential effects; e.g. there may be a very strong sense of attachment to the origin, and a very low sense of place, community, and attachment to the new city, which is normally enhanced by the lack of identity. The above was not focused in this study because of paucity of data about urban transportation facilities, and difficulty of collecting subjective data. Nonetheless, housing prices is another key factor that affects the growth of the new cities. The conditions of supply of houses in the developing housing market still face a lot of challenges to include the urban poor (Bredenoord & van Lindert 2010; Keivani & Werna 2001). As debated by Moreno & Blanco (2014), even though new development is planned to agglomerate low and middle-income households, however, most of these new developments in developing countries such as Egypt or Mexico are speculated by the real estate. Consequently, housing prices become an obstacle for many households to access the housing market and thus it is due to the misidentification of the target group. Thus, it is not surprising that *"Luxurious desert cities have been built to house Cairo's elite, with villas fetching millions of pounds in gated compounds"* (CAHF 2014, p. 77). Giving no choice to urban poor to live except living informally, or expand and built their own houses in their own way. In the end, *"They are the ones who have to rely on their own ingenuity, energy, skills and resources in order to meet their vital shelter needs"* (Bredenoord & Lindert 2010, p. 3). In short, the outcomes of the research encourage scholars to furtherly elaborate on the self-choices of the residential locations and on other related socio-economic factors not tackled in this research, in which it may add a new perspective that complement the physical factors of geographical locations of new cities and contribute to the theories of residential location choice in Egypt.

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