Physical Transformation of Rural Villages Encompassed into Egyptian City Borders

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Abstract

The sprawl of Egyptian cities has lead to the encompassing of adjacent peripheral villages into their urbanized areas. These encompassed villages have been undergoing uncontrolled physical transformations, causing them to lose their original identities but rarely gain full urban ones. This study aims to clarify the physical transformations occurring in such areas, while highlighting anticipated problems in continued uncontrolled transformations, for the purpose of further study on control strategies. A field survey was conducted in the El-Ekhsas neighborhood of El-Minya City, Egypt. Specifically, the study clarified physical transformations by investigating: 1) the changing urban fabric from an organic to more grid-like, and eventually to a random linear structure; 2) the decrease in plot areas due to inheritance practices and a linear subdivision system for agricultural land; and 3) changing trends in building heights and construction materials. The main existing physical problems are then summarized as: 1) inadequacy of street networks concerning vehicle access; 2) incompatibility of decreasing plot areas to the application of planning laws; and 3) lack of maintenance concerning streets, buildings, and infrastructure. Finally, the study suggests the formation of a partnership between villagers and the city government to establish special local bylaws and improvement projects applicable to encompassed villages.

Keywords: urban sprawl; urbanization; city planning; Egypt; El-Minya City

1. Introduction

1.1 Background

With the extraordinary expansion of Egyptian cities over the last four decades, many peripheral villages have become tangent and eventually encompassed into the urbanized areas of their neighboring cities. These villages, offering small-sized, cheap land and housing units for low and medium-income city dwellers, have gradually become natural growth nodes for cities. Furthermore, in the absence of concrete visions for urban planning and development control tools, many physical and social transformations have occurred in these villages. However, the few previous studies that have dealt with this situation in Egypt1,2 emphasize that the pace of transformation and related conflict in these encompassed villages is more remarkable than in other, isolated villages, converting such villages into enclaves within matrixes of suburban housing estates. Recently, as a step towards the control of their urban development, many of peripheral villages have been legally integrated into the administrative borders of their neighboring cities through new strategic plans advanced by the GOPP (General Organization of Physical Planning) in 2009 (e.g., El-Minya City in Upper Egypt encompassed four villages; El-Zaqaziq in Lower Egypt encompassed five villages)3. In actuality, the proposed plans, with the objective of encompassing and converting the villages into urban neighborhoods, only suggested improvement strategies without proposing any concrete tools or scenarios for their realization.

1.2 Research Problem

Urban encompassment and the related processes of changing tangent peripheral villages into urban neighborhoods have recently become prevalent in many medium-sized Egyptian cities, representing a real challenge to planners. A review of previous cases of administrative processes used to handle encompassment (e.g., the cases of Cairo1 and Giza3, etc.) reveals that villages that have been converted into urban neighborhoods, even those converted as long as a century ago, still undergo many random physical transformations. These transformations are practiced at the levels of street networks, block subdivisions, and building characteristics that include neither prior planning nor compliance with city laws. Indeed, the future continuation of such uncontrolled transformations is expected to result in smaller property areas, higher building heights, higher densities, with increasing car ownership, and the problem of incompatibility of street networks regarding vehicle access.

As a preliminary step for the improvement projects suggested by the new strategic plans, the existing physical characteristics, the transformations that have
occurred in such areas, resident requirements, and suggestions for solutions should first be investigated.

1.3 Definition of Terms

a) **Physical transformation**: refers generally to the transformation occurring in the physical structures of human settlements; specifically, here it concerns the physical transformations and adaptations that have occurred in street networks, city blocks, land plots, and building characteristics.

b) **Unplanned transformation**: sometimes called illegal, informal, or unauthorized transformations, here it refers to transformations that follow neither specific plans nor construction laws by changing land uses or planning requirements.

c) **Rural village**: generally defined as the home of those engaged in rural occupations tied to the cycles of agricultural life, includes simple traditional culture, small groups of dwellings, and historically has been ruled by a primitive democracy of the village council. Historically, the Egyptian rural village was virtually isolated from the impact of the outside world and distinguished by: i) its natural organic physical structure, with typically a semi-circular shape, and an organic street network including winding streets and cul-de-sacs; ii) its economic dependence on the agricultural sector; and iii) a social structure dependent on a kin-bound society and folk-sustained systems. With the political and economic changes following the revolution in 1952, Egyptian rural villages have drastically opened up to modern ideas through the development of transportation, communication, and education facilities.

d) **Encompassed village**: regarding the spatial distribution of villages through three tiers surrounding their mother cities, here encompassed villages are considered as those villages located on the first tier of city’s sphere of influence. These villages are almost exposed to city expansion; tend to be more comprehensively affected by urbanization flows and, further, to encompassment processes into city borders.

1.4 Literature Review

Recent studies that have examined this topic can be divided into two groups: i) those focusing on land-use change using mapping techniques for measuring the loss rate of agricultural lands caused by the prevalence of informal spontaneous expansions; and management strategies for conflicts that arise around the issues of agricultural land protection and urban development; ii) those focusing, mainly through fieldwork, on the actual transformations that have occurred in terms of land-use, lifestyles, and livelihoods throughout the residential cores of rural settlements encompassed into the urbanized areas of big cities, such as Kuala Lumpur-Malaysia, Delhi-India, Shenzhen-China, and Greater Cairo-Egypt. Nonetheless, studies of transformations, and specifically the physical transformations, of such villages encompassed within the urbanized areas of medium-sized cities, are still few. This study thus attempts to add to that research.

1.5 Research Objectives

This study aims mainly to: 1) examine the physical characteristics and transformations experienced in the El-Ekhsas neighborhood of El-Minya as a typical case of an encompassed village, and 2) identify the transformation trends, while also indicating the existing and expected problems in the case of continued uncontrolled transformations, so that our results can be a reference for future strategies to alleviate existing problems and avoid new ones.

1.6 Research Methodology

a) **Case study**

El-Minya (Fig.3.) was selected as a representative case study for the following reasons: 1) The city has widely practiced unplanned urban expansion on its rural peripheries and around its peripheral villages; 2) The rural areas encompassed within the city’s borders constitute about 40.2% of the city area, and 41.8% of its total population; 3) It is one of the four medium-sized Egyptian cities which have recently experienced an increase in their percentage of population change (Table 1); and moreover, among them it had the highest percentage of total urban population in 2006.

Through a revision of its Strategic Plan in 2009, El-Minya has already encompassed a number of rural areas (Table 2, and Fig.4.). For our case study, however, we selected an area depending on its degree of having the following main criteria: 1) definite geographic borders, 2) availability of periodic

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**Table 1. Population Growth of Medium-sized Egyptian Cities**

| City Name | % Population Change 1966-1996 | % Population Change 1986-2006 | 1966 Population | 1986 Population | 2006 Population |
|-----------|--------------------------------|-------------------------------|-----------------|-----------------|-----------------|
| Cairo     | 26.9%                          | 31.9%                         | 293,950         | 417,130         | 547,830         |
| Alexandria| 25%                            | 29%                           | 177,770         | 231,850         | 337,570         |
| El-Minya  | 22%                            | 26%                           | 130,580         | 166,940         | 211,400         |

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Source: CAPMAS- Egypt 2006, and analysis by the researcher.
classification as a separate urban unit, and 3) long history of encompassment with which a wide range of transformations is expected. El-Ekhsas not only meets these criteria, but it was also the first village merged into the city borders in the early 1970s; thus it was selected for the study, on the assumption that it is already well consolidated and would be resourceful of many detectable and analyzable transformations.

b) Methods

As an analytical study, our research depends on: 1) Literature reviews of research examining the urban encompassment process of growing cities beyond their peripheral villages; 2) Secondary data collection for El-Minya and its peripheral villages, including cadastral maps for the study area of El-Ekhsas; 3) Primary data collection by surveying the study area, observing the current state of buildings, and administering questionnaires to a sample of 100 heads of households to ascertain their social characteristics and opinions regarding the area's physical structure, transformations, problems, and suggestions for solutions; and 4) Data analysis using Excel and GIS programs, and then presenting the results in the form of correlations, diagrams, tables, and indicative maps.

2. Outline of the City and Study Area

2.1 El-Minya

El-Minya, the capital of El-Minya Governorate, lies on a long narrow strip of about 7.5 km of cultivable land along the western bank of the Nile River, about 245 km south of Cairo, with an area of approximately 9.2 Km² and a population of about 239,000. Through its growth stages, the city encompassed a number of rural settlements (villages and hamlets) that represent about 40.2% of the total city area. As an initial examination of the study area of El-Ekhsas, the physical transformations it has undergone to date are critically analyzed as follows.

2.2 El-Ekhsas Study Area

Historically, El-Ekhsas (Fig.5.) was a simple, small rural village until it was encompassed within the expanded administrative borders of El-Minya in the early 1970s, which resulted in it being converted into one of El-Minya's neighborhoods. It lies on the northern periphery of El-Minya, bordered by the Nile River on the east, and a cotton ginning factory on the north and west. This factory was recently closed and is to be redeveloped as a residential area. El-Ekhsas is connected with the city by El-Hurria and Omar-Sultan streets; its total expanded area, including its main core and a transitional urban area, is estimated as 20 acres (14 acres for the main core), with a population of 3,621 according to the 2006 census. Nevertheless, El-Ekhsas, and specifically its main core, experienced chronological physical transformations that were principally caused by the establishment of the cotton ginning factory in 1936 during the British colonial period, as well as the urban expansion of El-Minya towards the factory.

2.3 Chronological Growth

The village formation began before the 1930s from a small built-up area (part A) (Fig.6.a), including light structured houses and penetrated by many infill areas, like many other rural settlements in Egypt during that time. It was located on the western bank of the Nile, surrounded by the Damarees canal and a Muslim cemetery on the west, and agricultural lands on the north, south, and west. The residents were mainly villagers who worked on the surrounding agricultural land.

In 1936, the cotton ginning factory was built on the western side of the village. Up until the late 1960s, about 50% of the villagers worked in the factory's different branches; while the village's built-up area expanded westward forming part B (Fig.6.b).

In the early 1970s, the Damarees canal was filled up and replaced by a wide paved street (El-Teraa St.) that connects the two parts, A and B, together. The factory...
drew a high percentage of the village's labor force until it was closed in the late 1990s; however, the village built-up area continued to expand northward into the agricultural land, forming part C (Fig.6.c).

Coinciding with this development, the city expanded northward, encroaching on its agricultural periphery to form part D of El-Ekhsas (Fig.6.c), which includes a number of municipal service buildings (e.g., university dormitories, the Middle Egypt Mills company, a military office, and a bank branch), and other institutional and private high-rise housing. Through this transitional area (part D), the city became tangent to the village; moreover, the nearby Nile bank was further developed to create tourism uses. Thus, together with plans for reconstructing the factory as a new residential area, the village became totally encompassed into the urban fabric of the city (Fig.7.).

A field survey conducted in the area (from February 7th to March 3rd, 2009) focused on its main core (A, B, and C) and found that the area has undergone many transformations without regard for city planning ordinances or constructing laws, in the absence of a comprehensive plan and a powerful monitoring system.

3. Physical Characteristics and Transformations
To trace the transformations, first the urban fabric of the main core parts (A, B, and C) is generally analyzed. Second, to explain the factors affecting the physical transformations in the area, part A (the oldest part) is specifically analyzed at the block subdivision level. Finally, changing trends in building characteristics are analyzed through an examination of all area buildings.

3.1 Urban Fabric and Street Network
The urban fabric of El-Ekhsas has witnessed many chronological changes along its three expansions (Table 3.). Part A, the original nucleus, is characterized by an organic fabric which characterized most of the old Egyptian villages at the time, with narrow winding streets (1-4 m wide), cul-de-sacs, and small urban spaces. Expanding westward, part B was developed in a grid-like pattern (with streets 2-4.5 m wide), imitating the grid pattern used in urban districts during the colonial period. Furthermore, its block subdivisions followed the linear irrigation system used in these agricultural lands. Finally, part C, expanded in the 1970s, is characterized by a random linear fabric (streets 3-6 m wide) influenced by the informal random expansions that prevailed on the peripheries of most Egyptian cities during that time.

Hence, the urban fabric of El-Ekhsas, which developed in an area with neither legal guideline nor restricted monitoring, naturally simulated those urban patterns used in Egyptian cities at that particular time in history. Despite its complicated street network, part...
A provided small but efficient open areas that served as spaces for social communication. On the contrary, in spite of their easy accessibility, parts B and C lack such open spaces apart from their somewhat narrow streets. For this reason residents ended up using the connecting streets in ways they were not designed, such as social interaction, playing among children, and even animal breeding, all of which resulted in the obstruction of vehicle access.

3.2 Block Subdivision System

Part A is characterized by an irregular complex configuration of block patterns due to random unplanned construction on private agricultural land. On the other hand, the blocks of the expanded part B are semi-rectangular with widths ranging from 21 to 24 m and variable lengths. Similarly, the blocks of part C are a mix of randomly constructed and semi-rectangular blocks. The physical transformations, which occurred according to the adaptations made within the original plots and also the common methods of subdividing rural properties, can be summarized as the result of the two following factors:

1) Property inheritance: Property inheritance and the subsequent process of subdivision of one inherited plot into multiple smaller plots are recognized as the main key factors affecting the geometrical configuration of the village fabric. Indeed, 75.6% of the respondents of part A own their houses through inheritance. To better show the impact of this factor, part A was further analyzed. An analysis of the subdivision and plot adaptation practiced through the period spanning 1949–2008 revealed eight types of plot transformation, categorized as shown in Table 4. and Fig. 8.

Accordingly, it can be concluded that a high percentage of plot transformations occurred (45% of total cases) as a natural process. The transformations basically followed one of the following four categories (based on the above-mentioned eight types) and an additional fifth, “Unchanged” category (Table 5.):

a) Subdividing original plots: includes constructing of private cul-de-sacs and subdividing plots into number of smaller plots directly connected with a local or main street (categories 1, 2, 2’), comprising 25% of total cases; b) Re-subdividing original plots: involves merging a set of plots into one plot, and

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Table 4. Main Types of Plot Transformations in Part A

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Fig. 8. Part A of El-Ekhsas Showing the Plot Transformation Methods Used Between 1949-2008
then re-subdividing it (categories 3, 3'), comprising 7% of total cases; c) Merging original plots: Includes occasional adding of additional areas (categories 4, 4'), comprising 6% of total cases; d) New housing plots or expansion of original ones (category 5), comprising 7% of total cases; and e) Unchanged plots, comprising 55% of total cases.

2) Linear subdivision of agricultural lands:

Following the land reform laws enacted in the 1950s, the small areas of properties combined with a linear irrigation system for agricultural lands influenced the urban form of expanded built-up areas, as evidenced in parts B and C. Villagers first divided their land into blocks, ranging between 21 and 24 m wide, and then they divided the blocks further into smaller lots using narrow irrigation canals (1-3 m wide) as streets by filling them up. The lot areas ranged between 60 and 100 m², and in some cases the size was affected by inheritance practices, either by splitting a lot into smaller lots or by combining smaller lots into a bigger one. Such lots were usually transferred to successors by inheritance or by sale to other villagers or middle-income class citizens (Fig.9.).

Hence, all such transformations led to an overall decrease in the areas of individual properties. Indeed, this fact was mentioned by about 64% of the questionnaire respondents as the most problematic issue in applying construction laws in cases of new construction projects. About 46.3% of all plots in the area are equal to or less than 50 m², 30.2% fall between 50.01-75 m², 13.3% between 75.01-100 m², and 10.2% are more than 100 m² (Table 6.).

3.3 Changing Trends in Building Characteristics

An analysis of building characteristics in the main core of El-Ekhsas (A, B, and C) reveals that about 46% of buildings were constructed before the encompassment period (pre-1970), and that 54% were constructed during the period (Fig.10.). However, both of these building groups were examined to determine the changing trends of their characteristics before and after encompassment, specifically in terms of:

1) Changing height trends

Fig.11. shows that about 31% of all buildings have 1 or 2 floors, 50% have 3 floors, and 19% have 4 floors or more. By analyzing the buildings, more than 40 years old (i.e., built before 1970) (Fig.12.), it is found that 41% have heights of 1 to 2 floors, 51% have 3 floors, and just 8% have 4 floors. Accordingly, it can be concluded that the prevailing trend at the time was to construct buildings of low height (1-2 floors), with subsequent changes in some buildings in the form of raising their height by one floor, or more rarely, two floors. On the other hand, about 22% of buildings built after encompassment are 1-2 floors in height, 49% are 3 floors, and 29% are 4 floors or more. Thus, a changing trend toward an increase in building heights to more than 3 floors can be seen after encompassment.

2) Changing constructing material trends

Fig.13. shows that 39% of all buildings were constructed using mud walls and wooden ceilings, 36% using bearing walls, and 25% using reinforced structures. By comparing the buildings’ ages and their construction materials (Fig.14.), it is found that the prevailing trend before encompassment was construction using mud and wood (73% of all buildings before encompassment); whereas during the encompassment period the trend changed to an increase in construction using reinforced concrete (45% of total buildings following encompassment). This trend has recently been the norm in many Egyptian villages. Additionally, as

**Table 5. Percentages of Main Types of Plot Transformation Cases in Part A* **

| Cases of plot transformation | a. Subdividing original plots | b. Re-subdividing original plots | c. Merging original plots | d. New plots | e. No change |
|----------------------------|------------------------------|-------------------------------|-------------------------|-------------|-------------|
| No. of cases (148 cases)   | 8                            | 25                            | 3                       | 9           | 2           |
| % of total cases           | 6%                           | 17%                           | 2%                      | 6%          | 5%          |

**Table 6. Percentages of Plot Area in the Main Core (Parts A, B, C) **

| Plot Area | ≤ 50 m² | 50.01-90 m² | 90.01-150 m² | > 150 m² |
|-----------|---------|-------------|--------------|----------|
| No. of plots (549) | 24      | 230         | 166          | 73       |
| % of total plots    | 4.4%    | 41.9%       | 30.1%        | 13.1%    |

* Note: Parts A and B are referred in Fig.6.*
shown in Fig.15., the high percentages of good (30 % of total buildings) and average conditioned buildings (32%), emphasizes the sequential transformations that have been accelerated by modernization, natural growth, increased needs for housing, and the dominance of private ownership of properties.

3.4 Planning and Construction Laws Till 2008

Since El-Ekhsas became one of the city's neighborhoods in the early 1970s, its urban development has officially been under the jurisdiction of city planning law No.3/1982 and building regulating law No.106/1976 and its amendments in 1996; these laws included the following stipulations:

1) Regarding the street network: Construction works facing streets less than 6 m wide are not allowed. Otherwise, the building must be set back by a distance equal to half the difference between 6 m and the original street width (Fig.16.).

2) Regarding the block subdivisions: Each plot of land to be subdivided into more than 2 sub-plots must meet the following requirements:
   a) 1/3 of the land area must be allocated for roads, squares, and public parks.
   b) Each piece of the divided land must face at least one street (not less than 6 m wide).
   c) Enclosed areas of buildings must not exceed 60% of the plot, and the open built areas (terraces, stairs, and building entrances) may only extend for 10% of a building's enclosed area. This includes the possibility of exceptions in exceeding this percentage in some cases according to the discretion of local authorities.

3) Regarding buildings characteristics:
   a) Building height must not exceed 1.5 times the street width, with a maximum height of 36 m (in critical cases the Prime Minister has the right to minimize or maximize this height in special city areas).
   b) Building owners must provide a sufficient number of elevators for buildings whose top floor exceeds 16 m aboveground, with a sufficient number and area of parking spaces.
   c) Any additional constructions, changes, or facade paintings are not allowed until permission is obtained from the local authority.

However, our field survey found that most buildings located specifically within the inner parts of the area were constructed without regard to these laws.

4. Physical Problems and Resident Requirements

According to our analysis using resident questionnaire, the existing physical problems (Fig.17.) of the area were identified; specifically, the problems pertained to:

4.1 Street Network

The narrow width of the street network in El-Ekhsas was noted by about 44% of the respondents as one of the area's problematic physical issues. Except for its main street "El-Teraa St.", the street network has widths ranging from 1.5 to 4 m, with occasional winding streets and dead ends, especially in the older part A. Such narrow streets widths are incompatible with modern motor transportation and emergency vehicles in terms of accessibility (Fig.18.-a). Moreover, 51% of respondents complained of the lack of street maintenance (Fig.18.-b), 16% complained of the lack of a garbage disposal system, and 33% complained of small or no open spaces.

4.2 Plots (Block Subdivisions)

The continuous division of original plots by expanding families due to the previously mentioned inheritance practices has resulted in the formation of small property areas, some as small as 20 m². This issue was noted by 64% of respondents as a problem which forces them not to comply with construction laws in the case of reconstructing on their land (Fig.18.-c).

4.3 Buildings and Infrastructure

Despite significant improvements in their conditions and amenities, the buildings of El-Ekhsas still lag behind those of other middle-class neighborhoods in the city. This is observed from the state of building deterioration, their lack of both maintenance and facade paintings (29% of responses) (Fig.18.-d, e), bad natural ventilation (9%), and bad distribution of house elements (11%).

![Fig.16. Law Article for Street Widening](image1)

![Fig.17. Questionnaire Results about Existing Physical Problems](image2)
Additionally, El-Ekhsas still retains a gap in quality level in terms of infrastructure and services, compared with those provided to the other middle-class neighborhoods of the city. This view was supported by 33% of the respondents who complained of bad sanitation maintenance, water shortages, and occasional power interruption.

Revising the current planning and construction laws, and in light of the prevalence of narrow streets and small property areas, it can be argued that:
1) It is difficult for owners to set back their buildings by a depth equal to half the difference between the required 6 m and the original street width; because the usable area of small sized plots will decrease sharply; 2) The areas' unique building floor ratio, which reaches nearly 100%, makes it difficult for owners to comply with the law requiring such ratios to be 60%. Furthermore, due to the expected sharp decrease in the built areas, many owners refrain from obeying such construction laws.

Hence, and in the case of continued neglect of these problems without coming up with practical solutions, increased building heights will combine with increased densities to create even worse living environments, resulting in a disordered and degraded urban fabric.

Referring to the questionnaire results, residents noted that they require the following from future urban planning efforts: 1) softening of existing construction laws to be more practical, 2) providing loans for people to reconstruct and maintain dilapidated buildings, 3) excluding bakery shops from residential cores to mitigate congestion and noise, 4) improving infrastructure, 5) providing governmental projects for street maintenance, 6) providing a garbage disposal system, 7) moving the animal breeding areas out away from the residential areas.

5. Conclusion
This study examined the physical transformations practiced in the El-Ekhsas area of El-Minya City as a representative example of a rural area encompassed into the urbanized areas of an Egyptian city.

Based on a field observation, and the results of the conducted questionnaire in El-Ekhsas, the study has highlighted several issues regarding the physical characteristics and transformations in the area including: a) chronological changes in its urban expansion, that is, from organic to grid-like, and then to random linear, with the disappearance of open spaces within new expansions, b) the effects of both property inheritance practices and a linear subdivision system for agricultural land on the sequential transformations of plots that led to a decrease in their average areas, and c) an increasing trend of building heights becoming more than three floors following the encompassment period, as well as an increasing trend of using reinforced concrete structures.

In addition, several negative issues requiring intervention at both the city and village levels were also observed, such as: a) the narrow widths of streets for vehicle access, and the inappropriateness of current construction laws related to street widening in light of the existing situation; b) the small plot sizes which further encourage owners to refrain from obeying the law; and c) the deterioration and lack of maintenance of built up areas due to both weak governmental intervention and a lack of resident awareness concerning their role in such improvement projects.

Thus, in light of the expected exacerbation of the above problems, this study concludes by stressing the importance of establishing partnerships between local residents and the city government within the framework of the Egyptian city planning system. Such partnerships should work in parallel in two directions. The first is to study such conflicts to obtain a consensus about the suggested local bylaws that incorporate the interests of both villagers and city planners regarding, for example, the minimum requirements for vehicle street widths, building heights, and the minimum dimensions of plot subdivisions. The second is to promote improvement projects for mitigating existing problems after raising resident awareness by educating them on the importance of such projects and their participatory role in them.

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