Geographical Information System an approach for the Development of Slums and Deteriorating areas in Cairo, Egypt.
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GEOGRAPHICAL INFORMATION SYSTEM AN APPROACH FOR THE DEVELOPMENT OF SLUMS AND DETERIORATING AREAS IN CAIRO, EGYPT

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ABSTRACT

This Paper focuses on the slums as a main challenge facing Egypt and the effect of Geographical Information System (GIS) in the development process of slums and decision making.

It discusses the strategies and different approaches used by the agencies involved in the development process, when using GIS and where it fits. Two case studies are presented as examples of slums and deteriorating areas in Cairo. They are presented and analyzed upon the GIS implementation to develop these areas. It illustrates how effective the use of GIS in the decision support, for the phases of the development (modeling, archiving, etc.). Also, how it affected the development of the areas. The first case study "The sustainable development of Eldarb El-Ahmar" used GIS to create a sustainable development system of the area to overcome the challenges and make use of the capabilities of the area. Three modules were used to develop and integrate attached projects and Touristic Neighborhoods with the studied area. The second case study of "Mansheiet Nasser" used GIS to build trust between the community and the other participators. It helped in the development process and presented a new way of development to the local authorities.

By illustrating the success and shortcoming of the two case studies, this paper argues that GIS can become a tool to develop and improve the slums' conditions, increase the quality of life and overcome the shortage of decision support and evaluation systems.

KEY WORDS:
Geographical Information System; Slums; Deteriorating Areas; Egypt.

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INTRODUCTION

Many urban districts in Egypt and in Developing Countries (DC) suffer from the deterioration of the urban environment as a result of different reasons; as rising in the population's density and the shortage of the services offered. The formation of deteriorating areas is undergoing continuous lack in main infrastructure systems and lack in basic services. Nowadays, in many cities in DC's including Egypt, half of the population is living in what is called slums or informal settlements. That led to social, environmental, economic and urban problems to occur. Egyptians are in need of shelters, services and employment. The Egyptian Government is not able to provide these basic requirements for their inhabitants. Therefore, the informal sector provides them what is called informal settlements or slums.

This paper focuses on the Geographical information system (GIS) as a tool in the development process for the slums and deteriorating areas. GIS can be that effective system; it is a computer system capable of assembling, storing, and manipulating, analyzing and displaying geographically referenced information according to their locations and help in the decision making process.

Two different case studies in Cairo are presented, to explore different patterns and approaches of dealing with Slums and deteriorating areas. The two cases represent two different types of informalities. Eldarb El-Ahmar is representing an inner city deteriorated area, surrounded by historical and touristic neighborhoods. The area itself has capabilities and challenges facing the developing process. Mansheiet Nasser is a slum area where many developing projects took place. In 2008 the Doweiqa disaster took place within the slums of Mansheiet Nasser, where a part of the Mokattam hill fell on the inhabitants and the slum area which resulted in the death of hundreds of inhabitants. At the end of 2008, the Informal Settlement Development Facility (ISDF) was established by a presidential Decree # 305/2008, in order to be the main agencie responsible for the management of the Slums in Egypt (Khalifa, 2011). The ISDF is responsible for the financial support and the regulations followed by the governmental and private sectors regarding the development of slums. It was established to detect the unsafe areas, the informal markets and the unplanned areas in Egypt. It has contributed in the change of the classification of the term "Slums" or as it is known as a "Ashwaiyat" and turned it to "Unsafe Areas" and "Unplanned areas". In September 2012, the ISDF presented a new term for the "Unsafe areas" calling it as "Slums", in the conference titled "Endorsing Global Housing Strategy 2025, the 6th World urban Forum" (El-Faramawi, personal communication, August 2012).

GIS is used within the ISDF as an essential tool to detect and analyze the unsafe areas (Slums) and unplanned areas. GIS is updated utilizing field visits and satellite images. ("ISDF", 2013)

The GIS is an essential tool in different phases of slums' development, it is present in most of the departments in the private and governmental agencies of slums development in Egypt. The Egyptian experiences, regarding the GIS use, are affective and a strong base for future development. However, shortcomings are clear. GIS is mainly used in Egypt as an archiving tool without using its full scope. Due to the rapid expansion and change in Slums, the archiving function of the GIS loses its affect, as the data become obsolete and not up-to-date.

The paper is divided into three main sections. The first section the author shows the challenge of classification of the term slums and briefly explains the formation of slums in Egypt. In the second section the author shows the main agencies responsible for the development process of slums in Egypt. Showing the main strategies and interventions followed and the role of the GIS in the development

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process. In the third part the two case studies are presented then the paper concludes with learned lessons and recommendations.

SLUMS AND THE CHALLENGE OF CLASSIFICATION

SLUMS DEFINITIONS
The term "Slum" faces challenges in its definition. It is different in every region or country in its characteristics. 'Slum' is a term which has different categories of informalities. These categories are deteriorating inner-city tenements, squatter settlements, informal settlements and shantytowns (Khalifa, 2011). The UN- Habitat report describes the slums as "a heavily populated urban area characterized by substandard housing and squalor" (2003, p: 8). The definition shows the main characteristics of slums. Physical and spatial characteristics are presented in high density, low standard of housing (in the structure and services provided). The Social and behavioral characteristics are presented in the Squalor. In the Egyptian case, slums are known as "Ashwaiyat". The term means "haphazard" or "disordered" areas. "Ashwaiyat" are areas that suffer from problems in the accessibility, narrow streets, high residential densities, lacking in infrastructure and services and the absence of open spaces (World Bank, 2008).

According to Mike Davis "Planet of Slums" (2006), 39.9% (11.8 million) of the urban population in Egypt, live in slums. Cairo has four out of 30 biggest "mega-slums" in the world. These mega slums in Cairo are Imbaba (1.0 million), Ezbet El-Haggana (1.0 million), City of the Dead (cemeteries) (0.8 million) and Mansheiet Nasser (0.5 million) (Khalifa, 2011). Although slums form a big part of the urban context within the cities, "a slum is often not recognized and addressed by the public authorities as an integral part of the city" (UN-Habitat, 2003, p: 6). UN-Habitat therefore developed a household level definition in order to be able to use existing household level surveys and censuses to identify slum dwellers among the urban population (2003). A slum household is a household that lacks one of five elements; access to improved water, access to improved sanitation, security of tenure, durability of housing, sufficient living area.

Following these five elements of the UN-Habitat and after the establishment of the ISDF in Egypt (2008), a new categorization of slums was defined by the ISDF. The two new categories are "Unplanned areas" and "Unsafe areas". According to El-Faramawi (2012), the unsafe areas are going to be named back to "slums" to match the international understanding of the term slum (El-Faramawi, personal communication, August 2012). The criteria for intervention for the "Unsafe areas" were established to match the UN- Habitat criteria represented in the five elements matching the Egyptian case. Therefore, four grades of the degree of risk were established and the unsafe areas all over Egypt were classified. GIS is used as a tool to develop informal areas as it will be explained in the following sections.

Although the ISDF has defined and classified the informal areas in Egypt, other agencies and scholars have defined the informal areas with other categories and attributes.

For example the General Organization of Physical Planning (GOPP) in its report titled "The improvement of the urban and living conditions for the Informal areas through Participatory Planning" (2006) classified the way of intervention in informal areas under three categories; Upgrading,

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Redevelopment and Containment. Redevelopment is the complete removal of slums and can be called Rehabilitation. As to the Containment, it is structuring projects on the peripheries of the city in order to stop the informal urban crawl on the agricultural land.

Another example is the categorization done by Abdelhalim (2002). Adbelhalim states that the informal housing divers in its definition due to the variety of production of informal settlements in DC's. In Egypt there are three subcategories: Popular housing, Slum and squatters and Semi-informal housing. These three subcategories, share lack of planning and a degree of illegality that cause the lack of infrastructure especially in the beginning.

The term "popular" is used to indicate to the popularity of these types of housing to the poor. It is defined as informal houses below 'acceptable' standards constructed by the poor themselves on unauthorized land subdivision of agricultural land. [fig.1]. The term "Slum" is described as poor quality shelters as shacks, tents, one-room accommodation; roof slums or shanties and deteriorated residential buildings. Abdelhalim adds that slums usually exist in peripheral locations of the city as the garbage collectors' settlements around Cairo. They also exist in the inner-city especially in vacant plots and historical buildings. Slums also include the rural housing built around the city that used to be part of villages but with the expansion of the city is absorbed and became a part of the city. "Squatter housing" is established on both private and public land and usually built with temporarily materials. In Egypt squatter housing is combined with slums as in the cases of cemeteries and squatting on roofs [fig.2]. Squatter housing is due to removal and demolish more than slums as they lack of any form of land tenure [fig.3]. "Semi-informal" housing is a commercial development for upper low-income house holders in informal areas developed on converted agricultural lands, using small-scale contractors. The main difference from popular housing is that its developers obtain building permits and construction follows design drawings. This type has mixed characteristics taken from formal and informal housing [fig.4]

From the two previous definitions of the GOPP and Abdelhalim, we can conclude that there are different ways of interventions in the informal areas. Moreover, due to the variety of production of informal settlements in Egypt, the categorizations of informality also vary. Many categorizations of slums exist, where they share the lack of planning and living conditions. From here it is obvious that the categorization of slums is not easy and limiting the types of slums and ways of interventions to specific and certain ways is not always possible.

[fig.1] Sakakiny area, Sharabeya-Cairo . Source (ISDF, 2012)

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[fig.2] Cemeteries in Cairo being used for residence. Source (The author, 2012)

[fig.3] Squatter housing, Hadayek Zeinhom. Source (ERC, 2005)

[fig.4] Semi-informal housing developed on agricultural land, Dar Elsalam. Source (The author, 2012)

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AGENCIES INVOLVED IN THE DEVELOPMENT PROCESS OF SLUMS

In Egypt there are key agencies delegated the responsibility of monitoring, developing and creating databases about all types of slums. These agencies vary between governmental and non-governmental agencies. GIS is used in their development strategies and interventions. Following is a brief description of their role in providing an acceptable solution of the slums' status in Egypt.

The Informal Settlement Development Fund (ISDF):
At the end of 2008, with the presidential Decree No. 305 of 2008, the Informal Settlement Development Facility (ISDF) was established in order to be the main agency responsible for the management of the Slums in Egypt. The ISDF aims to detect the existing slums, limit their spreading, develop a strategic plan for the slums and supply them with facilities, basic water, sanitation and electricity (ISDF, 2013). It is responsible for the financial support and the regulations followed by governmental and private sectors regarding dealing with slums. The ISDF's terms of reference are conducted in coordination with the concerned ministries, agencies and local government units, to provide them with information, expertise and necessary assistance.
GIS is used within the ISDF as an essential tool to spatially detect and analyze the unsafe and unplanned areas in Egypt. GIS is updated utilizing field visits and satellite images (ISDF, 2013) and is used as a database to archive the urban, social, environmental, economic, and legal status of each area. Before the ISDF attempt, the slums' data was provided as lists containing the slum name, population and area, without identifying and mapping the shape and boundaries of the slum (Khalifa, 2011).

The General Organization of Physical Planning (GOPP):
The organization was established with the Presidential Decree No. 1093 of 1973. It was assigned the role of establishing the rules of public policy for urban planning and the preparation of plans and programs of Urban Development in Egypt. After the Construction of the Law No. 119 for the year 2008 the responsibilities of the GOPP were to be the authority responsible for public policy planning and sustainable urban development. The GOPP is responsible for the preparation of the plans and programs of this development at the national and regional level (GOPP, 2013). The GIS is used in the GOPP as an effective tool. It is used to build a huge database for the projects of the GOPP, as preparing the database for all the cities and villages of Egypt, in order to prepare the strategic plans and the new Haez for all cities and villages (The boundaries of the city or village that is not allowed to build outside it)(GOPP, 2010).

Non-Governmental Authorities in Egypt:
There are different non-governmental organizations that provide support to the development of Slums and generally to the urban development in Egypt. This support varies between technical assistance, financial support or organizations that provide both.
The technical assistance is represented in providing funds for training or studies for the development projects. It also includes providing technical training and expertise. Some of the organizations in this area are the GTZ (known now as GIZ[1]), UN-habitat, The United Nations Development Programme

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[1] Deutsche Gesellschaft für Internationale Zusammenarbeit (German society for international cooperation). The author will continue using GTZ in the following parts.

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(UNDP) and the Aga Khan trust for culture (AKTC). The financial support is provided mainly by World Bank and the Community Development Association (GOPP, 2010).

STRATEGIES AND APPROACHES UTILIZING GIS AS A TOOL IN THE DEVELOPMENT OF SLUMS.

GIS is a tool used to deal with complex data. It combines together fragmented data coming from different sources and links them spatially to one database. GIS helps storing, organizing, retrieving and analyzing spatial data in visible forms as maps, charts, reports, tables and other forms.
The GIS role doesn't stand at building a unified and spatial database but it extends to the process of analyzing and supporting the decision making.
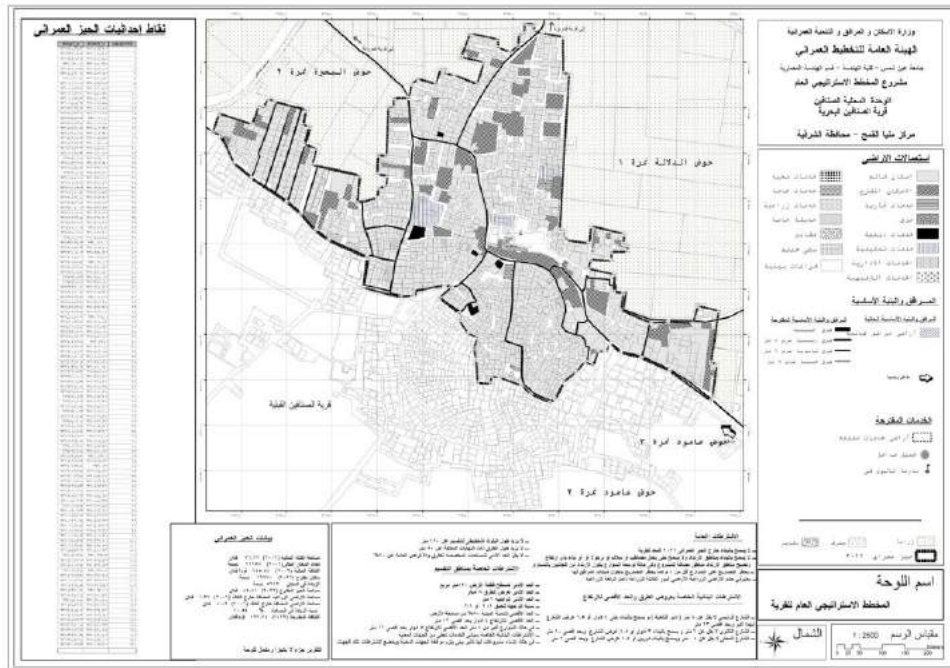
GIS AND STRATEGIES OF INTERVENTION IN INFORMAL AREAS:
The Egyptian government followed different strategies of intervention regarding informal areas. The GIS played in most of the strategies a role in establishing an updated database, where all the layers were combined to produce an updated status of the situation of informal areas.
Following two of the strategies to deal with existing and possible future formation of informal areas are presented (GOPP, 2010):

- Applications of GIS in preventing the formation of new informal areas:
  It is accomplished by upgrading informal urban settlements, providing new housing in the national programs for Housing and Tahzim the slums areas (creating boundaries around the built urban area and planning the areas surrounding slums). The government prepared a plan to prevent the growth of informal settlements by detecting the existing urbanity, creating the new "Haez" meaning the new boundaries of the Egyptian cities and villages that no buildings are allowed to be built after. The new "Haez" and the strategic plans will absorb the increase in population by providing new lands for housing and needed services for the Egyptian cities and villages [fig. 5] and [fig. 6]. The same procedure was followed with the slum areas by detect their boundaries and planning the areas outside these boundaries in order to maintain the informality. In the same time, housing projects were announced and provided in new areas.

- Applications of GIS in interventions in existing informal areas:
  The Egyptian state through its agencies and with participation of private sectors and NGO's used GIS as a tool in the development of Informal Areas through two main methods. First, creating databases and archiving the existing situation of slums in Egypt. Maps and statistics were used as a product of the system to integrate local community in decision making (see the case study of Mansheiet Nasser).
  Second, GIS is used to analyze the existing situation upon specific criteria and help the decision makers in the process of urban development (see the case study of Eldarb El-Ahmar).

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[fig.5] Strategic Plan map for El-Sannafin El-Bahareya village, Sharkeya. Source (The GIS done by the author for Ain Shams University, 2006)
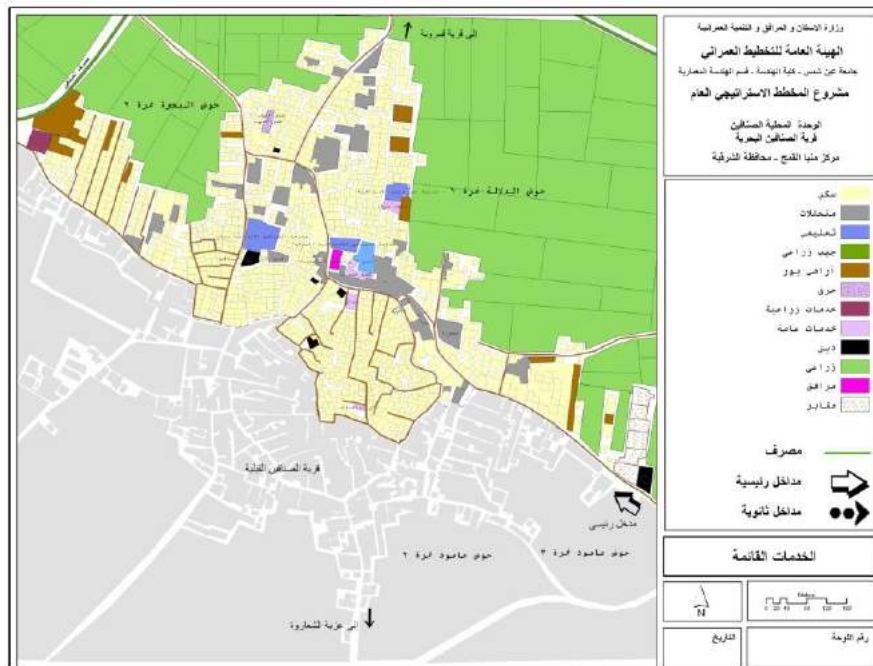
[fig.6] the existing services and the vacant lands map for El-Sannafin El-Bahareya village, Sharkeya. Source (The GIS done by the author for Ain Shams University, 2006)

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THE TWO CASE STUDIES

As explained in the previous section, the Egyptian state has used GIS as a tool for intervention in the existing informal areas. Two case studies are selected with different goals and objectives to illustrate the use of GIS and how it was implemented. The two different case studies were implemented by different governmental and private agencies. Each implemented a different strategy and procedures according to their goals and reached a certain level using GIS in their development.

In both cases the developers of the areas used maps provided by authorities and were digitized and imported into the GIS. In the case of Eldarb El-Ahmar, Autocad maps were imported to the GIS and data was collected from field and entered in the system. Modules were created afterwards, and the GIS was used in analyzing and decision making. In the second Case of Mansheiet Nasser, a different approach was used. The main idea was to involve the local authorities and the inhabitants of the developed area. The GIZ created a system unique to this case study. The two approached will be discussed below.

FIRST CASE STUDY: ELDARB EL-AHMAR

Eldarb El-Ahmar area is a deteriorating area (inner-city slum) located in the inner ancient city of Cairo [fig. 7] and [fig. 8]. The area is surrounded by the Azhar park, Salah Salem road and from the other side the historical El-Hussein district and the ancient Fatemic Cairo.

OBJECTIVE

The main objective of the project was to use the strategic location of Eldarb El-Ahmar that is surrounded by touristic historical district of El-Hussein and Azhar Park project. The workshops that supply the Bazars and shops of El-Hussein touristic district with handmade products, are located in the area of Eldarb El-Ahmar. By transferring the Azhar Park into a recreational area full of restaurants and green areas, targeting all levels of the society including the inhabitants of Eldarb El-Ahmar, was playing the role of the financial support for the development of Eldarb El-Ahmar.

Therefore, the GIS system was designed by the team (Abouelmagd, Hosny, Faruk, 2004) to achieve the following objectives:

- Introduce fast informed responses based on instant analysis.
- Produce new methods and techniques for efficient decision making in order to improve the living conditions of the inhabitants.
- Demonstrating the efficiency of GIS in managing sustainable development of Eldarb El-Ahmar

SYSTEM COMPONENTS

The system is divided into three modules. Each module was designed to be user friendly to non-GIS users and to be flexible and adjustable to the given criteria for selection and weighting by the decision maker (Abouelmagd et al. 2004). The modules are divided into:

1) Site Selection support system: Providing information and classification assisting planning decision making. This module is responsible for classifying the urban elements for development and illustrating them upon the criteria given by the user. The urban elements for developments varied between:

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[fig. 7] Eldarb El-Ahmar, deteriorating area. Source (AGTC, 2001)

[fig. 8] Eldarb El-Ahmar and on the right the area that became the Azhar Park. (AGTC, 2001).

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- The selected Paths to connect the surrounded Historical and Touristic areas with the Project of Azhar Park, going through the developed area of Eldarb El-Ahmar.
- The selection of land plots suitable for establishment of Markets to support the workshops and their products.
- The selection of land plots to create Open spaces. [fig. 9]
- The Emergency Exit routes for the inhabitants and for the Emergency vehicles to enter the condensed area of Eldarb El-Ahmar.

2) Maintenance support system: The module is responsible for:
- Archeological maintenance: Assisting maintenance statistics and implementation of valuable archeological places. Mainly responsible for the restoration of the historical Salah-eldin wall, where it was discovered under tons of dust when starting in the Azhar Park project. [fig. 10]
- Housing maintenance: Implementing the GIS system prioritizing decisions of housing maintenance. Specifically, the houses attached to the Salah-eldin wall and need immediate restoration.

3) Socio-Cultural Development Analysis: This module directs the socio-cultural development by providing various statistics & analysis techniques [fig. 11]. It is an updated module presenting data for:
- Employment for the inhabitants of Eldarb El-Ahmar.
- Employment needs.
- Credits and loans survey.
- Housing survey.
- Demographic data.

THE OUTPUTS OF MODULES
- Report of all candidate selections and scored upon the customized criteria.
- Thematic maps of the resulting candidates.
- Those outputs are to be used in further analysis to help in the Decision making process.

GIS OUTPUTS AND CONCLUSION
The project of Eldarb El-Ahmar, aimed to create a sustainable development to the area by targeting problems as poverty, unemployment, poor condition of housing and urban development. The project aimed at integrating Eldarb El-Ahmar area with surrounded projects as Azhar-Park. The Park is used as an open space for the inhabitants, it created job opportunities in its projects and is the financial resource to develop the individual projects and house maintenance to the inhabitants of Eldarb El-Ahmar.

The GIS with its layering system and integrating the factors together, more markets and workshops were located and classified. Which aimed to enrich the area and supply the surrounded touristic districts with ornamented and hand made products.
New touristic nodes were selected and classified to change the environment of the place and create touristic routes connecting the old Cairo with the park thought the developed area of Eldarb El-Ahmar. The GIS helped the decision makers by statistical reports and produced maps showing the houses in need for maintenance and attached to monuments or on chosen touristic routes connecting El-Hussein

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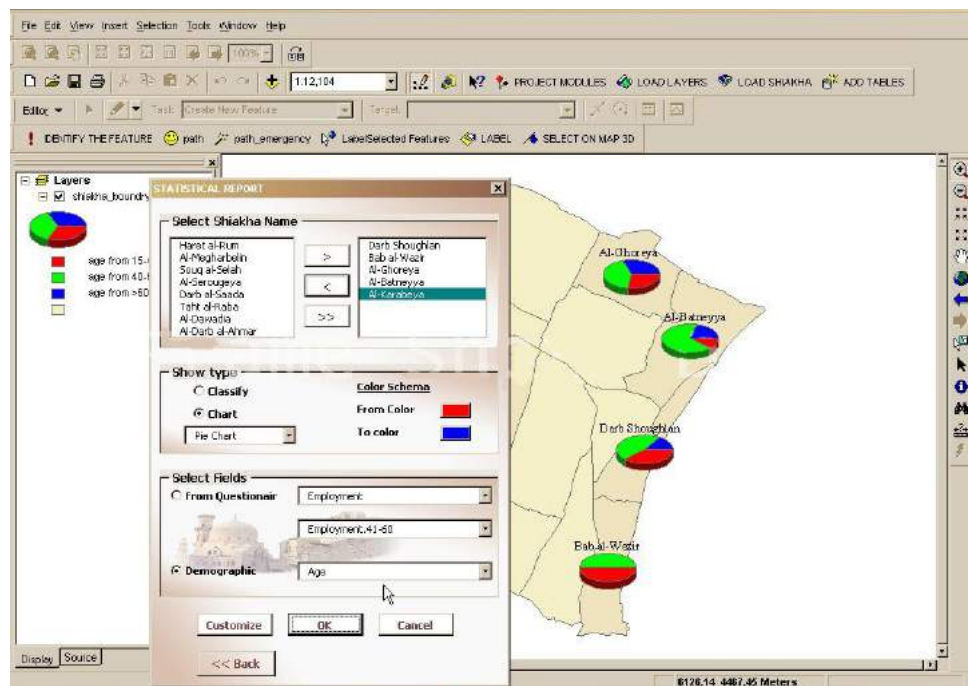**N-AERUS XIV**

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area with the Park through Eldarb El-Ahmar. All Selections were classified upon chosen criteria and weighted upon their importance.
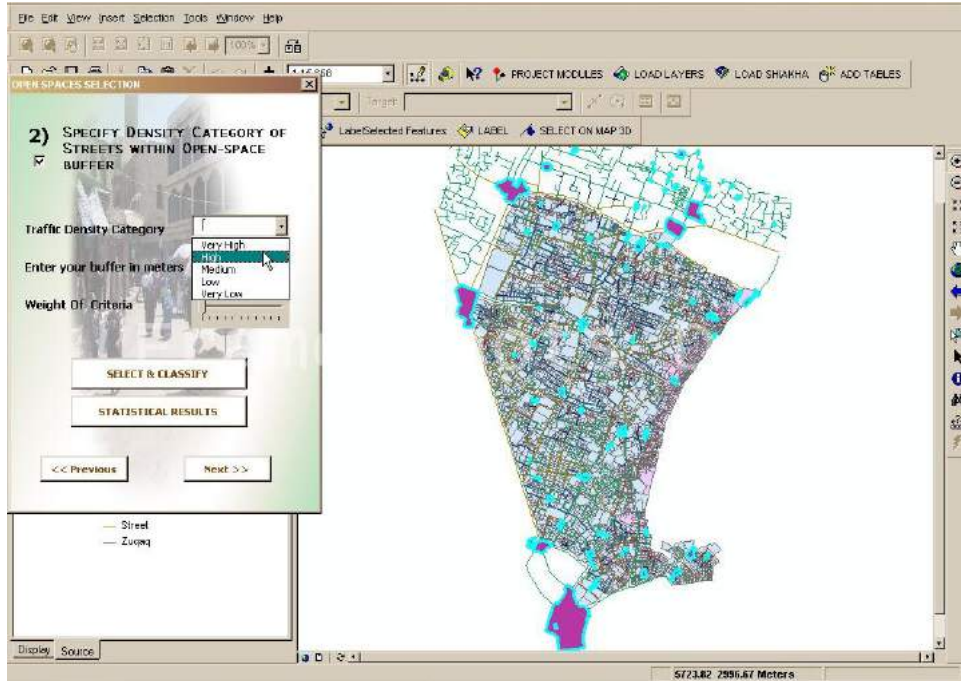
[fig. 9] Snapshot of the first Module, classifying the selected open spaces upon the density of the surrounded streets within a specified buffer as one of the criteria of the final selection. Source (The author, 2004)
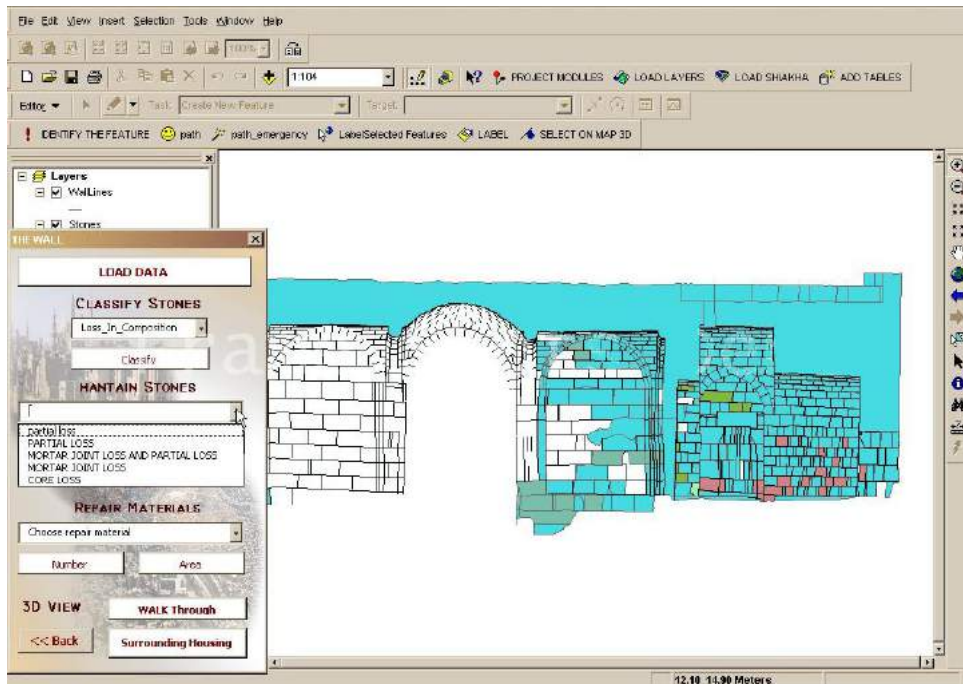
[fig. 10] Snapshot of the second Module, classifying the stones of Salah-eldin historical wall upon their conditions and the proper restoration materials. (The author, 2004)

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[fig. 11] Snapshot of the third Module, giving statistics of chosen demographic data. (The author, 2004)

SECOND CASE STUDY: MANSHEIET NASSER

The second case study Mansheiet Nasser area is a slum, located on desert land owned by the government. The area is a progressing settlement. It is located on the Nasr road and surrounded by El-Mokkattam hill, Tiaran road, Autostrad road and Salah-Salem road.

OBJECTIVE

The main objective of the development project was improving the living conditions of the poor population in the district of Manshiet Nasser. The GIS was used to achieve objectives including:
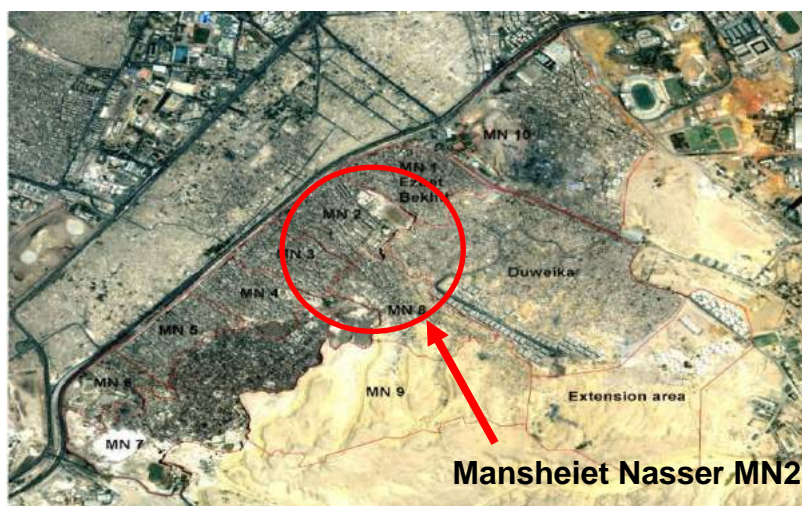
- Give the ability to representatives of local civil society, local business and local administration to implement available tools of participatory urban upgrading on their own.
- Enable the representatives to develop their own concepts to improve their environment, livelihood and access to services.
- Enable local stakeholders to consolidate a planning vision and mobilize public, private and community resources to implement development activities in a participatory way.

SCOPE OF PROJECT AND PARTICIPATORS

The scope in this study is the area of: Mansheiet Nasser, MN2 (Mansheiet Nasser area two) [fig. 12] and [fig. 13]. The participatory local development (5-Year-Plan 2002-2007) was based on the agreement between Cairo Governorate, The German Technical Cooperation (GTZ) and the German Bank of Reconstruction (KfW).

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[fig. 12] Mansheiet Nasser hard environment. Source (Middle East Online, 2007)

[fig. 13] Mansheiet Nasser, the area MN2. Source (Google maps edited by the author, 2006)

RESULTS OF THE PROJECT

In order to achieve and fulfill the objectives of the project certain actions had been taken (T.R. Manshiet Nasser, 2005):

Understanding the local community:

As the local community represents the main base for the development to succeed, certain actions took place to bond the connection between the stakeholders and the local community and to better understand the needs of the local community.

- Daily presence for one to two months.
- Using the satellite image maps to update the situation by the interested persons or groups of the local community by going with them on community walks. [fig. 14]

Public Days:

With the cooperation of the District Chief, local community was invited in Public days for participation. The meetings took place in public areas as schools, youth centers or any convenient

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space, but not in the administrative buildings. The local community included interested residents from genders, local business owners, local students and council members.

[fig. 14] Left, community participation on satellite images. Right, GIS outputs from the data of the community participation. Source (GTZ, 2006)

The local community organizes itself and integrates outside support:
It was essential to assist the community in establishing a stakeholder council. The representatives of public bodies (local administration, local popular council, NGOs) as well as natural community leaders and community representatives could be elected or nominated and then announced and endorsed at the end of the Public Day. This nominated council would act as a representative for the community and in the future without outside support.

Stakeholder Council presents a local development plan:
The participators (mainly the Cairo governorate and the GTZ) of the project acted as facilitators for the local planning meetings. They assisted the stakeholder council in organizing and conducting regular planning sessions by holding Public Days and meetings with the District Chief and the local community for discussion. GIS printouts and 3D models were presented to follow up with the development from one meeting to the next. The steps and decisions taken in these meetings were updated on the GIS database and simple GIS follow-up or model updating was presented the followed meeting. With public, private and community contributions, with help from a GTZ expert the budget plan was prepared.

Monitoring:
As the consultant keeps records of feedbacks after each step and meeting, GIS-information printouts of the neighborhood and progress were hand out to interested inhabitants.

The results of the above actions lead to a change in the local community and build trust and partnership. Young inhabitants started to participate and initiatives took place from the local community. The local community started to assess its needs on basis of studies and plans presented from the participators and took part in the Guide Plan and studies.

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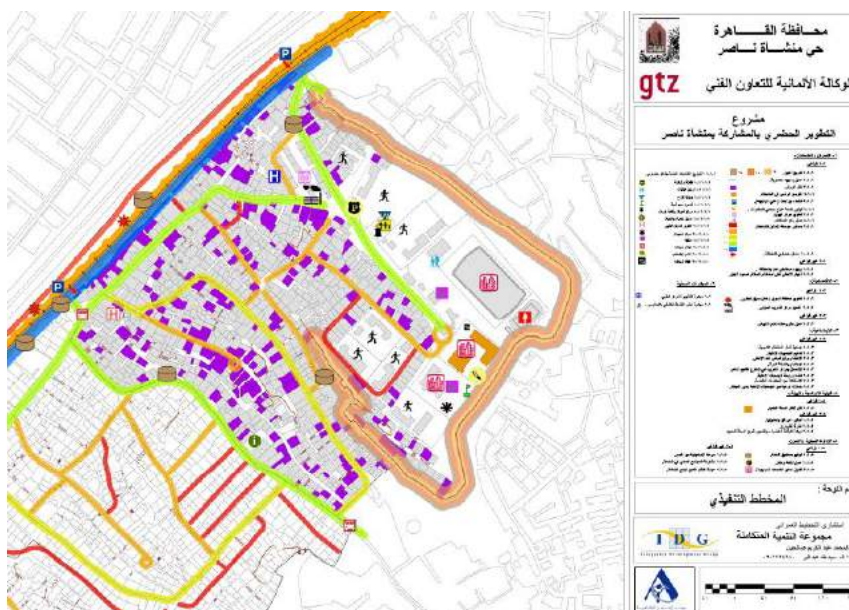**N-AERUS XIV**
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GIS OUTPUTS AND CONCLUSION

GIS acted as an important tool to archive, unify and correct the data of the district. It was used to produce the maps needed for the development process and for the visualization process for the inhabitants of the district. GIS had a role by its accuracy and illustrated outputs to build trust between the community and the other participators and to allocate the problems and the potentials of the district. GIS was also used to allow the community to participate in the strategic plan and allocate the needs of their districts.

On the other hand, the large potentials of GIS in analyzing, overlaying, cross sectioning all the data and helping in the process of decision support in urban development, were not completely used, except in very limited fields. As calculating the length and width of the streets, in order to calculate the pavement amounts needed and their costs. Also, to calculate the drainage and water supply pipes, their length, to whom they should be delivered and the lines directions.

The governorate didn't use the GIS as a decision support tool except in some limited cases, but mostly used it to unify the data for Mansheiet Nasser. The collection and unification of accurate data was an important achievement to update the local municipalities and be shared with other ministries in order to take decisions for the area. For example: the ministry of social solidarity, used the database and the functions of GIS, to detect the places of bread suppliers Kiosks or bakeries and how many inhabitants do they serve. Then they detected the areas in need. Using the database they detected the suitable places for new Bread distribution Kiosk and according to the availability of vacant lands and the inhabitants' density.

GIS was used in almost all the cases in archiving data, presenting outputs in forms of maps, entering the data of the decisions taken by the participators and local community [fig. 15]. The data was represented in form of maps, although in also some cases the AutoCAD program was used ignoring the potentials of using the GIS instead.

[fig. 15] Implementation plan of MN2 (GIS output). Source (Shaat, 2009)

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CONCLUSIONS PERTAINING BOTH CASE STUDIES:

- The application and in general "the sustainable development of Eldarb El-Ahmar" project, attempted to create a sustainable development to Eldarb El-Ahmar area, by trying to overcome challenges as poverty, unemployment, poor condition of housing and others. Not only by developing the area, but also with integrating the area with attached projects as (Azhar Park). This integration aimed to make the park an open space for the inhabitants allowing job opportunities. Parts of the resources coming from the park were used to develop the individual projects of the inhabitants of the area and for house maintenance. These decisions were taken based on statistical reports and maps from GIS, categorizing houses needing maintenance upon certain criteria. These criteria are as houses attached to monuments, located in touristic route and specific condition of the house, all weighted upon their importance.
- The layering system and the overlay that the GIS application allowed markets and workshops to be located upon specified criteria. As the neighborhoods around Eldarb El-Ahmar have touristic and historical value (old Cairo). These areas as the famous El-hussein touristic area needed supply for ornamented products from workshops of Eldarb El-Ahmar and the new markets would absorb the new products and enrich the area of Eldarb El-Ahmar.
- The touristic monuments were located, vacant lands or deteriorated buildings, were located chosen upon criteria, and new touristic nodes were chosen to change the environment of the place and create touristic routes connecting the old Cairo with the park thought the developed area.
- The second case of Mansheiet Nasser, the GIS acted as a tool to archive, unify and correct the data of the district. It was used to produce maps needed for the development process and also for the visualization process for the inhabitants. In order to build trust between the community and the other participators GIS was a critical tool to allocate the problems and the potentials of the district.
- GIS was used to allow the community to participate in the strategic plan and allocate the needs of the area.
- Except in very limited cases, the governorate did not use the GIS as a decision support tool. GIS was used to unify the data for Mansheiet Nasser. The collection of accurate data enabled the local municipalities to update and unify their database. Data could be shared with other ministries in order to make decisions for their respective areas. Examples are: the ministry of social solidarity to divide the production and the distribution of bread, it needed the bakery places and the more possible places to cover the distribution process.

LEARNED LESSONS AND RECOMMENDATIONS

- GIS is able to fit in the development plan and it would help to improve and facilitate the analysis, retrieving data as illustrated on maps.
- Mapping slums, their emergence, direction of growth, density and any changing in the urbanity can be done through using satellite images and the GIS applications in detecting these changes, archiving and analyzing them as the Mansheiet Nasser MN2 project with the GTZ .
- GIS could also help to provide alternatives and estimate the investment environment located in the area for development. Attracting investors and bank capital to finance the upgrading and development for these projects.
- The trained persons from the municipalities formed a node to spread the knowledge as to how to use the GIS and generate different databases, as in case of Mansheiet Nasser.

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- Although GIS represents a database for the slum areas and the development projects but the system lacks unification in its data between authorities. There are no shared data and the updates for each authority do not reflect on the other authorities. Money and effort are wasted and could be better used. The full use of the GIS capabilities for helping decision making were rarely used where GIS can be used to help creating a new improved urban environment and improve life of inhabitants.

- The author suggests building a unified urban data model (template) to be followed by the authorities in Cairo and gradually be followed by the rest of governorates.

- This unified data model should be built with the help of the local authorities, organization and the experts in the GIS applications.

- The model of Eldarb El-Ahmar as a friendly user GIS application connected to the unified database should be generalized. The authorities and decision makers should be supplied with a GIS user friendly application to work as an interface to the GIS database. This database has to be shared in a network between these authorities in order to facilitate the updating, retrieval, analysis and outputs of the data through a simple training to the employees without the need of special experts in all the processes.

- The project of Mansheiet Nasser trained the local authorities; a training module has been implemented to maintain the data and how to update it in the unified GIS database. Most of the authorities have a GIS unit but not fully active as it is not trained as other units in other areas and not following the same data model or database nor sharing the same system of work.

- The public participation proved to be essential. Not only for the public to allocate and describe the needed services, but also to build an accurate database and gain trust. No one knows the area better than its inhabitants. In each phase of the development project, public participation should be solicited and organized through workshops and seminars. Representatives from the inhabitant's genders should be invited including women, men from different ages and working status. These representatives should participate in the decision making process for each phase.

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