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**Master Thesis**

# **Developing Multi-Criteria System for Prioritization of Urban Developmental Projects Gaza City as a Case Study**

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## Dedication

A special dedication is presented to our beloved parents who supported and surrounded me, with their pure care, endless bounteous, and their sacrifice hearts, that illuminate our anguished sights.....

To my husband , my children Hesham, Akram and Mahmoud , sisters and brothers who offered me unconditional love and support throughout the course of this thesis...

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## **List of Abbreviations**

|        |   |
|--------|---|
| AHP    | Analytical Hierarchy Process                                  |
| CHF    | Community Humanitarian Fund                                   |
| GIS    | Geographical Information System                               |
| DSS    | Decision Support System                                       |
| DBMS   | Database Management Systems                                   |
| INGO   | International Non-Governmental Organization                   |
| MCDA   | Multiple Criteria Decision Analysis                           |
| MCDM   | Multi Criteria Decision Methods                               |
| MCM    | Million Cubic Meter   |
| MDLF   | Municipal Development and Lending Fund                        |
| MOE    | Ministry of Education   |
| MoLG   | Ministry of Local Governance                                  |
| NGO    | Non-Governmental Organization                                 |
| OCHA   | Office of the Coordination of Humanitarian Affairs            |
| SMCA   | Spatial Multiple Criteria Analysis                            |
| PCBS   | Palestinian Central Bureau of Statistics                      |
| PWA    | Palestinian Water Authority                                   |
| UNDP   | United Nations Development Program                            |
| UNICEF | United Nations Children's Emergency Fund                      |
| UNRWA  | United Nations Relief and Works Agency for Palestine Refugees |
| UN     | United Nation   |
| WB     | World Bank  |
| WHO    | World Health Organization                                     |

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## Abstract

In the meantime , development projects sometimes targeted unneeded geographical zones without having a clear framework that are based on studying Multi-Criteria of urban zones in term of poverty rates, available resources, current developmental projects, unemployment rates, youth distribution in the urban zones, gender share, ages and all related Multi-Criteria that should be taken into consideration while doing the needs assessment for Human Developmental Projects. Therefore, projects funded by donors or local institutions do not always properly integrate into a comprehensive planning system that correspond consistently with local community needs. So, it is crucial to develop a method for prioritizing the required projects based on the urban planning strategies available in the Ministry of Planning , Ministry of Local Governance and local municipalities. The Thesis discussed how to identify priorities for improvement and to create an optimized program to facilitate access to the measurement of these indicators. The methodology of the research was based on identifying relevant indicators and the weight of each one, in addition to the interrelated nature of the relationship between them. The main results were having a sample of computerized program that could be used to measure these indicators and their weights. Sub-indicators were also proposed based on response of 100 questionnaires that targeted professionals and stakeholders in Gaza City, as needed to help identifying these priorities and how to determine the extent of its power based on economic, social, and environmental aspects, additionally, regional plans and structural elements of local communities were taken into account. The thesis developed a new multi-criteria system using Gaza City urban structure as a case study to help the decision makers in NGO's and government in ranking developmental projects. The case study constituted a framework for available database for urban planning based on geographical distribution of developmental projects. The Thesis ended up with a framework for three case studies , the development of water networks , water wells and allocation for new schools that can be implemented by most of INGOs and Governmental Organizations in which they will be able to have a systemic approach in doing any needs assessment for urban planning for developmental Projects.

## المخلص

تعتمد المشاريع التنموية احيانا على استهداف مناطق جغرافية غير الضرورية دون وجود إطار واضح تقوم على دراسة جميع العوامل المؤثرة في هذه المناطق الحضرية مثل معدلات الفقر، والموارد المتاحة، والمشاريع التنموية الحالية، ومعدلات البطالة، وتوزيع الشباب في المناطق الحضرية، و توزيع والأعمار وجميع العوامل ذات الصلة التي ينبغي أن تؤخذ في عين الاعتبار عند القيام بتقييم الاحتياجات للمشروعات التنموية البشرية. لذلك و من هذا المنطلق، فإن المشاريع التي تمولها الجهات المانحة أو المؤسسات المحلية لا يتم دمجها أحيانا بشكل صحيح في نظام التخطيط الحضري الشامل التي تتوافق دائما مع احتياجات المجتمع المحلي. لذا، لا بد من تطوير طريقة لتحديد أولويات المشاريع المطلوبة على أساس استراتيجيات التخطيط الحضري المتوفرة في وزارة التخطيط والبلديات المحلية. ان أطروحة المقدمة تناقش كيفية تحديد الأولويات لتحسين وتهيئة البرنامج الأمثل لتسهيل الحصول على قياس هذه المؤشرات. استندت هذه المنهجية للبحث في تحديد المؤشرات ذات الصلة، ووزن كل واحدة، بالإضافة إلى الطبيعة المترابطة للعلاقة بينهما. إن أهم النتائج في هذا الصدد هو ايجاد برنامج محوسب يمكن استخدامه لقياس هذه المؤشرات وأوزانها، وسيتم من خلالها اقتراح مؤشرات فرعية بناء على الاستبيان الذي يستهدف مئة من المهنيين وأصحاب المصلحة، حسب الحاجة للمساعدة في تحديد هذه الأولويات، وكيفية تحديد مدى قوتها بناء على الجوانب الاقتصادية والاجتماعية، والبيئية، بالإضافة إلى الخطط الإقليمية والهيكلية متخذا بعين الاعتبار عناصر من المجتمعات المحلية. إن الأطروحة المقترحة تسعى الى وضع معايير جديدة متعددة الانظمة باستخدام منطقة بحثية و هي مدينة غزة كحالة دراسية لمساعدة صانعي القرار في المنظمات غير الحكومية والحكومة في تحديد اوليات المشاريع التنموية. تشكل دراسة الحالة إطارا لقاعدة البيانات المتاحة من أجل التخطيط الحضري على أساس التوزيع الجغرافي للمشاريع التنموية. إنتهت الرسالة بتحديد الإطار المنهجي لثلاثة من المشاريع التطويرية و هي تطوير شبكات مياه و انشاء ابار و انشاء مدارس جديدة الذي يمكن تنفيذه من قبل معظم المنظمات غير الحكومية الدولية والمنظمات الحكومية التي سوف تكون قادرة على اتباع نهج منسق في القيام بأي تقييم لاحتياجات التخطيط العمراني للمشاريع التنموية.





# Chapter (1) Introduction

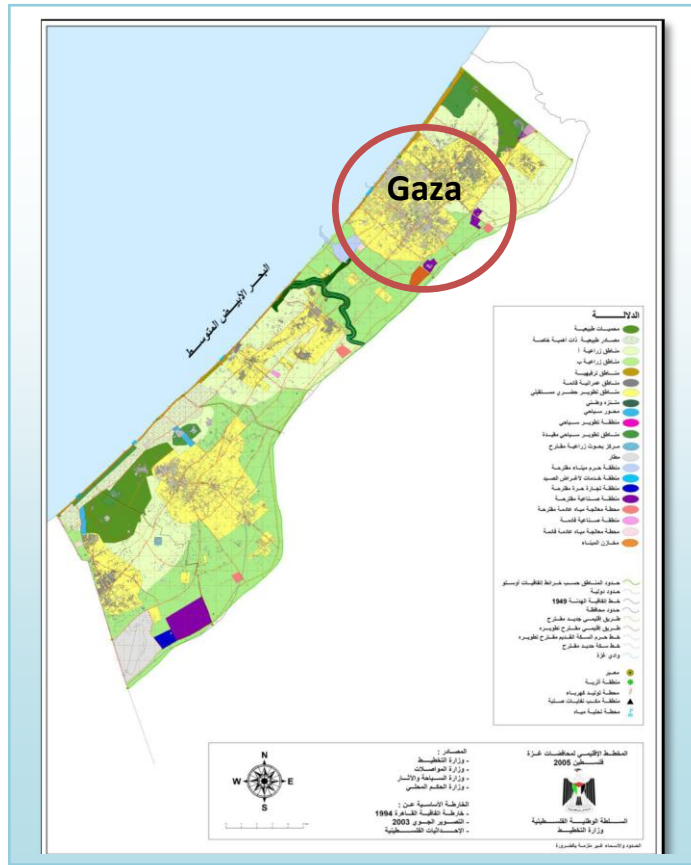
## 1.1 Introduction:

The Gaza strip is one of the most density populated areas in the world estimated at 3,800 persons/ Km<sup>2</sup> This has put a lot of pressure on the economy to sustain a certain level of living for Gaza residents. The unemployment rate is about 31%, while the people below the poverty line are approximately 80% (PCBS, 2011).

Economic resources of Palestinian national are limited and depend in many cases on external supports, donors and grants. Also Palestinian national economy has low national strategic control and self-monitoring system according to World Bank (2011).

Palestinian society has diversity of living environments and standards. Palestinian institutes and NGOs have played an important role in development activities. These activities have significant impact on the development of the local area, through infrastructure development.

This research will develop an important model for Multi-criteria analysis which can be used in several projects as a tool for prioritization of projects. This model will be



**Figure(1. 1) location map for case study in Gaza Strip (Source: Ministry of Local Governance, 2007)**

used as decision support system for planning departments in Palestinian institutes and NGOs. Allocation of development projects is critical task since each area in Gaza Strip (Figure 1.1) has different needs like educational needs, recreational needs, social needs and etc. Decision makers faced challenges in determining and assessment the needs.

## **1.2 Problem Statement:**

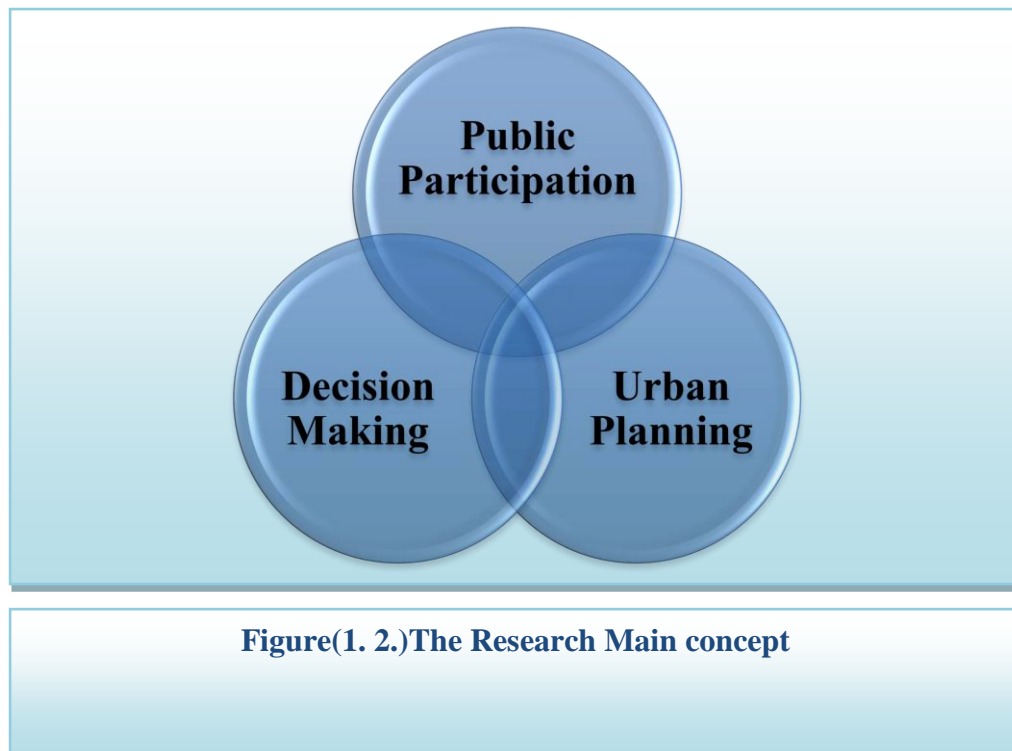
The Palestinian society has an integrated fabric community consisting from Refugees' camps, villages and cities. Due to Lack of financial resources the Palestinian society depends on the grants and external financial support. Allocation of the financial support among Palestinian cities faced in many cases conflicts in projects importance. World Bank (2006).

Poor information network between cities or municipalities causes in many cases wrong decisions. In addition to the limited highly cost available lands , which emphasized the needs of having conceptual framework of suitability mapping for the developmental projects.

Based on interviewing results and studying the local current approaches ,the majority of International Non-Governmental and governmental Organization are adapting nonsystematic approaches in identifying the needs of urban planning.

As a result, development projects sometimes targeting unneeded geographical zones without having a clear framework that are based on studying all Multi-Criteria of urban zones in term of poverty rates, available resources, current developmental projects, unemployment rates, youth distribution in the urban zones, gender share, ages and all related Multi-Criteria that should be taken into consideration while doing the needs assessment for Human Developmental Projects, *according to World Bank Report (2006)*.

Maximizing the benefits of limited resources and involve all partners in the process ,visualized a real need to develop effective prioritization model for developments projects.



### 1.3 Research Aim

The main aim of this study is to develop a framework model for assisting the decision makers to prioritize the development projects based on real criteria.

#### 1.3.1 Research Objectives:

- Objective1:** To assist the local and governmental organizations and INGOs in developing selection strategy for major urban developmental projects .
- Objective 2:** To establish a decision support system to implement the allocation strategy of prioritized urban projects.
- Objective 3:** To apply projects prioritization framework model based on weighted criteria using GIS –Based MCA System.

### 1.4 Research Importance:

The research highlighted the significance of decision making mechanism in Urban planning in Gaza Strip.

- The study led to determine a frame work for all INGOS and which uses sophisticated tools to analyze and measure multi criteria in indicators levels in master plans of Palestinian strategic plan

- The Thesis formalized a framework that can be implemented by most of INGOs and Governmental Organizations in which they will be able to have a systemic approach in doing any Needs Assessment for urban planning for developmental Projects.
- The conceptual frame work represented reference for many other Palestinian organizations in urban planning.

### **1.5 Research Scope and Limitations:**

This study was limited to Gaza governorate including the refugee camps. The projects used in this research was be limited to urban development projects under planning phase to support decision makers in determining the prioritization criteria.

### **1.6 Research Questions:**

The strategy of this research had been influenced by governmental organizations and INGOs. This research will answer the following questions:

- How we can improve the decision making process using Multi-Criteria Model?
- What are the most important criteria for prioritization of development projects?
- Where the most important projects do lies?
- Which projects are relatively effective to be implemented?

### **1.7 Research Hypothesis:**

The proposed thesis focused on proving a certain hypothesis: developing systematic conceptual framework model based on real criteria will lead decision makers to prioritize urban developmental projects.

### **1.8 Previous Studies:**

#### **❖ Study No. 1**

#### **GIS and Multi-criteria Analysis for Land Management , 1998.**

Summary: This paper addresses the land management and planning using open decision making process and multiple relative analyses. Its main objective is to develop a mechanism that enhances stakeholders decision making. It focused on how to facilitate MEDUSAT Model as structured application of GIS and Multi

criteria analysis methods to support land managers. The final model using this methods was used to aggregate the information and choose the most appropriate decision and solutions .It resulted in classification of land management into favorable, uncertain and unfavorable multi criteria. The resulting map in the paper translated the decision making preferences relevant to land management in the study area. The paper proposed an application concerning the suitability of evaluation habitation. (F.Jorin,1998)

❖ **Study No. 2**

**Using GIS and outranking multi-criteria analysis for land use suitability assessment , 2001.**

Summary: The paper addressed the issue raised by land-use planners in doing complicated decision in sustainable development and economic comprehensive . The methodology in the paper concentrated on the usage of MAGISTER which is a support software using GIS and MCDA which applies the analytical needs of lands planners. The paper's main result was to produce land suitability map based on complex evaluation criteria .The analysis facilitated an excellent tool ( framework ) for promotion of democratic decision making in the field of land planning in the urban design.( Jorin,2001)

❖ **Study No. 3**

**Spatial Multiple-criteria Decision Analysis in integrated planning for public transport and land development study in Klan valley, Malaysia ,2006.**

Summary: The paper focus on the evaluation of an integrated plan for public transport system and land use management in Klange Lang valley. The evaluation was facilitated through Spatial Multiple Criteria Analysis "SMCA" which aims to develop a framework that address an effective rail network (public transport)including land-use to meet future and long term 2020 socio-economic and environmental issues. The results obtained from the analysis of different evaluation criteria .

The paper empathized on using the approach of MCDA which help in performing effective decision making process related to network design alternatives. The final selection represented a network reflecting the engineering, environmental social and institutional objectives.

The main results can be summarized as modeled pair-wise comparison method as applied in the paper that had proven its ease of use within limited time constraints in the conceptual framework, while the usage of MCDA methodology in prioritization the public transport needs process to reach to satisfactory results despite having some weakness aspects. (Sharifi et al ,2006)

#### ❖ **Study No. 4**

##### **Urban Stream Rehabilitation through a decision-making framework to identify degrading process and prioritize management actions , 1999.**

Summary: The paper addresses the promotion of rehabilitation works in urban planning through physical habitat in urban streams to increase its biological diversity. The evaluation was carried out using multiple criteria of various indicators biotic , structure and function.

The paper proposed a method extracted two studies: the first one is region, as survey was conducted to discuss three environmental variables, the second one addresses an experiment to assess the effect of artificial rock riffles on small low land urban stream. The study was done using a method of decision making for prioritizing management. The main results were focused on developing model that proposed the initial plans towards effectiveness of resources in rehabilitation urban stream.(Walsh,1999)

#### ❖ **Study No. 5**

##### **GIS based and analysis Network process based on Multi-criteria decision aid for sustainable urban form selection of Stockholm Region, 2011.**

Summary: The urban planning in sustainable perspective visualized a great complexity, because of its intensive and different decision making process, alternatives and criteria that need to be taken in place, accordingly the usage of Multi Criteria Decision Aid (MCDA) in decision making process in planning configure a real potential in facilitating this mechanism in proper way, this methodology included GIS-based MCDA using the Analytical Hierarchy Process (AHP).

The paper emphasized on the cooperation of three main aspects of urban planning: land-use and transportation system together with public participation which will help planners and decision makers to understand the dynamic balance between

environmental, economical, and social sustainability. The hierarchal linkages between variables in the planning criteria configure problematic approach since the weight of the criteria state the weight of the alternative.

The Paper addressed the effective usage of GIS based MCDA tool to design a framework to model decision making process considering results taken from specified methods about relevant criteria to promote the sustainable development of Stockholm .The results of the paper were presented in maps as case studies using several urban planning scenarios, the paper concluded that compact one is considered to be the most applicable urban form for a sustainable approach of Stockholm. (G.Almu, 2009)

## 1.9 Methodology

The objectives of the research was achieved by conducting the following steps:

### 1) Literature Review

Relevant documents, papers, reports, experiences and practices were reviewed in the fields of decision support system and prioritization systems.

### 2) Assessment of prioritization criteria system.

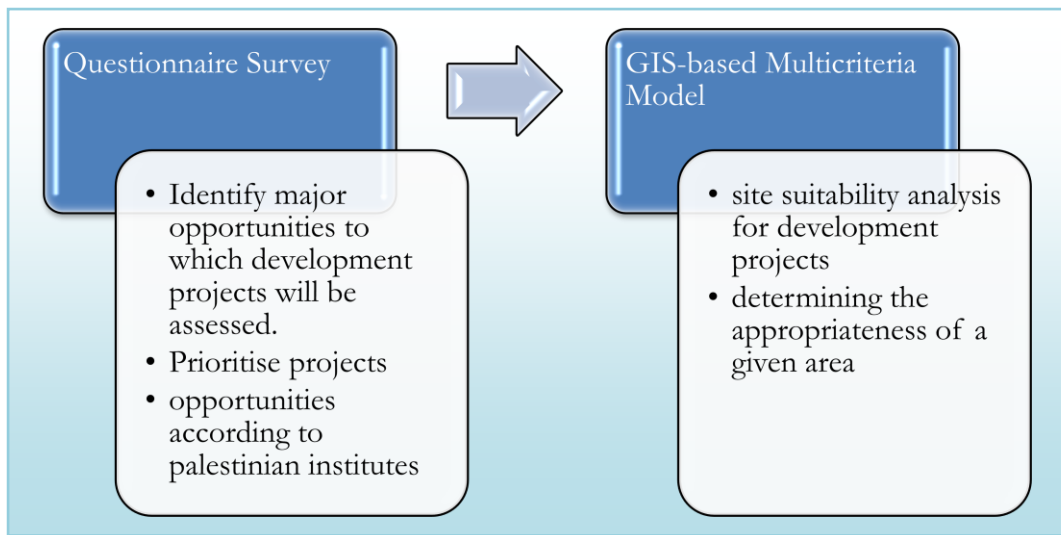
Strengths and weaknesses of the current process in Palestinian institutes were assessed based on prioritization criteria for development project selection.

### 3) Studying the policies of donors

Policies of donors were studied to build criteria system to avoid contradict between the model and available policies based on supporting sectors.

### 4) Designing a questionnaire

Several of meetings and interviews with the active representatives of Palestinian ministries and donors in the field of Decision support system was prepared. Questionnaires results were the input data for the model of GIS-based multi-criteria. Figure (1.3) shows the framework for development projects analysis.



**Figure(1. 3)A multi-criteria framework for development projects analysis**

#### 5) **Building GIS database**

Spatial allocation of development projects were done using GIS system. Comprehensive framework model will be established and integrated between GIS system and prioritization model. Several spatial maps were created for allocation of development projects in pilot study.

#### 6) **Pilot study**

A pilot study of this research was Gaza Governorate. Gaza city represents the economic center of Gaza Strip. Also in Gaza city there are diversity in Living environments and population activities , which can be suitable study area for this research.

#### 7) **Data analysis and findings**

The collected data had been efficient to gain clear picture on the priority of development projects.

#### 8) **Model development and evaluation**

Based on the data collected, observations and analysis, prioritization system will be organized and developed. The model was evaluated through Palestinian relevant ministries and organizations .**Materials**

Data required for the accomplishment of this study was acquired from the Ministry of planning, Land authority and Palestinian central Bureau of statistics.



### 1.10 Research Structure:

This research consists of six chapters as follows:

**Chapter (1), Introduction;** this chapter includes introduction to the research, problem statement, its main aim and objectives, the methodology applied for research and its organization.

**Chapter (2), State of knowledge;** this chapter includes literature review about GIS based multi-criteria models used in prioritization of development projects in developed and developing countries. It covers available techniques and strategies of multi-criteria system.

**Chapter (3), Methodology;** this chapter describes the methodology adopted for the research data collection, variables and sample selection. It covers questionnaire structure, database analysis used in decision support model. Also this chapter contains the GIS technique used in the framework model.

**Chapter (4), Assessment of development projects criteria in Gaza City;** this chapter covers the need assessment of development projects in Gaza city. This chapter analyzes the collected database using the questionnaire distributed to Palestinian institutes and NGOs located in Gaza. This chapter also presents and the allocation strategy for planned projects in Gaza city.

**Chapter (5), Prioritization of development projects by GIS Based Multi-criteria Model;** this chapter includes the description of the model, concept. It includes the Prioritization of projects using different criteria. Also this chapter will include the produced GIS maps and determining the location of the prioritization project in Gaza city.

**Chapter (6), Conclusions and recommendations;** this chapter comes out with, findings that are concluded from the research and the recommendations for decision makers in the planning departments.

# Chapter 2: State of Knowledge (Literature Review)

## 2.1 Introduction

The strategic urban planning is a scientific approach which is used to formalize the priorities and the developmental objectives for the urban communities; it also aims at determining the program. Since it is difficult to consider a Strategic development of the current and coming generations with-out deep considerations of a planned and controlled growth of urban areas, thus strategic urban development aims to focus on determining the potential needs and challenges and diagnosis the current situation.

In addition, it will lead to develop comprehensive vision expressing the current needs within an effective timeframe.

## 2.2 The Role of Multi Criteria System for Prioritization in Strategic Development Urbanization:

Developing countries are in continuous process in identifying suitable urban developmental projects for future development. Gaza Strip is already developed and the present population is exceeding the projected population. Thus, selecting the location for Urban Developmental Projects sites is a complex process involving not only technical requirement, but also physical, economical, social, environmental and political requirements that may result in conflicting objectives. Such complexities emphasize the usage of several decision support tools such as Geographical Information System (GIS) and Multi Criteria Analysis (MCA) (JOERIN, 2001)

All over the world are growing and most probably will grow at a much faster rate than their infrastructure can accommodate. According to the 2009 revision of the United Nations World Urbanization Prospect by the end of 2050 about 6.3 billion i.e. above 70 percent of the world's human population will live in urban areas

(UNDESA, 2009).

Accordingly, land-use management for the urban developmental projects is the main tool used to guide urban planning to the right approach for infrastructures development and transportation system, both at planning and decision-making stages.

Especially in the cities that land are very expensive and hardly can be invested as developmental projects, the suitability for various land uses should be carefully studied with the aim of directing growth to the most appropriate sites. Establishing appropriate suitability site selection Multi-Criteria is the construction of suitability analysis is essential to develop comprehensive model in land management.

Suitability analysis was developed as a method for planners to connect spatially independent Multi-Criteria within the environment and, consequently to provide a more unitary view of their interactions. Suitability analysis techniques integrate three Multi-Criteria of an area: location, development activities, and environmental processes. These techniques can make planners, landscape architects and local decision-makers analyze Multi-Criteria interactions in various ways (Al shababi et al., 2006)

### **2.3 Multi Criteria Decision Making (MCDM)**

Multi Criteria Decision Making (MCDM) is known as a decision-aid and a mathematical tool allowing the comparison of different alternatives or scenarios according to many criteria, in order to guide the decision maker towards an effective choices and approaches.

A Decision Analysis Technique is a subjective analysis based on: Criteria, scores and weights; Human judgment in determining the criteria, scores and weights Documented process to enable ex-post review and could be used for public scrutiny of assessment. The set of decision alternatives considered in a given problem is often denoted and called the set of potential alternatives.

Multi-criteria can be the best solution to avoid conflicting ideas, preferences and objectives. In this research, determining the location required an essential development projects will be achieved by using GIS based Multi-criteria Model (T. Marrero et al., 2012). These methods incorporate explicit statements of preferences of decision-makers. Such preferences are represented by various

quantities, weighting scheme, constraints, goal, utilities, and other parameters. They analyze and support decision through formal analysis of alternative options, their attribute, evaluation criteria, goals or objectives, and constraints.

If there is a conflict between the various actors, they can negotiate the subjective parameters, like the weights associated with each criterion before adopting a common set of values. It is also possible to repeat the MCDA process and thus select, for each different group of stakeholders, a solution that is adapted to its specific needs. MCDA results can be mapped in order to display the spatial extent of the best areas or index of land suitability. The negotiating parties can then discuss and compare the results by overlaying these maps, which are in fact geographical representations of their own set of preferences (Baptista M., 2007 ).

Spatial multi-criteria decision making refers to the application of multi-criteria analysis in spatial context where alternatives, criteria and other elements of the decision problem have explicit spatial dimensions. Since the late 1980s, multi-criteria analysis has been coupled with geographical information systems (GIS) to enhance spatial multi-criteria decision making. The techniques adopted in the various approaches of decision analysis are called multi criteria decision methods (MCDM).

Spatial decision involves a large set of feasible alternatives & multiple evaluation criteria which cause in many cases conflicting. Project Criteria are mostly evaluated by number of decision-makers and managers Multi criteria can be the best solution to avoid conflicting ideas, preferences and objectives (LORENT JOERIN, 1998).

Also MCDM provides a rich collection of techniques & procedures for structuring decision problems & designing, evaluating & prioritizing alternative decisions related to development projects.

#### **2.4A Brief History of Multi-Criteria Analysis (MCA)**

MCA techniques began to emerge during the early 1970s, actually it took its first vocabulary and from at the beginning of 1960s from a critiques of traditional neoclassical environmental economics. a number of workers particularly in the regional economic planning and decision making research fields had identified specific weakness in the neoclassical view of decision making and sites' locations of the developmental projects (LORENT JOERIN, 1998).

It is generally assumed that MCA was born and took its actual vocabulary and form at the beginning of 1960s. In fact, most of MCA practitioners consider that their usage largely from the research of Simon and his early works on goal programming. Closely related to decision-making in general and to MCA in particular is utility theory. Although utility theory was firstly used to model simple individual preferences, it has been extended to the multi-criteria preferences and led to the multi attribute utility theory. The first methods in MCA were developed during the 1960s. Goal programming, for example, uses the linear programming to resolve a multi criteria problem. In 1968, Roy conceived the initial version of ELECTRE method.

In the 1970s, MCA was widely used from 1971, Roy organized the 1<sup>st</sup> independent session especially devoted to MCA research within the 7<sup>th</sup> Mathematical Programming Symposium, held in The Hague. Second, in 1972 Cochrane and Zeleny organized the First International Conference on MCA decision making at the University of South Carolina. In 1975, Roy organized in Brussels the 1st meeting of the EURO Working Group on Multi-Criteria Decision Aid. Also in 1975, Thiriez and Zionts organized the First Conference of the International Society on multi-criteria analysis. In addition to these meetings, the MCA research focused in the 1970s on the theoretical foundations of multi objective decision making (Marrero, 2012).

The 1980s and 1990s witnessed the consolidation and development of a great number of interactive methods. Most of these methods are oriented toward the negotiation or multiple decision makers and multi-criteria decision support systems. MCA has been used since its emergence to deal with spatial decision problems. The first works involving GIS-based MCA were published in the late 1980s and the early 1990s. Currently, there are a number of relatively important devoted to GIS-based MCA that have been published (Baptista M., 2007).

A number of amendments and alternatives to the neo-classical approaches had been suggested in response to a realization that these conventional methods can't cope effectively with external negative spillover effects from environmental and economic development (e.g. pollution, health risks, planning process). A significant proportion of these focuses on the paradigm of multi dimensionally.

## **2.5 The Usage of MCA in Site Selection Process**

Site selection requires consideration of a comprehensive set of Multi-Criteria and balancing of multiple objectives in determining the suitability of a particular area for a defined land use.

In the past, site selection was based purely on economical and technical criteria. Today, a higher degree of complexity is expected. Selection criteria must also satisfy a number of physical, social and environmental requirements.

The selection of sites involves a complex array of critical Multi-Criteria drawing from physical, demographical, economic, policies, and environmental disciplines. The current spatial decision making could benefit from more systematic methods for handling multi-criteria problems while considering the physical suitability conditions. Traditional decision support techniques lack the ability to simultaneously take into account these aspects (P. Zander a & 1999).

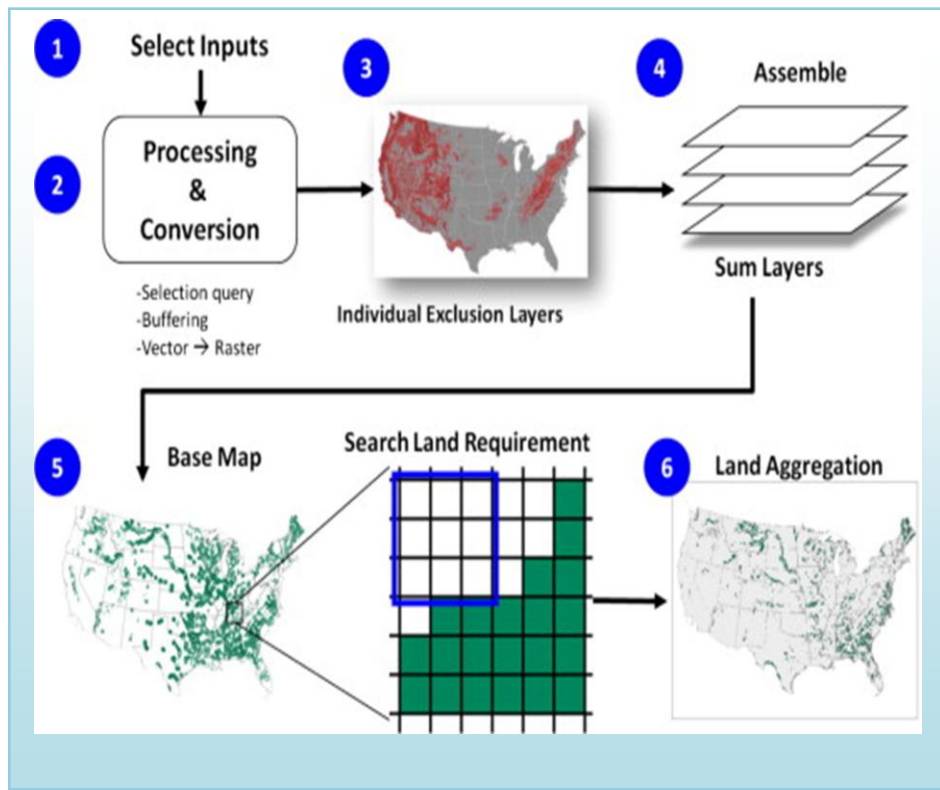
The process of Urban Developmental Projects site selection begins with the realization of an existing or projected needs. This recognition triggers a series of actions that starts with the identification of geographic areas of interest. (Sharma, 2010)

## **2.6 GIS based Multi-Criteria Decision Conceptual Framework**

GIS-MCDM is the process that is the combination of GIS and MCA which is used to facilitate the site selection process that can be divided into two stages: survey and preliminary site identification (Figure 2.1).

GIS facilities are used to input, transform, store and manipulate digital map data relevant to the main problem to be solved. Nowadays GIS have emerged as useful computer-based tools for spatial description and manipulation, although often described as a decision support system, there have been some disputes regarding whether the GIS decision support capabilities are sufficient (Jankowski,1995).

GIS-MCDM combines between spatial data and prioritization of criteria for decision making spatial multi-criteria decision problems typically involve a set of geographically-defined alternatives from which a choice of one or more alternatives is made with respect to a given set of evaluation criteria (Malczewski, 1996).

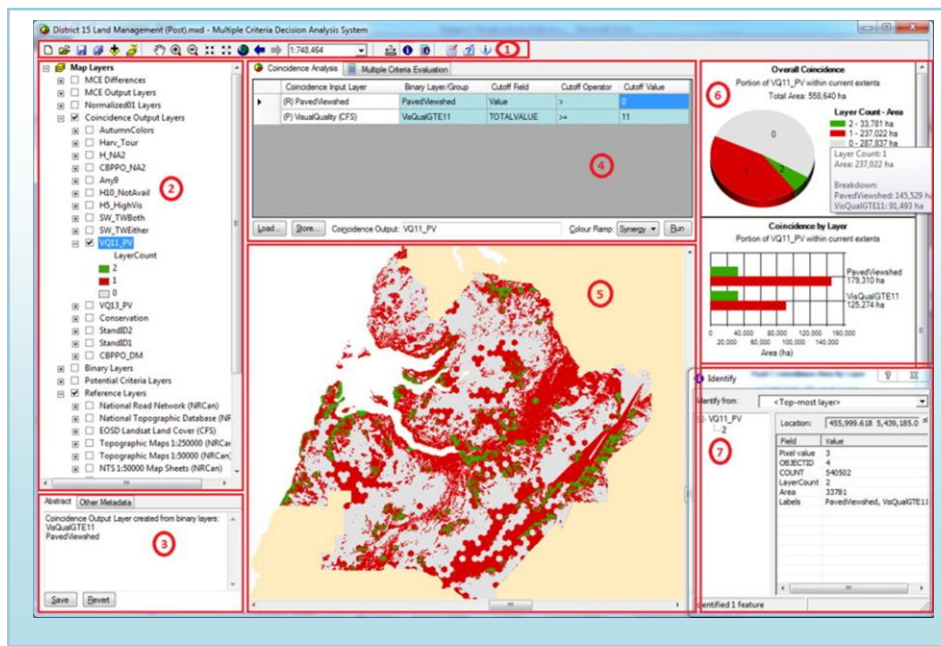


**Figure(2. 1)Samples of MC-GIS "Adapting a GIS-based multi-criteria decision analysis approach**

**Source:(Olufemi et al., 2012)**

GIS has received worldwide acknowledgement since it enhances sustainable urban planning and decision making processes by integrating decision support tools and methods in addition to its synergetic processing ability of temporal and multisource geo-referenced spatial problems with standardized data processing, digital mapping, and environmental modeling.(JOERIN, 1998)

GIS information provision at regional level and its flexibility of models with respect to variations in natural resource parameters contribute a great deal for planners and decision makers.



**Figure(2. 2) Samples of An approach to GIS-based multiple criteria decision analysis**

Source:((Randal, et al., 2010)

Moreover, GIS is an information management system competent of providing spatial analysis tools for sorting, retrieving, and manipulating geo-referenced-computerized maps. It is increasingly used in various research and applied fields including land use sitting.

In general, GIS plays a key role in maintaining account data to facilitate collection operations; analyzing optimal locations for locating urban developmental projects.

Since current GIS do not offer decision-making modules that reason a decision and are primarily based on manual methods and human judgments for problem solving, the individual should have the decision rules in place before GIS can be utilized. Other limitations in current GIS approaches include the incapable of processing multiple criteria and conflicting objectives (Carver,1991). They are also limited in integrating geographical information with subjective values/priorities imposed by the decision maker (Malczewski,1999).

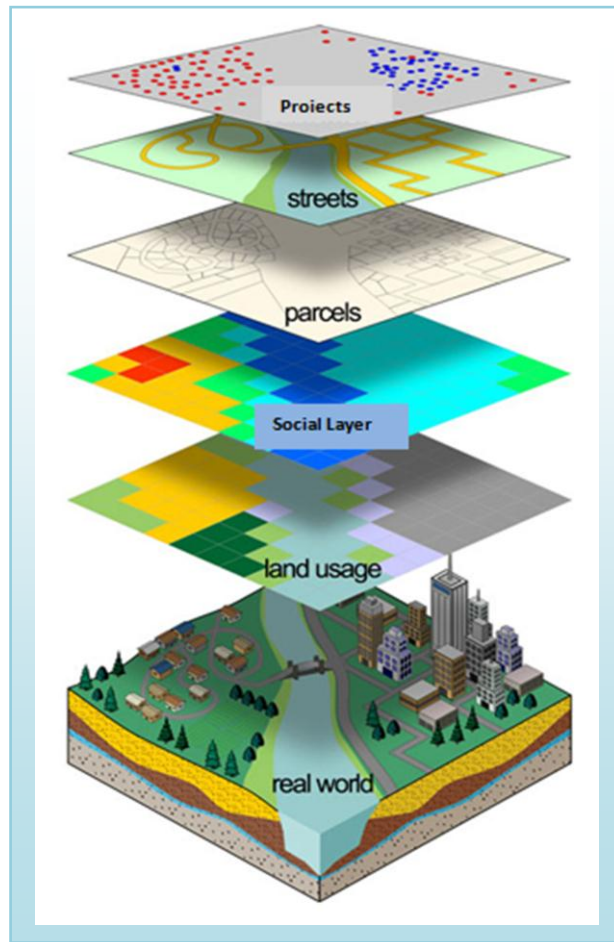


Combining GIS and MCDA is also a powerful approach to land suitability assessments. Subsequently, a similar approach, (Alemu, 2009) produced a land suitability map for an Paper tackled the effective usage of GIS based MCDA tool to design a framework to model decision making process considering results taken from specified methods about relevant criteria to encourage the sustainable development of Stockholm. While (Sharifi et al ,2006) empathized on using the approach of MCDA which help in performing effective decision making process related to network design substitutes in which the main results can be summarized as modeled pair-wise comparison method as applied in the paper that had proven its ease of use within limited time constrains in the conceptual framework, while the usage of MCDA methodology in prioritization the public transport needs process.(Salem Chakhar, 2010).

Arc-GIS will be used as an important tool to analyze the spatial decisions in the approach of GIS-MCDM which will be the

process that combines between spatial data and prioritization of criteria for decision making. Figure (2.3) shows samples of GIS layers used in research including land use layer and social layer containing Population densities, unemployment rates, etc. the location of prioritization projects will be generated by integrating layers using ArcGIS .

In GIS-MCDM process , the areas are screened using special techniques in order to identify all the potentially feasible areas in which to look for suitable site locations , for urban development. This is achieved by overlying relevant sitting



**Figure(2. 3)Samples of GIS layers Used in Research. Source(Esri.Com)**

Multi-Criteria (e.g. population, unemployment )to identify all the areas which is simultaneously satisfy the specified numerical and qualitative criteria(e.g. population density is less than 500 persons per square kilometers ) . The sitting criteria used in this stage of the analysis are often very deterministic in nature.(Siciliano, 2012)

In (Walsh,1999) focused on developing model that proposed the initial plans towards effectiveness of resources in rehabilitation urban stream using GIS-Multiple Criteria of various indicators biotic , structure and function, whereas In (Jorin,2001), concentrated on the usage of MAGISTER which is a support software using GIS and MCDA which applies the analytical needs of lands planners. The paper's main result was to produce land suitability map based on complex evaluation criteria.

Thus, allowing the decision maker to progress from a very large number of alternatives to a smaller and more manageable short list in a single and well defined set of process. thus despite the deterministic nature of the application , GIS allows a degree of flexibility to be maintained , thereby allowing survey stage sitting criteria to be changed as desired to meet needs and particular equipments.(Olufemi A. Omitaomu, et al., 2012)

In contrast to conventional MCDM analysis, spatial MCA requires information on criterion values and the geographical locations of alternatives in addition to the decision makers' preferences with respect to a set of evaluation criteria.

This means analysis results depend not only on the geographical distribution of attributes, but also on the value judgments involved in the decision making process. Therefore, two considerations are of paramount importance for spatial multi-criteria will be taken into account(CARVER, 2010)

## **2.7 Concept of the Model for Prioritizations development projects**

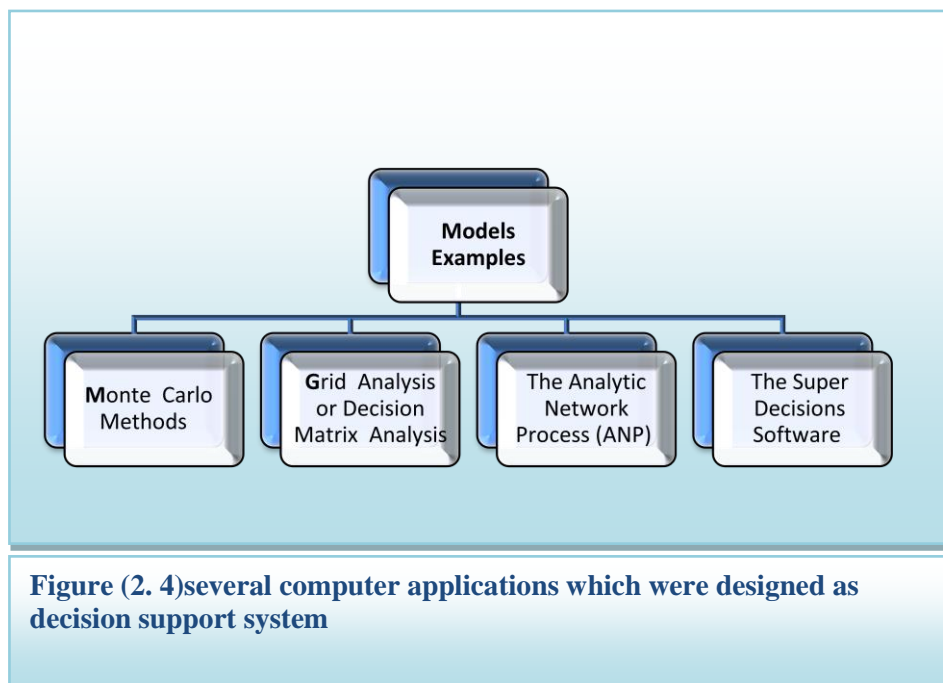
Project's prioritization model will be applied on different types of development projects like urban development, educational projects, recreational projects, health projects and etc. Prioritizations criteria were based on strategic development plans include the following plans and strategies based on strategic plan of World Bank (2006):

- a. City strategic plan.
- b. Planning, zoning, resource management and land use development strategies.

- c. Transportation strategies.
- d. Leisure and recreation strategies.
- e. Urban Developmental Projects strategies.
- f. Anti-poverty strategies.
- g. Education and training strategies.
- h. Public safety strategies.
- i. Environmental strategies and agenda.
- j. Wastewater disposal and pollution control strategies.

### 2.7.1 Models Examples

There are several computer applications which were designed as Decision Support System (DSS) such as:



A) **The Analytic Network Process (ANP)** is a process that allows one to include all the Multi-Criteria and criteria, tangible and intangible that has bearing on making a best decision, in addition, it is the most comprehensive framework for the analysis of societal, governmental and corporate decisions that is available today to the decision-maker. The Analytic Network Process allows both interaction and feedback within clusters of elements (inner dependence) and between clusters (outer dependence). Such feedback best captures the complex effects of interplay in human society, especially when risk and uncertainty are involved. (Saaty, 2007)

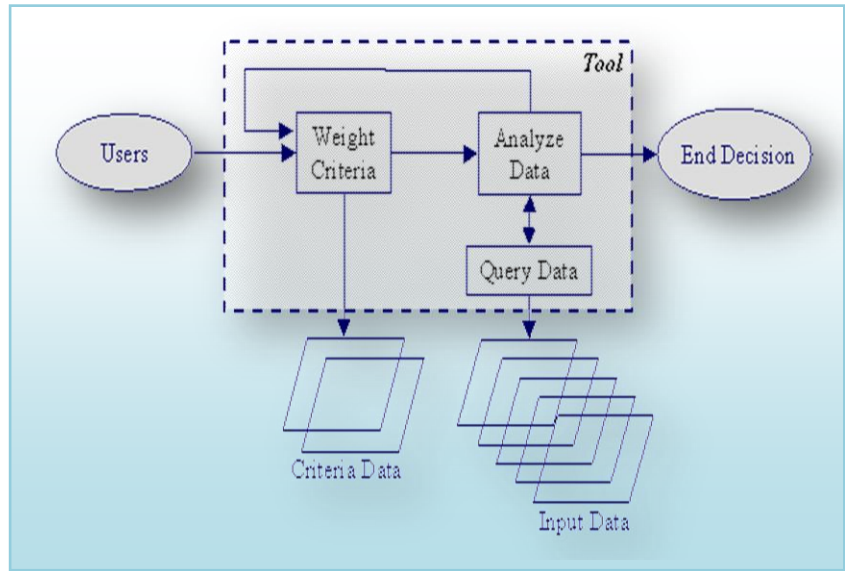
B) **The Super Decisions Software** is used for decision-making with dependence and feedback (it implements the Analytic Network Process, ANP, with many additions). In the AHP the elements are arranged in a hierarchic decision structure while the ANP uses one or more flat networks of clusters that contain the elements. Such problems often occur in real life. Super Decisions extends the Analytic Hierarchy Process (AHP) that uses the same fundamental prioritization process based on deriving priorities through judgments on pairs of elements or from direct measurements. . Most decision-making methods assume This means that qualities of decisions for most decision-making situations are governed by the structure of spatial decision problems and selection of appropriate decision systems (Malczewski,1999).

Since it is a selection from several choices of products or ideas and involves taking action, decision-making is regarded as a mental process for making up one's mind to select an action or an opinion among several alternatives independence between the criteria of a decision and the alternatives of that decision, or simply among the criteria or among the alternatives themselves .

C) **Grid Analysis or Decision Matrix Analysis**, is the simplest form of Multiple Criteria Decision Analysis (MCDA), also known as Multiple-criteria Decision Aid or Multiple Criteria Decision Management (MCDM) is a useful technique to use for making a decision. Decision matrices are most effective where you have a number of good alternatives and many Multi-Criteria to take into account. Options are laid as rows and Multi-Criteria are set up in columns of a table. Weights are allocated to show the importance of each of these Multi-Criteria . Choices are scored for each factor using numbers from 0 (poor) to 3 (very good). Multiplying each score by the weight of the factor shows its contribution to the overall selection. Total scores are added for each option to select the highest scoring option. Sophisticated MCDA involves highly complex modeling of different potential scenarios and advanced mathematics .

D) **Monte Carlo Method** is often used to find solutions to mathematical problems (which may have many variables) that can't easily be solved by integral calculus or other numerical methods. Most users of Monte Carlo simulations rely entirely on the initial subjective estimates and almost never follow up with empirical

observation a widely used class of computational algorithms for simulating the behavior of various physical and mathematical systems, and for other computations. They are distinguished from other simulation methods by being stochastic usually by using random numbers. Because of the repetition of algorithms and large number of calculations involved, Monte Carlo is a method suited to calculate using a computer utilizing many techniques of computer simulation. This may be due the overwhelming number of variables in many models and the inability of analysis to choose economically justified variables to measure further (Alemu, 2009).



**Figure(2. 5) Samples of An approach to GIS-based multiple criteria decision analysis** Source:((Randal Greenea, Joan E. Lutherb, Rodolphe Devillersa, & Brian Eddyb, 2010)

## 2.8 Weighted Multiple-Criteria Analysis

Weights to criteria enables all scores to be converted to a common scale, it will reflect both the relative importance of criteria as well as difference in unit of preference on different scales. Moreover, the term Swing weighting is equating the units is accomplished by judging the relative swing in preference from the bottom to the top of one preference scale as compared to another.

Weighting can be done as follows: Compare the difference between the least and the most preferred options. Low weight will be given to a criteria if the difference between the lowest and the highest options is small.

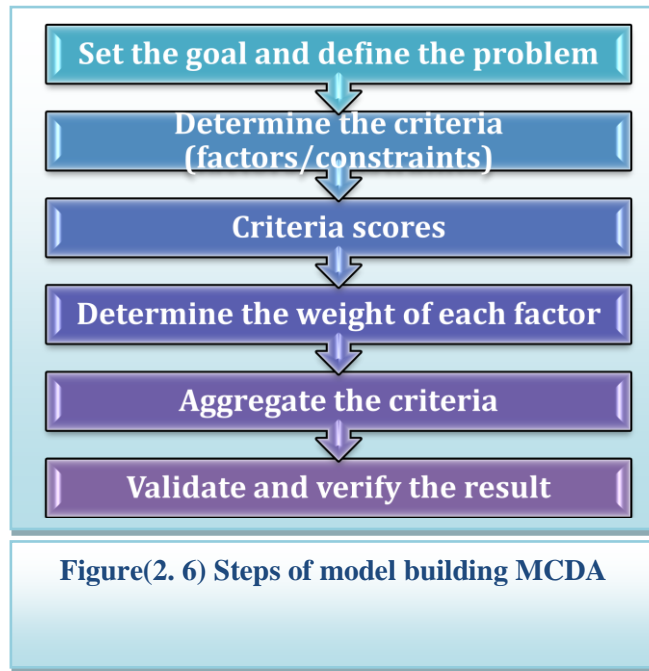
Compare the difference in absolute value. The highest difference is given 100 score. The rest is calculated based on the absolute value compared to the highest value .General criteria for selecting options: comprehensive in assessing the options, open to possibility of adding dropping options. contribute to the

objectives.

Criteria should be selected to evaluate potential Urban Developmental Projects sites and to support decisions concerning the location of additional Urban Developmental Projects areas. The criteria must be identified and include Multi-Criteria and constraints. **Constraints** are criteria that exclude areas from the analysis. Whereas **Multi-**

**Criteria** : are criteria that influence (enhance or detract) the viability of the objective under consideration. The selection of Multi-Criteria for an MCE analysis can be done in several ways. Multi-Criteria can be selected based on existing literature, they can be defined by an analyst, or they can be defined by a group of experts.

Several Multi-Criteria will be used in this study like population densities, poverty Multi-Criteria in Gaza strip, environmental Multi-Criteria and etc. each criterion has own weight developed by using questionnaire survey to NGOs and Palestinian institutes. (Malczewski,1999)..



## 2.9 Evaluation of Criteria

Evaluation criteria are associated with geographical entities and relationships between entities that can be represented in the form of maps.

Evaluation should be for each option on the identified criteria and sub-criteria, moreover evaluation could be monetary, non-monetary, or qualitative. A starting point for assessment could be qualitative description of each option on all criteria. An evaluation summary sheet of each option could be useful:

First step in comparing criteria are assigning scores. Score based on scale representing preference of option, scoring dependent on qualitative or quantitative assessment of options on a criterion and finally Process Record individual scores. Analyze extreme scores to understand the reasons and develop consensus approach

in providing a comprehensive information to policy/decision makers enhancing the transparency of the process(Marrero, 2012).

### 2.9.1 Identification and Prioritization of Development Projects

#### Criteria

Identification and Prioritization of Development Projects Criteria using questionnaire surveys , that were conducted in Palestinian institutes and international NGOs to identify criteria used for prioritization of development projects. Assessment of each criterion was then prepared. Based on the resulted list of determining criteria, a decision model was built using a multi-criteria analysis tool. Figure (2.7) shows a sample for determining criteria for project and the weight of each criterion.

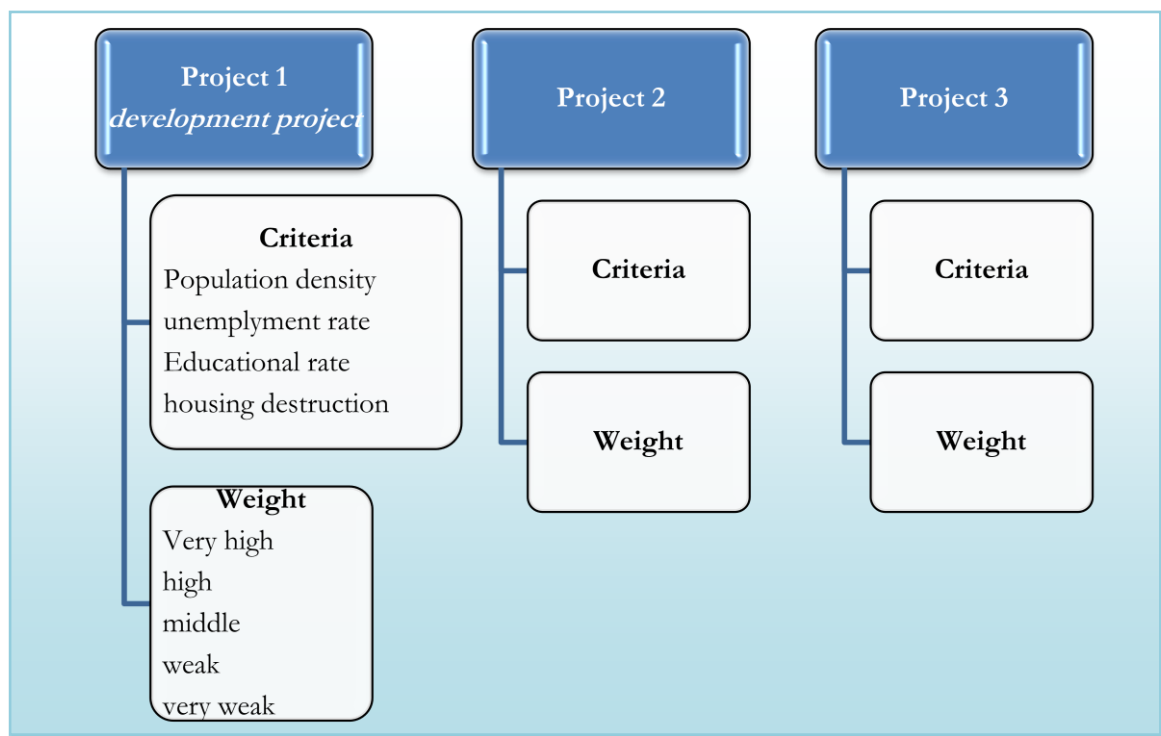


Figure (2.7) Sample of project criteria and weights

### 2.10 Integration of MCA and GIS to Support Decision-Making System

The advantages gained through the combination of GIS and MCA is representing the approach towards the development of the Spatial Decision Support System

(SDSS).

SDSS is used to assist the decision makers in taking effective evaluation in site identifications, Decision-making and decision systems Decision-making is a process of defining a problem and its environment, identifying alternatives, evaluating alternatives, selecting an alternative, and implementing the decision (Malczewski,1999). Decision-making process is primarily iterative because the decision maker uses a set of generated alternative solutions for evaluation and to gain insights and inputs used to define further analyses.

The term SDSS is used to describe a computer based system designed to help decision makers to make higher effective decisions concerning e.g. the built environment by identifying ill-structured spatial problems using data, knowledge, and communication technologies (Baloye et al, 2010).

Since decision makers play an active role in defining the problem, carrying out analyses, and evaluating the outcomes, the process could be considered to be participative. It can also be integrative in the sense that judgment values that materially affect the outcome are made by decision-makers who may have expert knowledge with respect to one or more criteria. Moreover, SDSS provides a framework of integration of spatial analysis , database management systems(DBMS), graphically displayed to obtain the most proper places for the developmental projects. In decision-making processes, criterion or criteria is a generic term that includes the concepts of both decision attribute and objective whereas alternatives are means for achieving decision objectives.

However, in the existent world, it is complicated to find neither completely structured nor totally unstructured spatial decision problems. This is the cause why the core concept of decision support systems (DSSs) is based upon the type of decision problem structures and problem solving elements .

As a result, the degree of decision- making complexity depends upon the amount of criteria and/or alternatives in the process (Malczewski, 2006).

For instance, it is very complex in natural resource management because large amounts of conflicting and/or contradicting criteria or alternatives are involved. In this respect, appropriate analyzing tools are required to deal with these problems using qualitatively and quantitatively mixed sets of data, accommodating expert opinions, and a collaborative planning and decision making environment.



Therefore, for better planning and decision making processes narrowing of information gaps via qualitative data and experimental knowledge within the participatory environment play key roles, since the process is iterative, participative, and integrative.

The structure of spatial decision problems ranges from completely structured to completely unstructured situations. These structures are classified based on four elements of problem solving activities: data, procedures, evaluation criteria and constraints, and strategies (Malczewski, 1999).

In this respect, SDSSs can be helpful for sustainable urban planning and decision making processes to improve the perception of planners and decision makers on interrelationships between natural and socio-economic variables. To this end, higher effectiveness of planning and decision making processes can be achieved from a system that can supply timely and accurate information and an interactive computer based system with capabilities of analytical modeling, database management, tabular reporting, and graphical display. Nowadays, multi-criteria-SDSS, which is an extension on GIS, becomes more relevant to generate an encouraging decision-making environment (Baloye et al, 2010).

### **Conclusion:**

The different methods of Multi criteria analysis were illustrated besides the new approaches of different references in using GIS based Multi criteria analysis in suitability mapping . It can be concluded that decision support system (DSS) had demonstrated effective linkage and integration with GIS - based Multi criteria in developing good decision making process in the urban planning . The different approaches in the past knowledge showed that the main usages of Multi criteria analysis can be facilitated in different urban developmental projects with varied objectives and usages, even though they all were unified in the main concept.

# Chapter (3) Methodology

## 3.1 Introduction

This chapter will illustrate the main approach of the research to indicate the main steps in details. Moreover it will focus on the strategy, design , sampling , location and development of the conceptual framework of the study .

The processes of conceptual framework's development will be identified in systematic procedures ,to enable having clear perspective about research methodology and main approach.

## 3.2 Research Strategy

This is analytical study which is designed by triangulation of mixed method approaches. The research methodology implemented a strategy of inquiry that consisted of sequential mixed methods procedures which the Researcher seeks to elaborate on the findings of one method to the another.

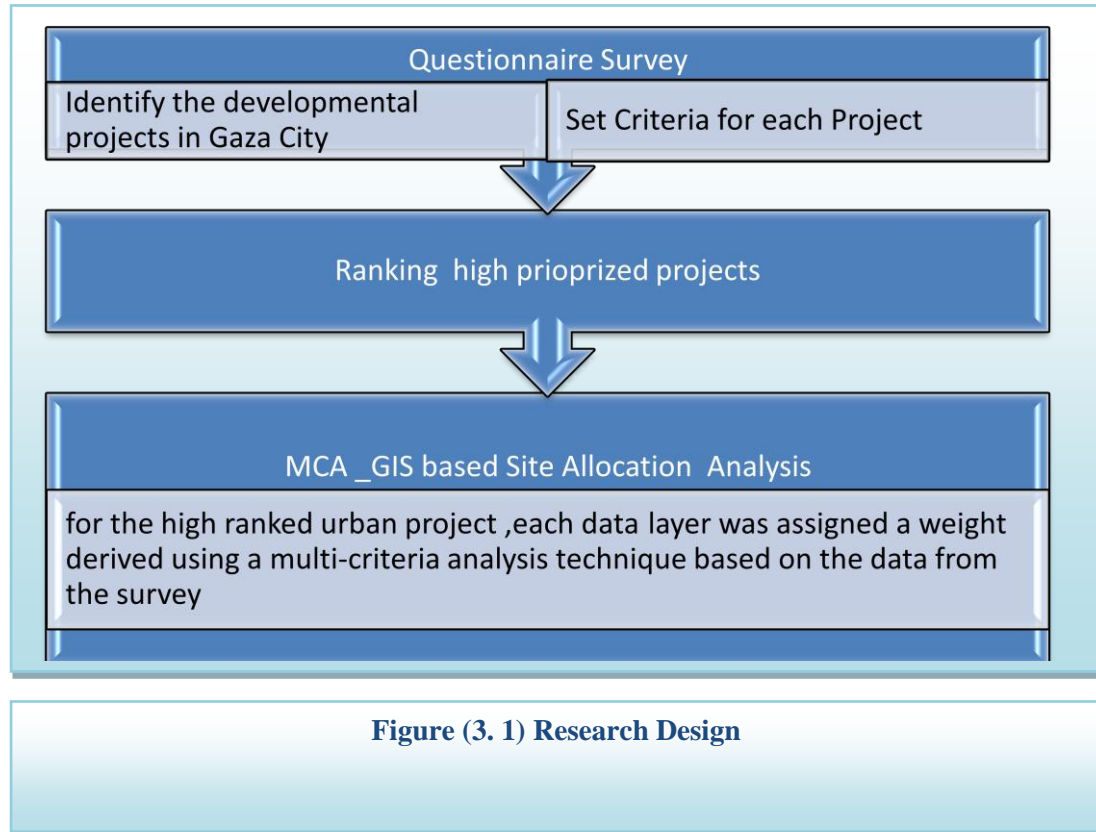
The research design was mainly relying on the deductive approach were the theory is extracted from the results using different approaches of quantitative and qualitative including the multi-criteria analysis and ARC–GIS programs to visualize the output into maps

## 3.3 Research Design:

The research design was based on the mixed used method including Quantitative Data which is one of the main parts of this study, which aimed to rank priorities for the main urban developmental projects and set-up main criteria for selection and site allocation. The Researcher used the closed ended questionnaire approach focusing on prioritization.

Firstly, the theoretical framework of the study (the use of the descriptive approach).Secondly, the operational framework and information for the study (the

analytical framework for the study (deductive approach deals with the analysis of information and data that will be obtained).Figure(3.1)illustrated the concept of research design .



### 3.4 Research Variables

In regard to Measurement of Variables, there are interrelationships and interdependences among problems of the proposed thesis. The research studied the relation and interpolation between the independent and dependent variables, many spatial problems was structured hierarchal because the importance of the criteria determines the selection and allocation of different urban projects .

Accordingly the mean weight is the dependent variable and is changing among the in-dependent variables criteria in different projects.

### 3.5 Survey Method:

In this section the surveying methods will be discussed to illustrate the procedures in-depth

### 3.5.1 Questionnaire Design

After completing the literature review process and the meetings with different stakeholders in the different associations, especially to go in-depth with the developmental Gaza City Plan that was developed recently, the questionnaire was design accordingly and approved by four Assistant professors besides the supervisor of the thesis. The questionnaire was collected from relevant stakeholders about developmental projects

A pilot sample of the questionnaire was conducted to ensure reliability of the content and consistency of the flow of questions, thus the modification were made (see Annex1) to develop the final draft of the questionnaire.

### 3.5.2 Research Population

The correctness of the research population refers to its suitability for the realization of the intentions of the study. The selection of study population was stand on the basis of appropriateness usually influences the strength of consequent generalizations from the results.

This implied the need for having accurate sampling of the research and close attention at the early stage of the given study to reach out the specific targeted results. The sample size was calculated based on probability sampling method , in which stratified sample of 100 stakeholders was calculated as follows

$$\text{Survey Sample Size} = \frac{PQ(Z)^2}{E^2} \quad (\text{Brown, 2012})$$

Since the sample size **N**, **P** proportion of society to be studied in the case of lack of knowledge that is used greater percentage rate possible (50%).

**Q** the ratio of complementary, **Z**-class standard (0.05 = 1.96 & 0.01 = 2.58), **E** at both sampling error (0.05 or 0.01) upon assuming the proportion of available community (7%)(Based on OCHA data that includes the majority of stakeholders in different developmental projects , such as governmental cluster , UN agencies, UNDP, World Bank, International NGO, local institutes , municipalities and utilities in Gaza City , the percentage of stakeholders in Gaza Population), the complementary percentage (93%), and the degree of standard (1.96) and 0.05 sampling error, the sample size is (100) individuals and this volume represents the engineers' community.

### 3.5.3 Research Location

A pilot study of this research will be Gaza Governorate. Gaza city represents the

economic center of Gaza Strip. Also in Gaza city there is diversity in Living environments and population activities which can be suitable study area for this research.

#### **3.5.4 Data Collection**

The fieldwork started based on the sample size; 100 questionnaires were filled through personal interviews , each of them took 30 minutes to finish the questionnaire since the questionnaire needs very accurate ranking and scoring of the data for each criteria.

#### **3.5.5 Data Entry:**

An SPSS data entry sheets were developed and disaggregated per each of the proposed urban developmental projects to set-up criteria per each of them , accordingly a coding system was developed to formulize reposes into analytical SPSS sheet that enabled transferring the data from the questionnaires into the SPSS sheets. Each of the filled questionnaires was entered through five SPSS files depending on the type of the proposed projects.

Data cleaning was conducted to the computerized filled SPSS files to eliminate errors and check consistency.

#### **3.5.6 Data Analysis**

The collected data was analyzed to have a comprehensive view about the priorities of development projects in the Gaza city. SPSS was used since it is an enormously powerful data analysis package that can handle very complex statistical procedures, 1)major colorations, 2)frequencies and 3)tabulations were conducted to the entered data to compare between the developmental projects and its relevant criteria were formulated to set out the precise major criteria of project selection for the highly ranked projects according to the results of the questionnaire.

### **3.6 Interviews**

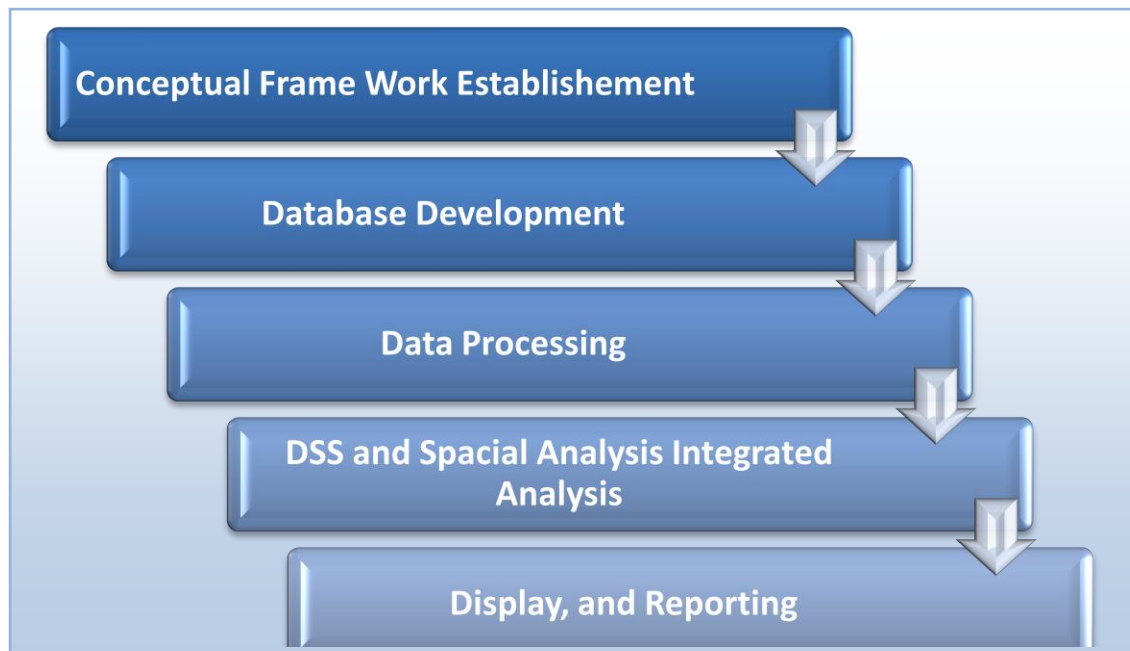
Semi-structured interviews were conducted in parallel with Questionnaire's design and collection period, thus the interviews were targeting the stakeholders , active representatives of Palestinian ministries , donors in the field of decision support system and experts in planning and strategic development , the interviews lasted for 30 minute and were based on open-ended questions, the interviews were taken

place with OCHA representatives, governmental ministries , International Red Cross Committee, OXFAM , CHF , CRS ,USAID,WFP in addition to many other organizations that was about 100 interviews while filling the survey.

### **3.7 Establishment of Computer Conceptual Framework**

The establishment of the conceptual framework was the bench mark of the thesis, it was intended to initiate an effectual and systematic approach while designing a project, and allocating its optimum location.

The combination of different tools including the ARC-GIS, Multi-Criteria analysis and DSS were essential tools to launch comprehensive data processing to lead the decision making process and facilitate the strategic urban planning.



**Figure (3. 2) Conceptual Frame Work Establishment**

ARC-GIS was used because of its systematic usage of multi software's that includes DSS, special analysis , data processing and layering for the reason that of its flexibility, numerical efficiency in calculations involving combinations and statistical exploration of spatial variables,

In the methodology of the conceptual framework, it was disaggregated into multi stages in which GIS has been used in many applied fields that involve spatial data analysis among which the recognition, viewing, assessment and optimization of Prioritization Model of the Developmental projects sitting processes.

Reported Approach and levels of complexity applications were varied in light of the usage of GIS-based methodologies to the problem of Prioritization Model of

the Developmental projects.

The process started from direct screening or digital intersecting of maps that were collected from relevant resources after linking them with the relevant statistics that were obtained from the Palestinian Bureau of statistics.

The data was then disaggregated by Governorate, mainly to reflect its percentage into the neighborhood of Gaza City itself, all related statistics were incorporated into a database that was programmed into the ARC-GIS Program as the first stage. Consequently, the survey results were disaggregated by the type of the projects and were set as the database of the multi criteria analysis to be done through special programs. Based on set criteria to attempt at integration of the GIS spatial analysis capabilities with other codes or software, which would deal with optimization and or ranking of options and alternatives.

As a result, frequent transitional analytical map layers were created using GIS map analysis approaches. The procedure included buffer zoning, neighboring multiplication, and digitizing tools in terms of overlaying, intersection, union, featuring, etc..The main criteria of the projects selection were aligned with relevant data from the statistics and then overlaid with the highest prioritized projects from the survey results as will be discussed in the next chapter.

The next implemented stage was the combination of setting the criteria to produce the intermediate map analysis, that enabled excluding the zones that are not satisfying the specific setting criteria.

The geo-processing tools constituted the most commonly used GIS function in selecting the sites satisfying all the required conditions.

Values of cell features were expressed with numbers in various geo-referenced map layers based on the results gained from the survey, where the mean average of the scored criteria were taken into consideration while adapting this approach to overlay between public participation, decision making process and urban planning procedures.

With logical or arithmetical operations, this overlay function performs arithmetical expressions on existing map layers to create a new map layer, each map layer is manipulated as a particular variable, and a new value of each cell is calculated based on the expressions from values of the cell at the same geo-referenced location of map layers included in the computation.

Accordingly, once all the map layers satisfying the criteria were developed, an overlay map was obtained representing the final Prioritization Model of the Developmental Projects suitable areas (Sadek, 2001) .

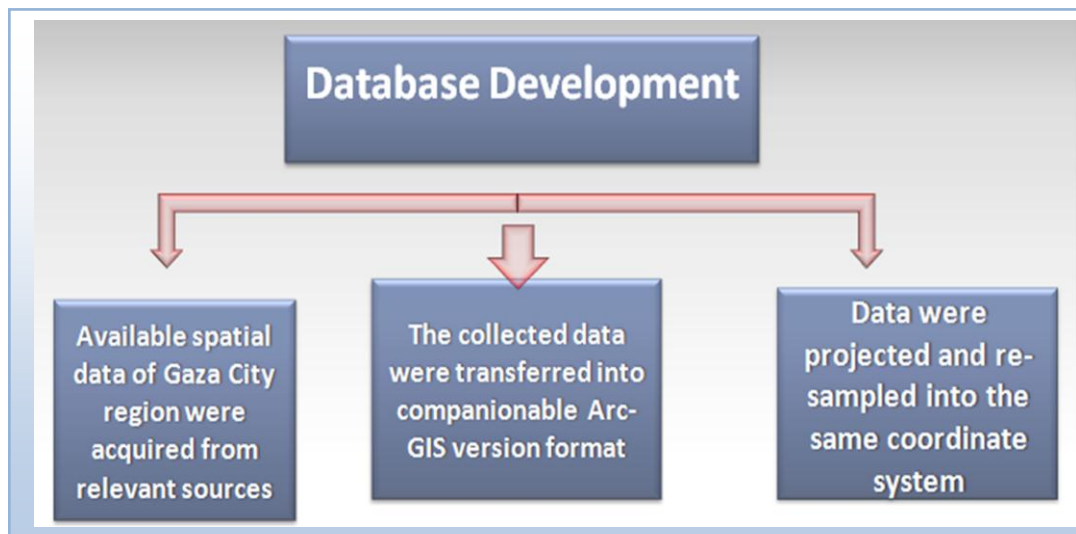
In view of the fact that the implementation of GIS-based MCDA , several procedures were tracked to combine information from several criteria of the case study and to structure a particular evaluation directory. These procedures were: database development, data processing, integrated analysis, display, and reporting.

### 3.7.1 Database Development

The usage of ARC-GIS played an integration role between MCDA and the DSS technique. GIS was utilized for collecting, storing ,renovating, analyzing, and displaying of spatial data. In order to develop such process .

It was important, to collect the current data bases about Gaza City which is the case study region developing the database .

For this purpose available spatial data of Gaza City region were acquired from relevant sources. The collected data were transferred into companionable Arc-GIS



**Figure (3. 3) Database Development**

version format before they were projected and re-sampled into the same coordinate system, and fitted into targeted zone to organize them for data processing.

### 3.7.2 Data Processing

GIS data processing embarked on by creating evaluation criteria index based on their relevancies and data availability that were obtained from the survey results.



Criteria were established for high density population, geology, land-use, roads, green areas, being away from land fill and crowded zones, close to the main streets and protected ground water. The disaggregation level of projects' type as what will be illustrated in Chapter four.

Criteria data were categorized into a common scale after transforming vectors into raster formats. To identify the criteria of interest, distance operations were performed on roads, rails, and protected areas. The consequent criteria maps of the study area were amended for accomplishing an improved simulation for MCDA.

### **3.7.3 Multi-Criteria Decision-Making and Display**

This is the most important stage of Conceptual framework GIS-based MCDA modeling, which was used to create suitability maps from summarized several contributing and relevant criteria.

Criteria directory was built for each project model and a Multi-Criteria model were developed for this purpose.

There were several different criteria limitations map based on the outcomes of the allocation strategy.

All the map layer has been divided into dominant features which the highest influential factor was given to the highest site selection score followed by the lowest criteria.

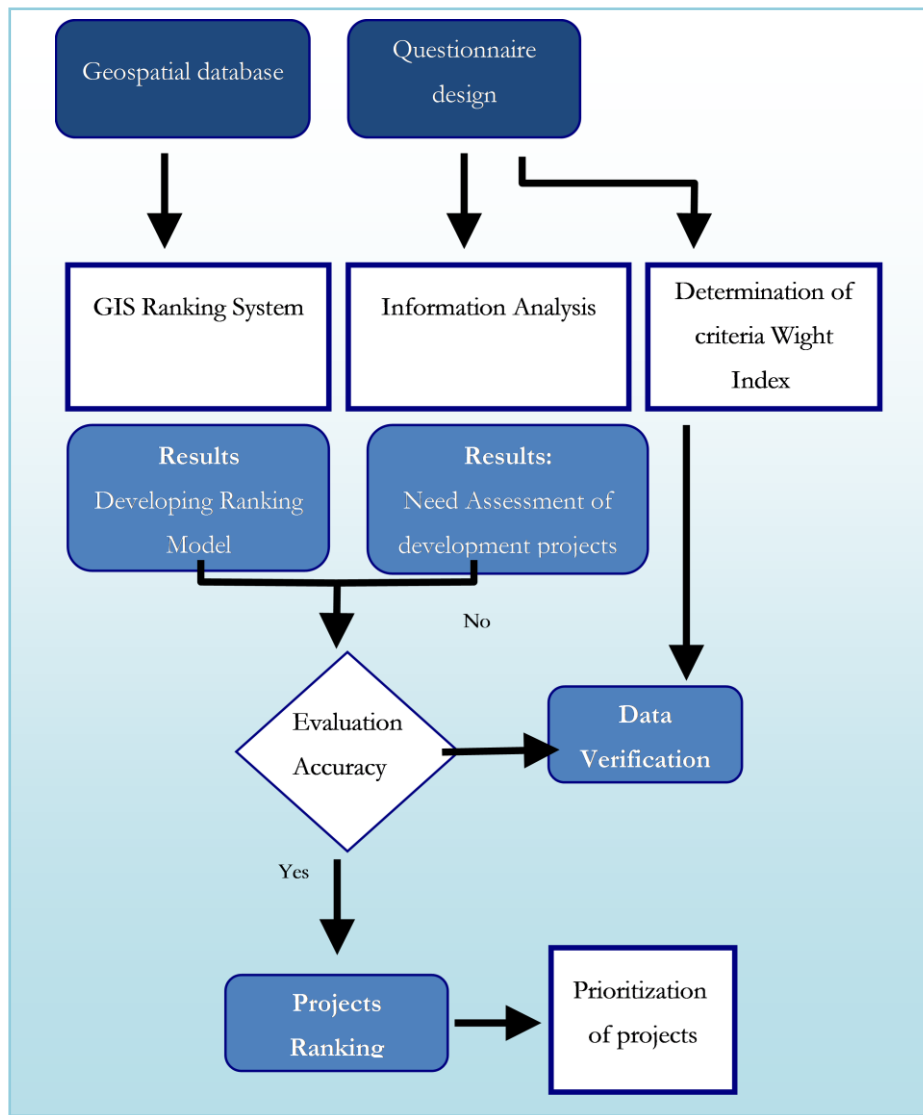
### **3.7.4 Evaluation of Computer Model:**

Multi-Criteria maps were organized and extracted by overlaying relevant criteria from the land-use map and other data sources. The scale rate was from 10 the highest score till the lowest one. The combination of the newly proposed score affected the final scoring but enabled having specific and compromising locations. Factors were ranked based on its significance to make preferences from them, this ranking provided a standardized common scale for each factor. In this fashion, factor maps were prepared for each site allocation criteria. Finally, all multi- criteria maps were weighted by means of weighted average to merge them as will be illustrated in section 4.6.

After weighting each factor and applying multi-criteria contrast, which is the method in the context of decision-making, a particular Multi-criteria maps were arranged by multiplying each standardized factor map by its factor weight and then summing the results. Consequently, this map was the result of map

overlaying using linear combination of all factor maps .

The decision making process was facilitated in a systematic situation; in ARC-GIS-MCDA analysis , the problems of site allocations were treated into decision situations. A suitability (composite) map was derived by covering the restrictions from the Multi-Criteria map to house qualitative criteria for the final planning and decision making process. Then a sensitivity analysis was also conducted to the final map to examine how sensitive the choices were, using attribute values and overlying weights. After thus checking the applicability of the analysis, the final suitability maps were prepared to the highest prioritized urban developmental projects , more over the plans were presented to respective experts to se to what extent they are compatible with the current needs . Figure (3.4) shows the Flow chart of research Methodology.



**Figure (3.4) Flow chart of the Methodology**

# Chapter (4) Assessment of Urban Developmental Projects Criteria in Gaza City as Pilot Study

## 4.1 Introduction

The urban strategic planning is a scientific method used to develop priorities and development goals for residential pools and identifying programs and projects capable of achieving these goals during a certain period of time in line with the aspirations of the population, taking into account available resources and possible constraints. In this chapter an overview of the current Prioritization model in Gaza City including the current strategic plan that recently adapted , the questionnaires' results will be mainly discussed to set-up the main criteria per each urban developmental projects and the allocation strategy .

This chapter investigates the data and feedback collected by the field survey conducted mainly in Gaza City area targeting the effectual stakeholders in urban development process. The principle objective of this research analysis is to establish a comprehensive mechanism of prioritization modeling system, including the development of a computerized model to help in the project prioritization process.



Figure(4.1)Gaza City Location Map Source(Wikipedia,2010 )

## 4.2 Gaza City population & Economy

Gaza City is one of the largest Palestinian cities in term of population percentage and the provisional headquarters of the Palestinian National Authority. Gaza City is one of the oldest cities in the world, has gained importance because of its geographical location at the confluence of the continents of Asia and Africa, which have great commercial importance.

Where it is located on the most prominent trade routes of the ancient world. After long years of Israeli occupation deprived the city of Gaza from its historical identity, the city began to regain its glorious past, historical and ancient researches had shown the that Gaza is one of the oldest cities in the world. Due to its unique geographical location between Asia and Africa, and between the desert in the south and the Mediterranean Sea to the north.

The city of Gaza was and is still considered a breeding ground and a place sought by travelers by land and sea. Gaza was always a place commercially rich, and that was reason enough to punish the occupation of the city by many armies throughout history. After years of Israeli occupation of the city, Gazans go ahead towards building their ancient city.

The Gaza Strip is located between Israel and Egypt on the Mediterranean coast.

The area of Gaza Strip is 365 km<sup>2</sup> (40km long and 6 to 12km wide). The Gaza Strip is bounded by the Green Line which is the border with Israel from the north and east. Egypt bounds the Strip from the south, and the Mediterranean Sea is the western border (<http://www.geography.about.com>, 2006). In addition , The total number of residential housing built of stone in Ottoman thousand and three hundred homes. Gaza suffered several invasions and occupation throughout history was ended with the Israeli occupation of the city in 1967 .

The area of Gaza City is 55.8 square kilometers according to the regional plan of the city. In 2007, the first census of population and housing facilities was conducted in Palestine, where the population of Gaza City at the time (448,426) people, and the number of the city's population in (2011) almost (650,000) people come to the city of about 150,000 people from the North and South for the purpose of work, study and daily shopping and tourism. (Gaza Municipality Web page, 2012 )

### 4.2.1 Geographical Distribution of the Population:

Gaza City has high-density with different populations, which varies in the neighborhood and according to the region to another, featuring some areas concentrating population severe and others heavily populated low and through demographic reality of the city, the distribution of population in Gaza City, which is a heterogeneous distribution of the population that can be actually assessed into two ranges, one characterized by erratic and scatter the population and the other concentration and congestion. (Gaza Municipality Web page,2012 )

#### 4.2.1.1 The Scattered Population Distribution Areas:

These areas are located on the outskirts of the city and at the borders.

- ❖ **The scattered population distribution areas:** These areas are located on the outsides of the city in the external borders.
- ❖ **Intensive population distribution areas:** these areas in the center of Gaza city, such as neighborhoods Shijaia, Tufah, Sabra, Al Daraj, Sheikh Radwan, Al Remal and other areas where services are available to citizens, such as commercial, schools, transportation, markets and shops, in addition they are characterized by concentration of population dense, adhesion houses and multi stories buildings. The area of Gaza City 55,806,796 square meters

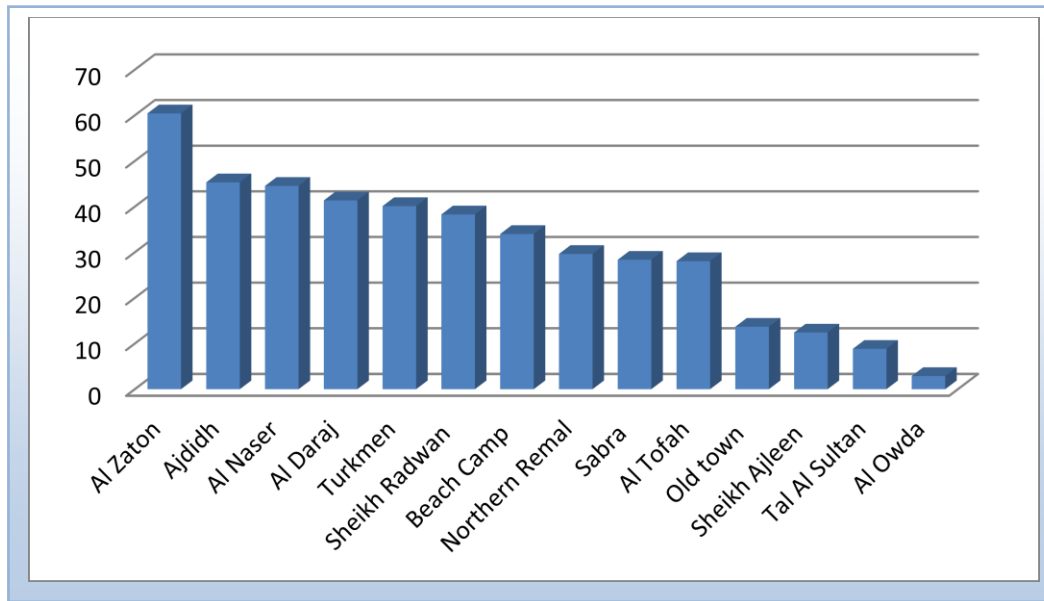
**Demographic information about the population:** Gaza City is characterized by youth category since male female ratio equivalent in number and a number of age group accounted for about 55% of the population for the elderly over the age of 65 years they constitute about 3% of the population.

The unemployment rate is about 38%, while the people below the poverty line are approximately 80%. Furthermore, the per capita GDP dropped from approximately \$1,200/capita in 2000 to about \$600/capita in 2009.

In 2005 the Ministry of National Economy has worked on the preparation of an economic plan for developing Gaza Strip over the coming three years and has done the SWOT analysis. At regional level Ministries of National Economy, Planning and Industry are considered the main players responsible for national economy development (PRCS,2012).

Gaza City has fourteen neighborhoods, the total populations is almost 448,426

inhabitants .Figure(4.2) indicates the percentage of population per neighborhood



**Figure (4. 2) Percentage of population per neighborhood.**

**Original source (PCBS, 2012)**

#### **4.2.2 Gaza City Economy**

Because of the Israeli imposed closure of the Gaza Strip in mid-2007, the Gazan economy received a severe shock that almost brought economic activity to a standstill. It also caused the closure of most industrial establishments, and halted the work of nearly all export oriented activities including manufacturing and agribusinesses.

The Palestinian Central Bureau of Statistics (PCBS) estimates that unemployment in the Gaza Strip at the end of the third quarter of 2012 at 28%, down from 40.5% in the same period 2011 Despite the slight improvement in the economic situation, Gaza still suffers from severe poverty and harsh economic conditions. A recent Fact Sheet released by Office for the Coordination of Humanitarian Affairs (OCHA) in the occupied Palestinian Territory, revealed that 44% of Gazans are food insecure and about 80% are aid dependent. In addition, the gross domestic product (GDP) per capita in 2011 was almost 17% below the equivalent figure in 2005, before the last Palestinian parliamentary elections. The report continues to say that the increased level of economic activity during 2011 was largely due to an influx of funds from abroad that concentrated on the service and construction sectors.

Gaza Strip will increase from 1.6 million people today to 2.1 million people in 2020, resulting in a density of more than 5,800 people per square kilometers. Infrastructure in electricity, water and sanitation, municipal and social services are not keeping pace with the needs of the growing population.(UNRWA, 2012).

This has put a lot of pressure on the economy to sustain a certain level of living for Gaza residents. In addition, during the last intifada Gaza economy has been the target of many Israeli actions such as the bulldozing of land, commercial and industrial establishments.

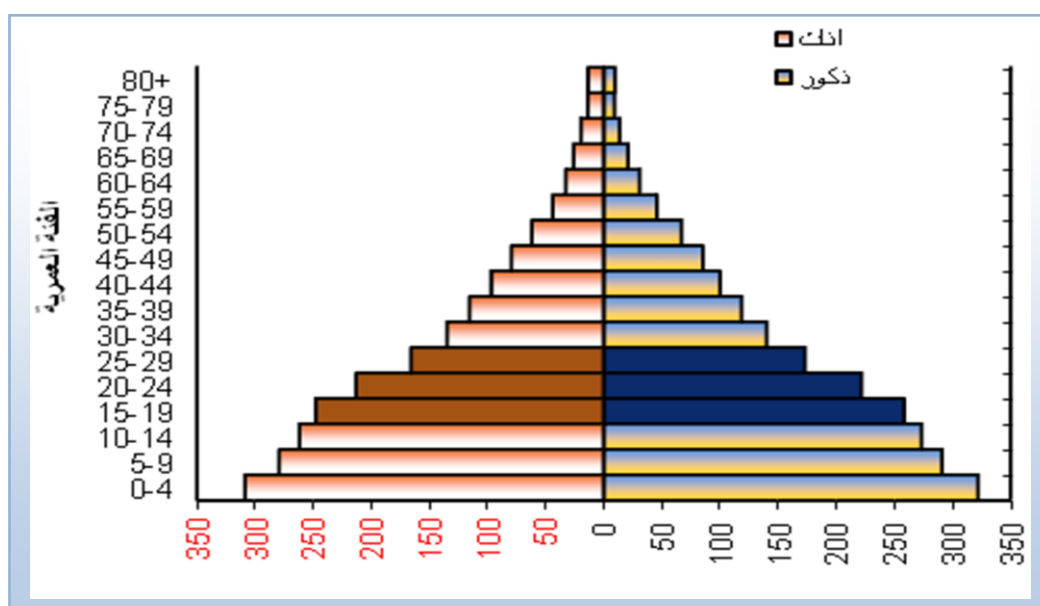


Figure (4.3) Population pyramid of Gaza Strip

Also, border closures and internal closures were imposed. These measures together with the already weak economy and high level of poverty worsened the economic situation in Gaza to a point that it is no longer able to sustain the pre Intifada level of living. The economic indicators reflect the needs of Gaza economy to support a recovery that would alleviate some of the bad effects (PCBS, 2012).

### 4.3 Current Projects' Funding Approach in Gaza city

The socio-economic condition of much of the population of Gaza was difficult prior to the war on Gaza in 2008-2009. The Israeli of military operations in December 2008 created even more desperate conditions for large sections of the Gazan populations. Many families became refugees in UN shelters and sought assistance from various international donors to provide the most basic needs for their existence - food, water, and health care. Combined with the continuing economic restrictions of Gaza.

Gazan population are facing the critical impediments for their speedy economic recovery and adverse effects on local agriculture income, market prices, housing, businesses and infrastructure rehabilitation. The operational environment presents significant challenges. Education, health and infrastructure facilities have suffered years of neglect, lack of sufficient maintenance and inability to import the required replacement construction and rehabilitation materials.

The absence of a specific mechanism for coordination between the policies set by the funding program at the international level created many obstacles.

Although it was suggested that the World Bank to oversee the formal financing mechanisms, but constraints prevented the completion of this and that is attributable to state united control on various decisions, sparking controversy among donor countries about the eligibility of each command and dominate the situation, which resulted in marginalizing the role of the donors as well as Palestinian bodies in charge of coordination with donor countries.

The look of donor countries to finance programs often formed a barrier before functioning properly, all of this is resulted from having improper consideration of the Prioritization system of the urban developmental process.

The privacy of the Palestinian situation makes it imperative for development programs which rely on two pillars: Firstly: reconstruction, and secondly: building the foundations of a national economy capable of self-reliance.

The adoption of these two pillars are essential to improve the urban strategic planning process to promote the building of Palestinian infrastructure and establish a long-term base development may be able to rely on the same according to (WB,2010).

#### **4.4 Current Situation of Prioritization model in Gaza City.**

Local constraints faced by aid programs to the Palestinians are basically due to the lack of the Palestinian Authority's strategy , and experience directed to these programs.

The absence of centralized and decisive decision-making process in parallel with special committee to prepare policies and development plans in the Palestinian territories , that has allowed many of the executive bodies overseeing the various sectors to use its influence to implement its own projects.

In addition , the failure of others who do not have such influence to achieve the



minimum of their needs, thus many gaps that have hindered the integration of development plans.(WB, 2010)

On the other hand , many other constraints faced the urban developmental projects funding programs intertwined with considerations of international politics surrounding the peace process, where is the discrepancy between estimates of the Palestinian Authority and donors to finance one of the most important problems faced by funding programs.

In the last years, Gaza City stakeholders adapted the past model for prioritization the urban developmental projects, which were chosen based on decisions form the stakeholders , without having any criteria of selection .

Currently Gaza City adapted new methodology of Prioritization which depended on several stages based on evidence development planning prepared earlier in collaboration between the Municipalities' lending Fund and the Ministry of Local Governance.

The strategic plan was formed based on five basic stages that were applied firstly through three phases of participation from broad community, where several meetings and workshops were held based on public participation.

This was done to inform the representatives of the local community and the private sector for their role in policy-making processes of development and decision-making leading to the strengthening of the partnership between them and the municipality .(SDIP, 2012)

Based on the final assessment done recently in the municipality of Gaza, the following final prioritized projects were ranked as mostly needed ones are as follows:

#### 4.5 Priority Development Issues

| Development Field                               | Priority Issues  |
|---|--|
| 1) <b>Municipal Services and Infrastructure</b> | Deterioration of water supplies and sanitation.  |
|   | Inefficiency of road networks and lighting.  |
| 2) <b>Environment and Public Health</b>         | Deterioration of environmental situation.  |
| 3) <b>Local Economy</b>                         | Increasing unemployment levels, deterioration of economical situation, and limitation of municipal revenues. |
| 4) <b>Culture and Sport</b>                     | The need to increase cultural awareness and interest in sport activities.                                    |
| 5) <b>Planning and Ruling</b>                   | Unplanned construction of buildings and facilities.  |
|   | The need to shift to an electronic municipality.   |
| 6) <b>Security and Disasters</b>                | Low efficiency and readiness of crisis and disaster management.  |

The assessment shows six prioritized projects that were chosen without having specific criteria of selection, even though the allocation strategy were set manually to obtain the optimal sites in the regional plans .

The following section indicated the results of the questionnaires which will show the criteria adapted for each of the maximum four ranked urban developmental projects .Those prioritized projects were taken into account while analyzing the extracted data from the survey results.

#### 4.6 Analysis of the Collected Database using the Questionnaire Distributed to Palestinian Governmental, Local Institutes and INGOs Located in Gaza.

In total , the filled questionnaires were analyzed using different techniques to compare the results and rank the criteria as per the results of the weighting .

The One-Way ANOVA procedure was used as a method of analysis to produce a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable. Analysis of variance was used to test the hypothesis that several means are equal. This technique is an extension for the two-sample t test.

In addition to determining that differences exist among the means of the criteria' weights , it helped to know which means differ.

In addition the frequency test was used to obtain the results per variable, it provided statistics and graphical displays for describing many types of variables , the outcomes were ranked according to the results to obtain a sheets per projects that

includes the most highly ranked criteria relevant to the proposed project , the final results were evaluated to check the consistency of the data flow ,

Another test was conducted which is the reliability test to facilitate the studying the measurement scales and the items that make them up.

The Reliability Analysis procedure were calculated a number of commonly used measures of scale reliability and also provides information about the relationships between individual items in the scale.

On the other hands , the usage of two-Sample t-Test was very helpful to compare two independent means of the scored criteria .

The outcomes data were cross tabulated to form two-way and multi-way tables and provides a variety of tests and measures of association for two-way tables.

The scores of the weighting results using consistent criteria were ordered by the size of their means (in ascending or descending order),

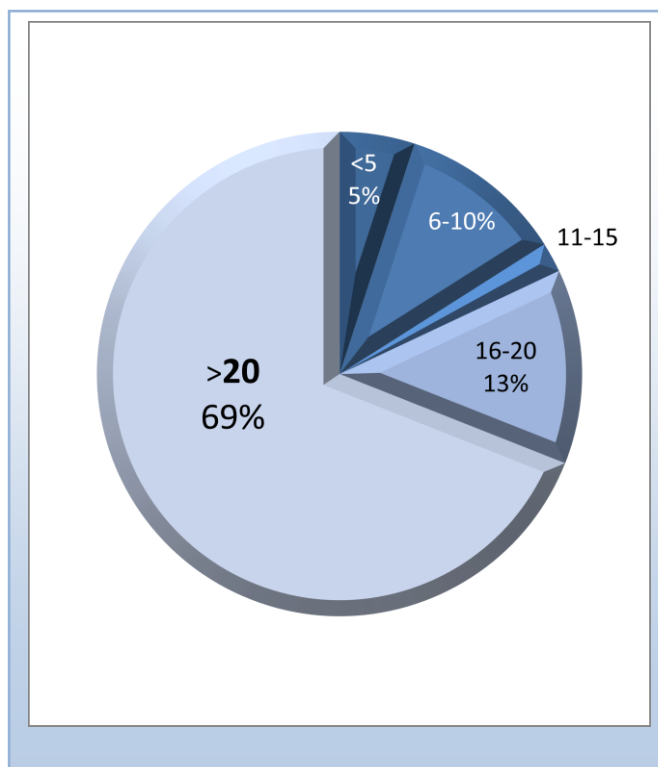
#### 4.6.1 Demographic Description About the Targeted Stakeholders :

Based on the analysis , 85% male and 15% female stakeholders in Gaza city participants.

63% of total interviewed were stakeholders engineers, while 11% were managers in different organizations.

They were member of different organizations , such as UNRWA , governmental organization such as Ministry of Governance , Ministry of Planning , municipalities, contracting companies, international non- governmental organization INGOS , such as Islamic Relief , CRS , UNICEF, OCHA , etc.

In total the respondents were highly appreciating the initiative of the survey to rank the priorities of the urban developmental projects, the total respondents were having



**Figure (4. 4) Number of projects implemented by all surveyed stakeholders in last five years**

at least 15 years of experience in developmental projects , each survey took at least 20 minutes interview to rank the priorities effectively.

#### 4.6.2 Projects implemented by institutions

During the last five years the respondent institutions accomplished many projects , since the targeted stakeholders were working in organizations that have at least 30.6 years of experience in the field of urban developmental projects and supporting the local economy .

69% of total organizations stakeholders’ organization implemented less than 20 projects in the last five years , while 13% executed 16-20 projects and less than 15 projects in the last five years of process.

#### 4.6.3 Categorization of Targeted Organizations

24% of total organizations categorized water development sectors as their main type of urban developmental projects , while 22% considered the wastewater networks development as the main field work .

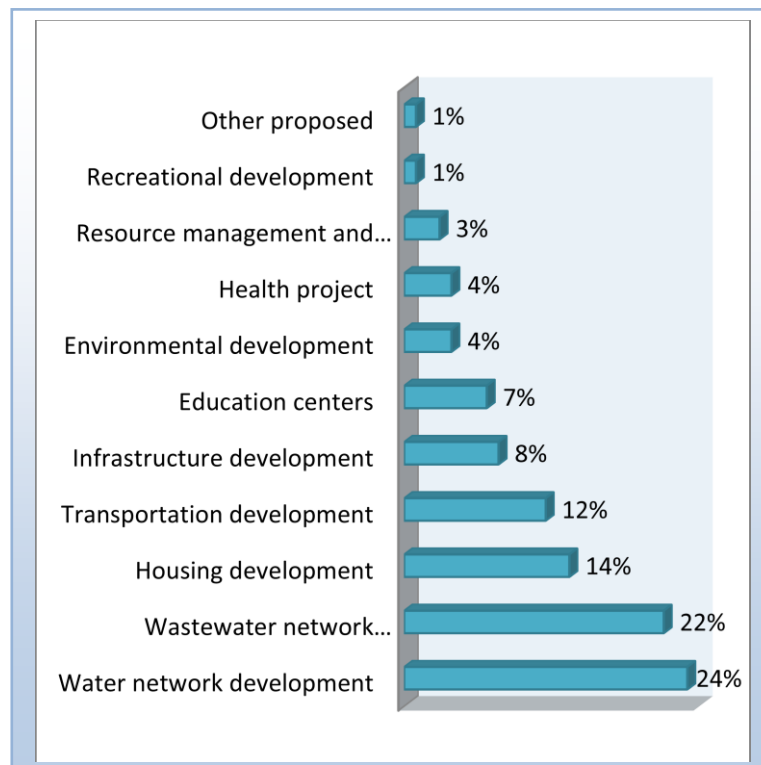
This can be illustrated due the continuous support provided in the sector since Gaza strip is suffering from scarcity of water and dropped wastewater network .

14% of total targeted stakeholders stated that 14% of total fund is directed to implement housing projects, while 12% of major executed projects were related to transportation projects .

Only 1% of targeted organizations stated that

major implemented projects were related to improve recreational urban development.

The stated results represent the targeted sample size , however it visualize the current situation of fund flow in the Gaza city .



**Figure (4. 5) Categorization of Current Work of targeted institutions**

#### 4.6.4 Fund Sources of Projects in the Majority of Surveyed Organizations:

The results of the survey represented the reality of current local economy of the Palestinian regions .

78% of total organizations were having donations and grants to implement their projects , despite the fact that 12% were having governmental support , others were having different sources of fund to implement the urban projects in the Gaza city.

#### 4.6.5 Current Situation Reflects Adequate Planning of Developmental Projects Development:

The questionnaires analysis results showed that only 5% of total interviewed believed that the current planning situation reflects adequate planning of developmental projects.

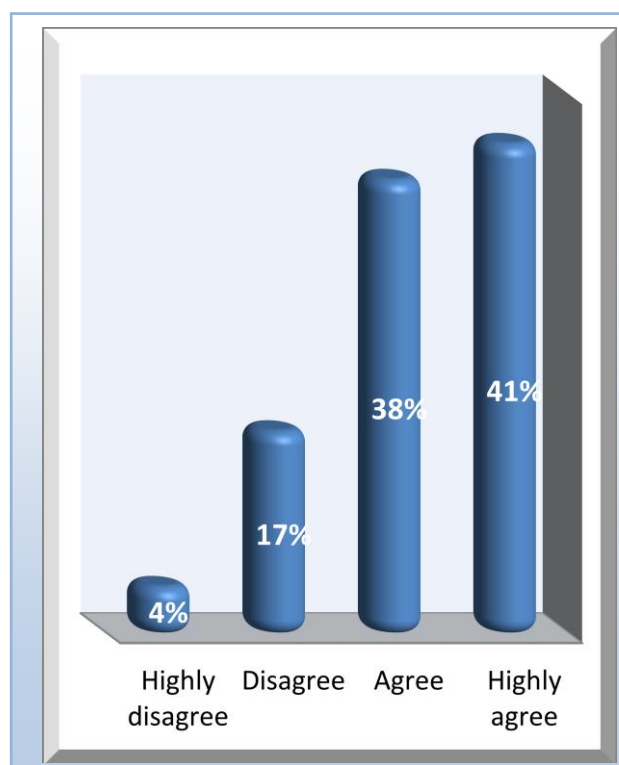
Conversely 50% considered the current planning as prominent approach in the meantime within the imposed siege and lack of resources.

The initiative of developing prioritization modeling was greatly appreciated by the targeted stakeholders

40 % of total interviewed were highly agreed with having a systematic model of planning and strategic thinking of the priorities and needs of Gaza city , in addition 17% were neutral in their response but 4% were not agreed .

#### 4.6.6 The Importance of having Effective Model to Prioritize and Implement Development Projects:

Figure(4.6) shows the responses percentage that intended to measure the acceptance of having computerized model to be adapted in the Palestinian originations which is taking the leads in prioritizing the urban developmental projects , the responses varied among



**Figure (4.6) The Importance of having Effective Model of Prioritization**

stakeholders , where the majority highly agreed with having such a model , since it will facilitate comprehensive use of resources and will manage decision making process , 38% were agreed with this model , in addition to 17 % and 4% were neutral

and disagreed respectively. Consequently, when targeted stakeholders were asked about the effectiveness of having computerized program to prioritize the needs and site selection of the urban development projects , 85% agreed on the usage of such conceptual program , while 9.3% disagreed with the concepts and 5.7% were uncertain. This results had showed the awareness and realization of high experienced stakeholders about the consequence of the research and the establishment of the conceptual framework.

#### 4.6.7 Ranking of Mostly Active Urban Developmental projects in the targeted Stakeholders Organizations :

58% of total interviewed stakeholders ranked water networks development project as the most action line of their organizations, whereas 59% considered their second action line projects is Wastewater developmental projects taking into account the scarcity of wastewater network in the Gaza city especially in the coming winter.

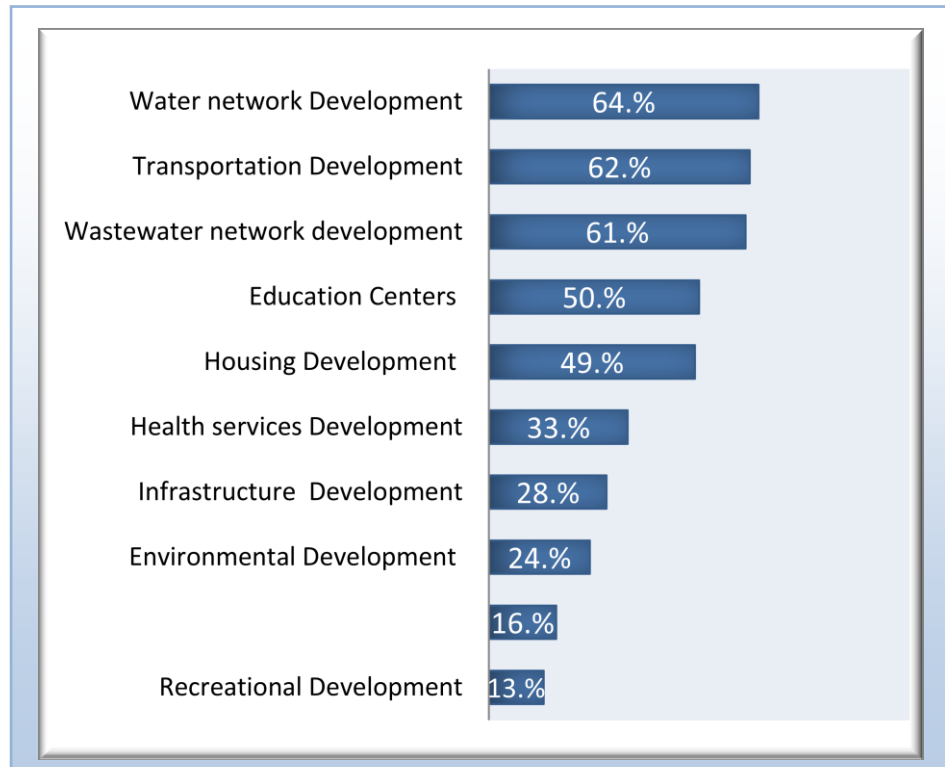
When the third choice was ranked , it can be concluded that the housing issues were taken into consideration , since 23% prioritized housing developmental projects as the third choice . Conversely, environmental projects were taken as the fourth choice as action line in the targeted organization main filed of interest .

|   | First Choice | Second Choicer | Third Choice | Fourth Choice |
|---|--------------|----------------|--------------|---------------|
| <b>Water Network Development</b>                    | 58%          |                |              |               |
| <b>Wastewater Network development</b>               | 13%          | 59.1%          | 2.2%         | 11.4%         |
| <b>Transportation Development</b>                   | 12%          | 2.2%           | 20%          |               |
| <b>Recreational Development</b>                     | 1%           | 1.1%           | 6.7%         | 2.5%          |
| <b>Education Centers</b>                            | 16%          | 14%            | 12.2%        | 7.6%          |
| <b>Health Development</b>                           |              | 6.5%           | 18.9%        | 15.2%         |
| <b>Resource Management and Land use Development</b> |              | 4.3%           |              | 3.8%          |
| <b>Housing development</b>                          |              | 7.5%           | 23.3%        | 12.7%         |
| <b>Environmental Projects Development</b>           |              | 2.2%           | 7.8%         | 21.5%         |
| <b>Others</b>                                       |              |                | 3.1%         | 25.3%         |

The respondents were asked to rank the different urban developmental projects to agree upon mostly important four projects, after data analysis using multi-criteria

process ,the projects were ranked based on the multi criteria analysis for the proposed weight per projects .

Table(4.3) illustrated the final ranking based on three criteria ,which are high importance , middle and low. The weights were then divided by number of responses to determine the actual weights of the importance of the projects .



**Figure (4.7) The Final Ranking of the urban Developmental Projects according to Survey Results**

It was concluded that water developmental projects visualize the highest priority , the transportation development projects was considered as the second ranked one , the wastewater network development was ranked as the third proposed projects , education projects were the fourth degree .

Decision making process should be based on analyzing the priorities and compromising between the validity of each of them to facilitate the smoothly taking decision making process.

The ten projects will be taken as the pilot case studies to be analyzed in depth in term of allocation and criteria selection, but the four ranked proposed ones will

| <b>Table (4.3) Final Ranking of the urban Developmental Projects according to Survey Results</b> |        |                |        |      |  |
|--|--------|----------------|--------|------|--|
| Proposed Projects  | Weight | Very Important | Middle | Weak |  |
| <b>1</b> Water network Development   | 64.0%  | 85%            | 14%    | 1%   |  |
| <b>2</b> Transportation Development  | 62.0%  | 50%            | 45%    | 5%   |  |
| <b>3</b> Wastewater Network Development  | 61.0%  | 81%            | 19%    | 0%   |  |
| <b>4</b> Education Centers   | 50.0%  | 57%            | 34%    | 9%   |  |
| <b>5</b> Housing Development   | 49.0%  | 53%            | 35%    | 12%  |  |
| <b>6</b> Health services Development   | 33.0%  | 65%            | 26%    | 9%   |  |
| <b>7</b> Infrastructure Development  | 28.0%  | 41%            | 38%    | 17%  |  |
| <b>8</b> Environmental Development   | 24.0%  | 51%            | 40%    | 9%   |  |
| <b>9</b> Resource Management and Land-use Development  | 16.0%  | 32%            | 48%    | 18%  |  |
| <b>10</b> Recreational Development   | 13.0%  | 24%            | 50%    | 26%  |  |

#### **4.6.8 Weighting of Mostly Active Selection Criteria for Urban Planning Developmental Projects Based on Survey's Results:**

Land suitability assessment is similar to choosing an appropriate location, except that the goal is not to isolate the best alternatives, but to map a suitability index for urban planning of developmental projects.

Criteria's weights facilitated all scores to be transferred to familiar scales, it will emulate both the comparative importance of criteria as well as difference in unit of inclination on different scales. Moreover, weighting was accomplished by judging the relative judgment in preference from the bottom to the top of one score scale as compared to another.

Selecting criteria from a list of Multi-Criteria was an important step for the



compromising between projects. Some criteria were retained by all of them for some projects , but others were only considerable for certain projects.

consequently, having effectual approach of identifying the selection criteria for the major urban developmental projects visualizes criteria weight. In the data analysis, it was shown that the respondent were able to rank the selection criteria for different projects that were proposed.

In order to have valuable mechanism to be prepared for the computerized proposed program, respondents and stakeholders were engaged in weighing the suggested twenty five criteria to be applied by the computerized program as fundamental approach for creation such urban projects selection. The weighted index was shown for each criterion as a result of survey analysis.

In general the stakeholders were asked to rank the four proposed projects using the maximum weight of 10 till the minimum weight of zero. These criteria may be considered as a pilot case study and thus they can be adjusted upon the specific nature of the project itself. It shows the logic ranking of the criteria that may be used for a transparent and fair prioritization process.

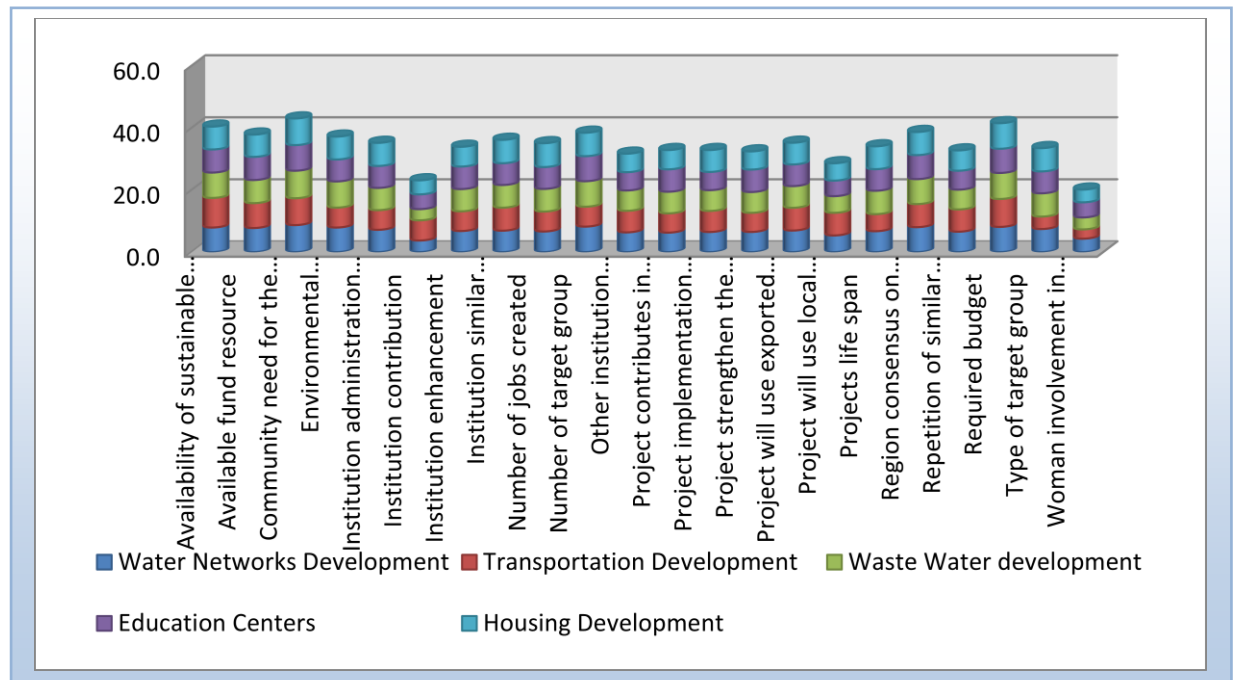
The weighted results will be disaggregated by the proposed ranked projects; this was crucial process to provide unique perception about the selection criteria and allocation strategy per each to them to facilitate inclusive approach of selection and allocation. The Evaluation method used was to rank the mean weight sequenced from the analysis of t-test and Lanova test using SPSS analytical methods , in addition it was ranked using Excel program

Table(4.4) shows the collected data from the ten proposed urban developmental project disaggregated by the proposed criteria. The table explained the mean average score of the criteria per projects , they are not ascending but the mean values are presented .

**Table (4.4) Collected Data from the Ten Proposed Urban Developmental Project Disaggregated by the Proposed Criteria.**

|   | Water | Transportation | Wastewater | Education | Housing | Health services | Infrastructure | Environmental | Land M | Recreational |
|---|-------|----------------|------------|-----------|---------|-----------------|----------------|---------------|--------|--------------|
| <b>Availability of sustainable Multi-Criteria</b>                                 | 7.9   | 9.5            | 8.2        | 7.4       | 7.4     | 7.4             | 7.3            | 7.3           | 8.3    | 8.3          |
| <b>Available fund resource</b>  | 7.8   | 8              | 7.5        | 7.5       | 7.2     | 7               | 7.5            | 7.2           | 7.1    | 7.1          |
| <b>Community need for the project</b>   | 8.7   | 8.7            | 8.9        | 8.3       | 8.6     | 8.1             | 7.6            | 8             | 9.1    | 9.1          |
| <b>Environmental consideration</b>  | 7.9   | 6.4            | 8.4        | 7.1       | 7.4     | 7               | 7.2            | 8.2           | 8.4    | 8.4          |
| <b>Institution administration team repetition</b>                                 | 7.2   | 6.3            | 7.2        | 7.1       | 7.4     | 6.5             | 6.5            | 6.9           | 6.2    | 6.2          |
| <b>Institution contribution</b>   | 3.7   | 6.5            | 3.6        | 4.8       | 4.5     | 4               | 4.2            | 4.2           | 3.8    | 3.8          |
| <b>Institution enhancement</b>  | 6.8   | 6.4            | 7.2        | 7.3       | 6.4     | 6.8             | 7.4            | 6.4           | 6.6    | 6.6          |
| <b>Institution similar experience</b>   | 6.9   | 7.4            | 7.3        | 7         | 7.5     | 6.8             | 6.8            | 6.5           | 5.8    | 5.8          |
| <b>Number of jobs created</b>   | 6.6   | 6.4            | 7.3        | 7         | 7.7     | 7.3             | 6.2            | 6.4           | 6.2    | 6.2          |
| <b>Number of target group</b>   | 8.2   | 6.4            | 8.2        | 8.1       | 7.6     | 8.2             | 6.8            | 7.9           | 8.3    | 8.3          |
| <b>Other institution involvement in project (selection and/or implementation)</b> | 6.4   | 7              | 6.6        | 5.9       | 6       | 6.2             | 5.7            | 6.7           | 6.3    | 6.3          |
| <b>Project contributes in capacity building of local human resources</b>          | 6.3   | 6.2            | 7          | 7.2       | 6.2     | 7               | 6.7            | 6.5           | 7.1    | 7.1          |
| <b>Project implementation duration</b>  | 6.5   | 6.8            | 6.7        | 5.9       | 7.1     | 6.9             | 5.5            | 6.9           | 5.9    | 5.9          |
| <b>Project strengthen the relations between local stakeholders</b>                | 6.5   | 6.2            | 6.7        | 7.2       | 5.9     | 6.3             | 6.2            | 5.7           | 7.4    | 7.4          |
| <b>Project will use exported materials</b>  | 7     | 7.3            | 7          | 7         | 7       | 6.6             | 5.3            | 5.9           | 6.9    | 6.9          |
| <b>Project will use local materials</b>   | 5.4   | 7.3            | 5.4        | 5         | 5.6     | 5.8             | 5.8            | 5.5           | 6.1    | 6.1          |
| <b>Projects life span</b>   | 6.7   | 5.5            | 7.5        | 7         | 7.4     | 6.9             | 5.8            | 7             | 7.5    | 7.5          |
| <b>Region consensus on project</b>  | 8     | 7.4            | 8          | 7.7       | 7.4     | 7.8             | 7.5            | 7.4           | 7.9    | 7.9          |
| <b>Repetition of similar projects in the area</b>                                 | 6.6   | 7.2            | 6.4        | 6.1       | 6.6     | 6               | 5.4            | 5.9           | 4.8    | 4.8          |
| <b>Required budget</b>  | 8.1   | 9              | 8.4        | 7.8       | 8.2     | 7.6             | 7              | 45.5          | 7.8    | 7.8          |
| <b>Type of target group</b>   | 7.4   | 4              | 7.5        | 7.1       | 7.5     | 7.5             | 7              | 7.4           | 6.4    | 6.4          |

The comparison between the ten urban developmental projects shows that the mean average proposed criteria differentiated among the selection criteria , They were depended on the nature of the project itself.



**Figure (4. 8) The ranking of the twenty two criteria per each project**

Ranking the projects were one of the most imperative prioritization process that was substantiated during their responses in the survey ,subsequently, the respondents were able to score them based on the real needs and the importance of the relevant criteria . The higher scores four projects which had the uppermost scores in the frequently proposed projects .

The following sections will acquire in-depth details about the high five projects, which was decided upon needs and high priorities.

It was intended to identify common scoring for common criteria for the ranked developmental projects , in order to compare the five highest ranked projects .

The main criteria were the community needs of the projects, since it was scored as the highest scores among the participants , on the other hand the environmental impact was considered as the fundamental selection criteria of the projects' itself, moreover the available fund was determined as the major third one in comparison to other criteria. Figure (4.7) shows the ranking of the twenty two criteria per each project .The harmonization among the selection criteria can be seen since all the projects were shared with similar criteria but with different scores.

#### 4.6.8 .1 Water Developmental projects Selection Criteria's Weights:

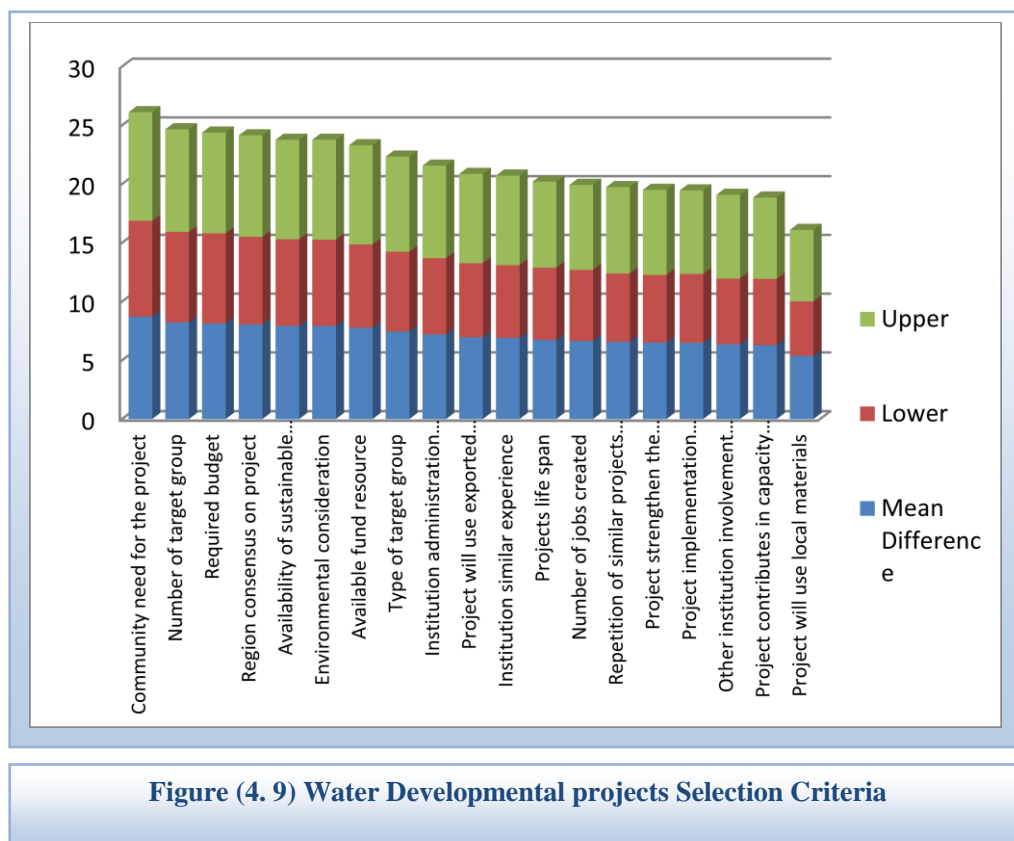
As previously stated, water development projects coincide with the most priority ranked within the total respondents , the main case study in the next chapter will be focusing on the this projects using the computerized program .

The decision making system will be feed with the output of the criteria's weight to facilitate effective usage of available resources. The survey results showed that almost all respondents agreed that the community need for the project comes on the top of criteria with weighted mean of (8.70). Number of target group is the second criterion with weighted mean of (8.2). Required budget are of equal importance as criteria Multi-Criteria with weighted mean of (8.12).

Region consensus on project ,availability of sustainable Multi-Criteria , environmental consideration, Available fund resource, Type of target group ,Institution administration team repetition were next with weighted mean of (8 –7.1). Lowest weighted mean of (0.69) was for two criteria of Project contributes in capacity building of local human resources and Project will use local material.

Table (4.5) indicates the prioritization of Water development projects criteria and summarized the feedback about the water development major criteria to taken into consideration while designing similar projects .

|   | t    | Lower | Upper  |
|---|------|-------|--------|
| <b>Community need for the project</b>   | 31.9 | 8.1   | 9.2    |
| <b>Number of target group</b>   | 32.0 | 7.7   | 8.7    |
| <b>Required budget</b>  | 35.8 | 7.6   | 8.5    |
| <b>Region consensus on project</b>  | 27.5 | 7.4   | 8.6    |
| <b>Availability of sustainable Multi-Criteria</b>                                 | 28.8 | 7.3   | 8.4    |
| <b>Environmental consideration</b>  | 27.0 | 7.3   | 8.5    |
| <b>Available fund resource</b>  | 22.9 | 7.0   | 8.4    |
| <b>Type of target group</b>   | 22.7 | 6.7   | 8.0    |
| <b>Institution administration team repetition</b>                                 | 20.9 | 6.5   | 7.8    |
| <b>Project will use exported materials</b>  | 21.4 | 6.3   | 7.6    |
| <b>Institution similar experience</b>   | 19.0 | 6.1   | 7.6    |
| <b>Projects life span</b>   | 22.4 | 6.1   | 7.3    |
| <b>Number of jobs created</b>   | 22.3 | 6.0   | 7.2    |
| <b>Repetition of similar projects in the area</b>                                 | 17.1 | 5.8   | 7.3    |
| <b>Project strengthen the relations between local stakeholders</b>                | 17.5 | 5.7   | 7.2    |
| <b>Project implementation duration</b>  | 20.9 | 5.8   | 7.1    |
| <b>Other institution involvement in project (selection and/or implementation)</b> | 16.4 | 5.58  | 7.1320 |
| <b>Project contributes in capacity building of local human resources</b>          | 19.7 | 5.64  | 6.9177 |
| <b>Project will use local materials</b>   | 14.8 | 4.64  | 6.0    |



**Figure (4.9) Water Developmental projects Selection Criteria**

The consensus was relevant to the community needs for the projects ,in the meantime the water crises in the Gaza Strip showed the high percentage of polluted water due to the drop Wastewater network and high nitrate percentage base on last UNRWA report that the necessity for clean water will be increased by 60% in the coming seven years , which indicates the importance of having wide-ranging criteria upon selection such projects.(UNRWA,2012)

**4.6.8.2 Transportation Developmental Projects Selection Criteria's Weights:**

Transportation Developmental Projects corresponded with the second priority ranked within the total respondents .The decision making system will be feed with the output of the criteria’s weight to facilities effective usage of resources. The survey results demonstrated that almost all respondents agreed that the available fund resource move towards on the top of criteria with weighted mean of (9.5). Environmental consideration is the second criterion with weighted mean of (8.6). Community need for the project is of less weight as criteria Multi-Criteria with weighted mean of (8.0). Required budget, Number of target group, projects life span, Region consensus on project were next with weighted mean of (7.4 ).

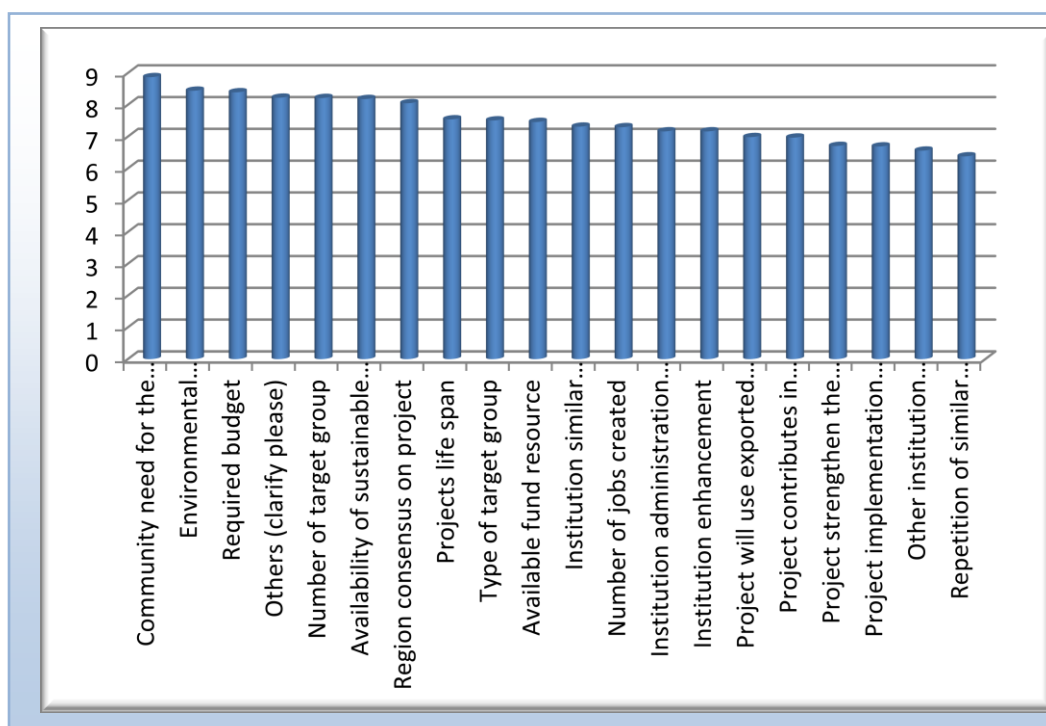
The other criteria were weighted based on different Multi-Criteria , for example e, the type of targeted committee availability of sustainable impact , the projects duration , the usage of exported materials , and having similar experience were the next level of importance criteria for selecting transportation projects with mean value ( 6.4 to7.3). The lowest criteria were given to the usage of local materials, having similar projects in the area, institutions enhancement.

| Table(4.5)Transportation Developmental Projects Selection Criteria's Weights |      |                |                 |
|--|------|----------------|-----------------|
|  | Mean | Std. Deviation | Std. Error Mean |
| Available fund resource  | 9.54 | 77.3           | 9.8             |
| Environmental consideration  | 8.6  | 11.7           | 1.4             |
| Community need for the project   | 8.0  | 1.9            | .2              |
| Required budget  | 7.4  | 2.6            | .3              |
| Number of target group   | 7.4  | 2.3            | .3              |
| Projects life span   | 7.3  | 2.1            | .2              |
| Region consensus on project  | 7.3  | 2.8            | .3              |
| Type of target group   | 7.1  | 2.4            | .3              |
| Availability of sustainable Multi-Criteria                                   | 7.1  | 2.4            | .3              |
| Project implementation duration  | 6.9  | 2.4            | .3              |
| Project will use exported materials  | 6.7  | 2.7            | .3              |
| Institution similar experience   | 6.5  | 3.1            | .39             |
| Other institution involvement in project (selection and/or implementation)   | 6.4  | 2.9            | .3              |
| Institution administration team repetition                                   | 6.4  | 2.9            | .3              |
| Project contributes in capacity building of local human resources            | 6.4  | 2.9            | .3              |
| Number of jobs created   | 6.35 | 2.5            | .3              |
| Institution enhancement  | 6.3  | 2.8            | .3              |
| Project strengthen the relations between local stakeholders                  | 6.2  | 2.8            | .3              |
| Project will use local materials   | 6.1  | 2.8            | .3              |
| Repetition of similar projects in the area                                   | 5.5  | 3.1            | .4              |

#### 4.6.8 .3Wastewater Development Selection Criteria's Weights

Wastewater development projects overlapped with the third priorities categorized within the total respondents .The survey results showed that almost all respondents agreed that the community need for the project comes on the top of criteria with weighted mean of (8.8). Environmental consideration is the second criterion with weighted mean of (8.4). Required budget , number of targeted group who will be benefited from the projects , availability of sustainable conditions and the consensus upon such projects were considered the major lower scale weighted

criteria with weighted mean of (8.1 to 8). Region consensus on project ,availability of sustainable Multi-Criteria, environmental consideration.



**Figure (4. 10) Waste Water Developmental projects Selection Criteria .**

Available fund resource, type of target group ,Institution administration team repetition were next with weighted mean of (8 to 7.1 ).

Other criteria were ranked with the range from (6.5 to 7.5),such as the criteria related to institution administration team repetition Institution enhancement .

Project used exported material, Project contributes in capacity building of local human resources and project strengthen the relations between local stakeholders Figure (4.9) provided in-depth view about the respondents weighting to the criteria related to Wastewater projects.

Lowest weighted mean of (6.6) was for project other institutions involvement in project (selection and/or implementation) and repetition of similar projects in the area with the range of (6.3 to 6.5), there were three to four criteria that were ignored, since their weight were less that the average accepted rate , in addition to being not relevant to the nature of the project.

| Table(4. 6)3Wastewater Development Selection Criteria's Weights            |      |                |
|--|------|----------------|
|  | Mean | Std. Deviation |
| Community need for the project   | 8.8  | 1.736          |
| Environmental consideration  | 8.4  | 2.061          |
| Required budget  | 8.3  | 2.09           |
| Number of target group   | 8.2  | 2.030          |
| Availability of sustainable Multi-Criteria                                 | 8.1  | 2.03           |
| Region consensus on project  | 8.0  | 2.3            |
| Projects life span   | 7.5  | 2.0            |
| Type of target group   | 7.5  | 2.7            |
| Available fund resource  | 7.4  | 2.8            |
| Institution similar experience   | 7.3  | 2.5            |
| Number of jobs created   | 7.2  | 2.2            |
| Institution administration team repetition                                 | 7.1  | 2.4            |
| Institution enhancement  | 7.1  | 2.3            |
| Project will use exported materials  | 6.9  | 2.8            |
| Project contributes in capacity building of local human resources          | 6.9  | 2.7            |
| Project strengthen the relations between local stakeholders                | 6.7  | 2.8            |
| Project implementation duration  | 6.6  | 2.5            |
| Other institution involvement in project (selection and/or implementation) | 6.5  | 2.8            |
| Repetition of similar projects in the area                                 | 6.3  | 3.2            |

#### 4.6.8 .4 Education Centers Selection Criteria's Weights:

The education centers incorporate varied range of different types and for different purposes, The respondents and stakeholders were oriented on how to rate those types of projects , explaining the rationale of such projects , in order to indent the most relevant indicators that affects the selection of such projects in the urban planning priorities. Table(4.8) indicates the total respondent per criteria ranked from the highest to the smallest.

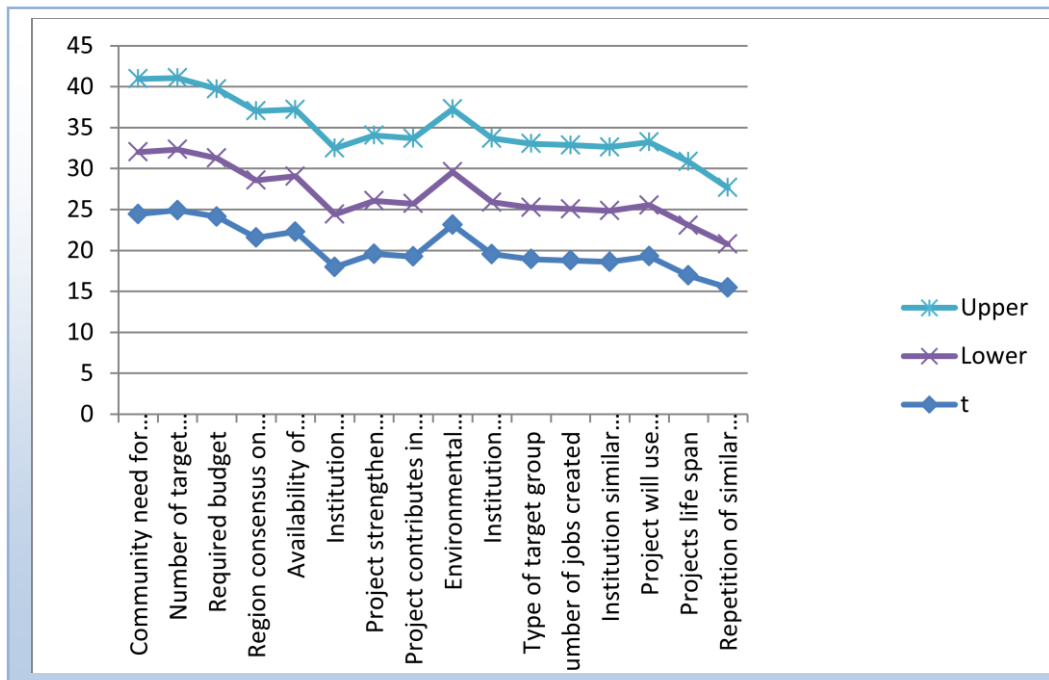
The highest rate of mean average was provided to community about the project with weight of (8.2), the next weight was given to the number of targeted group , Other criteria were ranked with the range from (7.8 to7.0),such as Region consensus on project.



| Table (4.7) Education Centers Selection Criteria's Weights        |      |                 |
|---|------|-----------------|
|   | t    | Mean Difference |
| Community need for the project                                    | 24.4 | 8.2             |
| Number of target group  | 24.9 | 8.0             |
| Required budget   | 24.1 | 7.8             |
| Region consensus on project                                       | 21.5 | 7.7             |
| Availability of sustainable Multi-Criteria                        | 22.2 | 7.4             |
| Institution enhancement   | 17.9 | 7.2             |
| Project strengthen the relations between local stakeholders       | 19.5 | 7.2             |
| Project contributes in capacity building of local human resources | 19.2 | 7.2             |
| Environmental consideration                                       | 23.1 | 7.0             |
| Institution administration team repetition                        | 19.5 | 7.0             |
| Type of target group  | 18.9 | 7.0             |
| Number of jobs created  | 18.7 | 7.0             |
| Institution similar experience                                    | 18.6 | 7.0             |
| Project will use exported materials                               | 19.2 | 6.9             |
| Projects life span  | 16.9 | 6.9             |
| Repetition of similar projects in the area                        | 15.4 | 6.1             |

Availability of sustainable Multi-Criteria , institution enhancement, Project strengthen the relations between local stakeholders, project contributes in capacity building of local human resources, environmental consideration, institution administration team repetition, type of target group, number of jobs created and institution similar experience. Lowest weighted mean of (6.9 and 6.1) for the project duration and repetition of similar projects in the area.

Similar to above projects , there were three to four criteria that were ignored, since their weight were less that the average accepted rate , in addition to being not relevant to the nature of the projects.



**Figure (4.11) Wastewater Developmental projects Selection Criteria**

#### 4.6.8 .5 Housing Development Projects Selection Criteria's Weights

Housing Development projects coincide with the fourth priorities classified within the total respondents .The questionnaires' analytical results showed that almost all respondents agreed that the community need for the project comes on the top of criteria with weighted mean of (8.6). Required budget consideration is the second criterion with weighted mean of (8.2). Institution similar experience, type of target group, region consensus on project were next with weighted mean of (7.5 ). In addition , other criteria were weighted with mean average of (7.3 and 7.0) such as Institution administration team repetition, availability of sustainable Multi-Criteria , environmental consideration, projects life span ,available fund resource, project implementation duration, project will use exported materials. Furthermore, housing developmental projects were ranked with criteria such as repetition of similar projects in the area, Institution enhancement and Project contributes in capacity building of local human resources with an average mean value of (6.5 and 6.3).

|  | Mean | Std. Deviation | Std. Error Mean |
|--|------|----------------|-----------------|
| Community need for the project   | 8.6  | 1.5            | .2              |
| Required budget  | 8.2  | 1.8            | .2              |
| Number of jobs created   | 7.6  | 2.3            | .3              |
| Number of target group   | 7.5  | 2.5            | .3              |
| Institution similar experience   | 7.5  | 2.6            | .3              |
| Type of target group   | 7.5  | 2.4            | .3              |
| Region consensus on project  | 7.4  | 2.7            | .3              |
| Institution administration team repetition                                 | 7.4  | 2.4            | .3              |
| Availability of sustainable Multi-Criteria                                 | 7.3  | 2.4            | .3              |
| Environmental consideration  | 7.3  | 2.3            | .3              |
| Projects life span   | 7.3  | 2.2            | .3              |
| Available fund resource  | 7.1  | 2.7            | .3              |
| Project implementation duration  | 7.0  | 2.4            | .3              |
| Project will use exported materials  | 7.0  | 2.4            | .3              |
| Repetition of similar projects in the area                                 | 6.5  | 2.9            | .4              |
| Institution enhancement  | 6.3  | 2.6            | .3              |
| Project contributes in capacity building of local human resources          | 6.2  | 2.6            | .3              |
| Other institution involvement in project (selection and/or implementation) | 5.9  | 3.2            | .4              |
| Project strengthen the relations between local stakeholders                | 5.8  | 2.8            | .4              |
| Project will use local materials   | 5.5  | 2.3            | .4              |
| Institution contribution   | 4.5  | 3.4            | .4              |
| Woman involvement in project identifying                                   | 4.1  | 2.7            | .3              |

On the other hand , there were some criteria such as project will use local materials, project strengthen the relations between local stakeholders, Other institution involvement in project (selection and/or implementation) were considered the major lower scale weighted criteria with weighted mean of (5.9 to 4.10).

Table (4.9) provided comprehensive illustration about the respondents weighting to the criteria related to housing projects.

#### 4.6.8 .6 Health Development Projects Selection Criteria's Weights

The survey results showed that almost all respondents agreed that the number of target beneficiaries and community need for the project comes on the top of criteria with weighted mean of (8.1-8). Region consensus on project is the second criterion with weighted mean of (7.8).

In general the health projects were ranked as the fifth choice with (33) number of scoring as proposed main priority in the mean time.

Region consensus on project, Required budget, Type of target group, Environmental consideration, Number of jobs created, Available fund resource, Availability of sustainable Multi-Criteria , Required budget , number of targeted group who will be benefited from the projects, availability of sustainable conditions and the consensus upon such projects were considered the intermediate scale weighted criteria with weighted mean of (7.6 and 7).

Other institution involvement in project, project strengthen the relations between local stakeholders, Institution administration team repetition were demonstrated with the lowest scale scores with weighted mean of (6.3 and 5.8 ).

Table(4.10) provide in-depth view about the respondents weighting to the criteria related to Wastewater projects

| Table (4.9)Health Development Projects Selection Criteria's Weights        |      |                |                 |
|--|------|----------------|-----------------|
|  | Mean | Std. Deviation | Std. Error Mean |
| Number of target group   | 8.1  | 1.8            | .3              |
| Community need for the project   | 8.0  | 2.3            | .4              |
| Region consensus on project  | 7.8  | 2.5            | .4              |
| Required budget  | 7.6  | 2.4            | .4              |
| Type of target group   | 7.5  | 2.5            | .4              |
| Availability of sustainable Multi-Criteria                                 | 7.3  | 2.8            | .4              |
| Number of jobs created   | 7.2  | 2.2            | .3              |
| Available fund resource  | 7.0  | 2.5            | .4              |
| Environmental consideration  | 6.9  | 2.5            | .4              |
| Project contributes in capacity building of local human resources          | 6.9  | 2.7            | .4              |
| Project implementation duration  | 6.9  | 2.0            | .3              |
| Projects life span   | 6.9  | 2.8            | .4              |
| Institution similar experience   | 6.8  | 3.5            | .6              |
| Institution enhancement  | 6.8  | 2.9            | .5              |
| Project will use exported materials  | 6.6  | 2.4            | .4              |
| Institution administration team repetition                                 | 6.4  | 3.1            | .5              |
| Project strengthen the relations between local stakeholders                | 6.3  | 2.7            | .4              |
| Other institution involvement in project (selection and/or implementation) | 6.2  | 2.9            | .5              |
| Repetition of similar projects in the area                                 | 5.9  | 3.4            | .5              |
| Project will use local materials   | 5.8  | 2.5            | .4              |

#### **4.7 The allocation strategy for planned projects in Gaza city.**

The allocation strategy was determined using specific criteria weight based on the scores resulted from the survey data analysis .The analysis of the survey illustrated the differentiation among scores based on the importance of spatial allocation.

It is also important to remember that the purpose of the site allocation criteria is to assist decision making process by providing them with suitability maps based on the site allocation criteria. Each of these suitability maps that will be discussed in the next chapter as the outcomes of the computerized program would be based on its own list of criteria. So, these criteria lists were justified according to the results of the interviews related to the three case studies..

For example, soil productiveness should not be included in the appropriateness criteria for housing. Instead, this factor should be put aside and used only for agriculture land . This methodology of urban planning circumvented imbalance difficulties related to the overestimation of some criteria .

The main criteria were disaggregated based on the type of the projects , it was noticed that the mean average weight was decreased or increased based on the rationale of the criteria itself , the major weights were classified upon anticipated projects ,

Table(4.11) indicated the different scores for the ten proposed projects , it illustrated that the common high score was given throughout the ten projects were the high density , in addition being away from crowded zones, having location type ,such as camps , having children density and high Population density were several common criteria that had been weighted in the allocation study of the survey.

The weights of the main allocation criteria increased based on the nature of the projects , for example the children density and being nearby main streets were main criteria that increased the possibility of having a location comparing to others , on the other hand having high population density was the main allocation criteria for both infrastructure projects and recreational projects .

Being close to sea shore was the second main allocation criteria in the recreational activities. There were some of allocation criteria that had much less weight when comparing to other indicators , such as being away from crowed zones , having high locations, being city or a camp, and mixed land use.

The common sites' suitability scoring was given in detailed comparing the five highest ranked projects similar to what was done formerly for the project selection

criteria .The criteria proposed in the survey per each projects were taken into consideration. Another survey was conducted with stakeholders to get in-depth realization of the proposed criteria and its relevance to the nature of the projects .

**Table (4.10)The allocation strategy for planned projects in Gaza city .**

|                         | Water Networks | Transportation | Waste water | Education Centers | Housing | Health services | Infrastructure | Environmental | Resource management and land use | Recreational |
|-------------------------|----------------|----------------|-------------|-------------------|---------|-----------------|----------------|---------------|----------------------------------|--------------|
| Wind Direction          |                |                | 9           |                   |         |                 |                |               |                                  |              |
| Land Slope              | 8.3            |                | 8.3         |                   |         |                 |                |               |                                  |              |
| Environmental Impact    | 7.5            |                | 7.5         |                   |         |                 |                |               |                                  |              |
| Aquifer level           | 8              |                | 5           |                   |         |                 |                |               |                                  |              |
| Away from crowded zones | 5.5            | 5.8            | 8           | 5.2               | 6.5     | 5.1             | 6.7            | 8.3           | 5.4                              | 6.7          |
| Children density        | 6.7            | 6.6            | 6.8         | 6.5               | 6.6     | 7.1             | 8              | 5.2           | 5.7                              | 8            |
| City area               | 7              | 7.2            | 7.4         | 6.4               | 6.8     | 6.6             | 6.1            | 6.7           | 3.4                              | 6.5          |
| Close to seashore       | 6.3            | 5.7            | 5.3         | 4.5               | 5.5     | 4.6             | 6.5            | 7.0           | 3.0                              | 6.1          |
| Having high location    | 5.0            | 5.8            | 4.2         | 4                 | 4.8     | 4.3             | 8.2            | 5.3           | 7.7                              | 6.5          |
| High Population density | 7.3            | 7.2            | 8.1         | 7.2               | 7.2     | 7.6             | 5.7            | 4.6           | 4.6                              | 8.2          |
| Location type           | 5.9            | 6.3            | 5.9         | 6.7               | 7.0     | 6.5             | 7.3            | 7.8           | 5.1                              | 5.7          |
| Mixed land-use          | 5.5            | 6.0            | 5.1         | 5.9               | 6.6     | 5.6             | 6.4            | 6.5           | 5.0                              | 7.3          |
| Nearby Main Streets     | 6.5            | 6.5            | 6.2         | 6.2               | 7.0     | 6.7             | 6.4            | 7.0           |                                  | 6.4          |

#### 4.7.1 Water Developmental Projects Site Selection Criteria's Weights

Water development project was the highest scored projects because of its importance, it was indispensable to study thoroughly the site's suitability criteria when Water development projects' allocation .It is worthy to mention that that the survey results were harmonized with the highest priorities that were ranked recently in the Municipality of Gaza in Cooperation with MoLG and MDLF.

The land slope and the aquifer level were two proposed criteria based on the survey analysis ,these two main criteria were the highest scored ones with mean average of (9) and (7.5) respectively , it was suggested to make them as priority. The next weighted criteria were the having high density location (7.4), and Type of the soil being in a city with mean average of (7) .

The lowest scale site selection criteria for a water urban development projects were being close to main streets , and seashore with average mean value of (6.5) and (6.3).

On the other hand the type of the region was taken as low scaled criteria , similarly for being in crowded place or mixed land use.

|                                 | Mean Difference |
|---------------------------------|-----------------|
| Land Slope                      | 9.0             |
| Aquifer level                   | 7.5             |
| High Population density         | 7.3             |
| Type of the soil                | 7.2             |
| City / area                     | 7.0             |
| Nearby Main Streets             | 6.5             |
| Close to seashore               | 6.3             |
| Location type eg. Camps         | 5.9             |
| Away from crowded zones         | 5.5             |
| Mixed land-use (please specify) | 5.5             |
| Having high location            | 5.0             |

#### 4.7.2 Transportation Developmental Projects Site Selection Criteria's Weights:

Based on the data analysis, it had been confirmed that The transportation development had the second ranking scale , the allocation site selection criteria were weighted by the respondents to give clear perspective , the flow of traffics in roads configured the highest mean (9) including being surrounding to roads(8.1).

On the other hand, the types of roads and the trips were some of the listed criteria by the stakeholders who nominated them based on their experience with a score of (8.3) , the types of zones in term of being

|  | Mean |
|--|------|
| Flow of Roads traffics                                 | 9    |
| Being Surrounding Roads                                | 8.1  |
| Type of the trips                                      | 8.3  |
| Type of adjusting zones (industrial , commercial ,etc) | 7    |
| High Population density                                | 7.2  |
| City area  | 7.2  |
| Nearby Main Streets                                    | 6.5  |
| Location type eg. Camps                                | 6.3  |
| Environmental impact of the roads                      | 6.2  |
| Mixed land-use   | 6.0  |
| Having high location                                   | 5.8  |
| Away from crowded zones                                | 5.8  |
| Close to seashore                                      | 5.7  |

commercial , industrial , etc all had the impact of having transportation development site with a mean score of ( 7). In addition , the high dense population

and being in a city , nearby main street were considered besides the environmental impact was taken into account as next weighted criteria with mean average from (7.22 to 6.3).

Least weighted criteria were being close to the sea shore and away from high locations and crowded zones

### 4.7.3 Wastewater Developmental Projects Site Selection Criteria's Weights

Wastewater development networks coincide the third place in urban planning priorities based on the data analysis .

The stakeholders suggested many other relevant criteria to the selection of the Wastewater development sites , such as land slope with was highly weighted with a mean of (10) , while the high population density was weighted by (8.1),similarly to land type which was scored with (7.7) .Other criteria such as wind direction, being away from main Streets , the environmental impact , wind Direction, being away from housing compounds, away from health compounds, close to green

The least weight was given to being away from seashore and mixed land use.

**Table (4.13)Wastewater Developmental Projects Site Selection Criteria's Weights**

|                             | Mean |
|-----------------------------|------|
| Land slope                  | 10.  |
| High population density     | 8.1  |
| Land type                   | 7.7  |
| Environmental impact        | 7.7  |
| Wind direction              | 7.5  |
| Away from housing compounds | 7.5  |
| Away from health compounds  | 7.4  |
| Close to green lands        | 7.4  |
| Away from city area         | 7.4  |
| Away from main Streets      | 6.2  |
| Away from crowded zones     | 6.1  |
| Location type eg. camps     | 5.9  |
| Away from seashore          | 5.3  |
| Mixed land-use              | 5.1  |



#### 4.7.4 Housing Developmental Projects Site Selection Criteria's Weights:

Housing Developmental Projects matched the fourth priority based on respondents proposals .

The respondents of the survey suggested other applicable criteria to the selection of the housing development sites , such as percentage of People without houses in the targeted zones with was highly weighted with a mean of (9) , while the high population density was also weighted by (8.5), similarly to nearby main Streets which was scored with (8.4) .

Other criteria such as wind direction, being in a city or camps , at least one Kilometer far away from the public services , near to green areas , the environmental consideration , such as wind direction , sun shines , away from main Streets , the environmental

impact , wind direction, being away from other housing compounds(, away from health compounds, close to green areas (7.2). The next weights were relevant to the security and healthy of the selected space , in tem of being away from buffer zones , having high children density , away from the industrial zones , and landfills zones

#### 4.7.5 Education Developmental Projects Site Selection Criteria's Weights

Education/schools development facilities concurred the fourth place in urban planning priorities based on the data analysis .

High population density was highly weighted with a mean of (7.6) , while children high population density was weighted by (7.1).

|   | Mean |
|---|------|
| Percentage of People in cities                | 9    |
| High Population density                       | 8.5  |
| Nearby Main Streets                           | 8.4  |
| Location type eg. Camps                       | 8.3  |
| Near to public services ( not less than 1 KM) | 7.2  |
| Having green zones                            | 7.2  |
| Environmental Consideration                   | 7.0  |
| Regional classification as housing zones      | 7.0  |
| Away from Buffer zones( secure place)         |      |
| Away from land fill zones                     | 7.2  |
| Away from industrial zones                    |      |
| City area                                     | 6.89 |
| Children density                              | 6.61 |
| Mixed land-use (please specify)               | 6.61 |
| Away from crowded zones                       | 6.53 |
| Close to seashore                             | 5.54 |
| Having high location                          | 4.83 |

Similarly to being nearby main streets which was scored with (6.7) .Other criteria such as, the environmental impact , wind Direction, being away from Buffer zones( secure place), away from land fill zones, close to green areas .The least weight was given to being away from seashore and mixed land use

| Table (4.15)Education Developmental Projects Site Selection Criteria's Weights |      |
|--|------|
|  | Mean |
| High Population density  | 7.6  |
| Children density   | 7.1  |
| Nearby Main Streets  | 6.7  |
| Number of surrounding school and zoning circle they had.                       | 6.6  |
| Environmental consideration  | 6.0  |
| Regional classification as housing zones                                       | 6.2  |
| Away from Buffer zones( secure place)  |      |
| Away from land fill zones  | 6.8  |
| Mixed land-use (please specify)  | 5.6  |
| Away from crowded zones  | 5.1  |
| Away from seashore   | 4.6  |
| Having high location   | 4.3  |

## Conclusion

Prioritizations procedures that were adapted in the survey design and analysis in the previous chapter confirmed the main procedures in developing projects' selection and allocation criteria and elaborated the results to improve systematic site allocation strategy .

The ten proposed urban developmental projects were ranked based on the survey results , accordingly the highest five prioritized urban projects were ranked in the presence of the sites allocation differentiation .

The top five urban developmental projects were water developmental projects , transportation development, wastewater network development, education centers and housing development thus the case studies were obtained for three sample projects which were highly ranked from targeted population of stakeholders to substantiate the public participation to identify the urgent demands of their respective communities.

It is worthy to mention that all the weights were justified based on the interviews results as will be shown in the next chapter.

# Chapter (5), Prioritization of Urban Development Projects by GIS Based Multi-Criteria Conceptual Framework

## 5.1 Introduction

A set of conceptual steps were used to build the conceptual model of the thesis. In order to recognize the sequence of steps, the conceptual framework will mainly focus on the establishment concept and producers of the GIS based Multi-Criteria having been finding appropriate locations or zones for a new urban projects, such the two developmental projects

## 5.2 GIS - Based Multi-Criteria Analysis Conceptual Framework

The major steps of the establishment of the conceptual framework will be illustrated in next section which comprised of five main steps

### 5.2.1: Stating the Main Scope of the Suitability

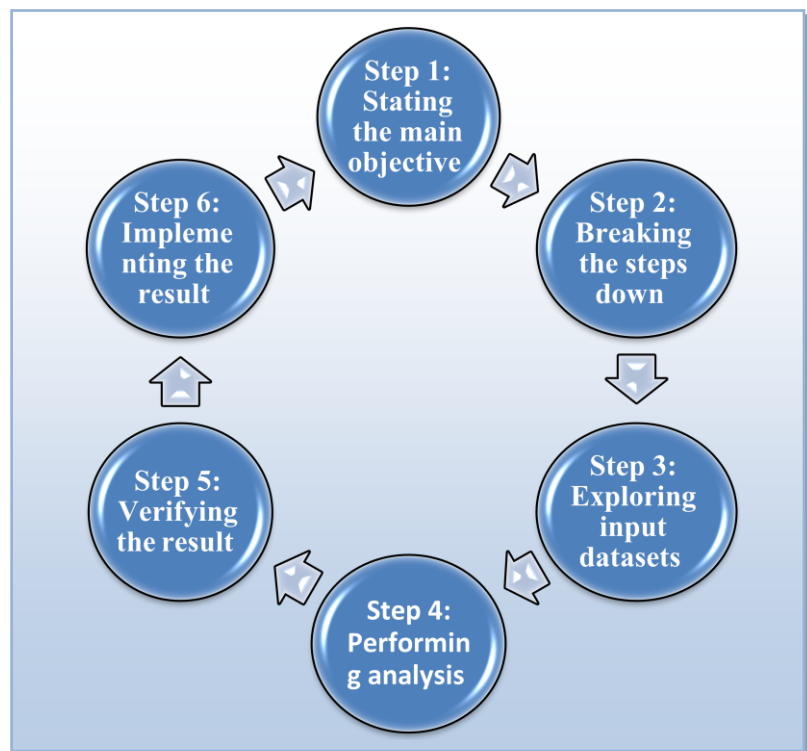
#### Analysis :

Stating the main approach of the suitability analysis is the main approach to determine urban developmental projects.

The first step aimed to solve and the stated goal, by starting with the potential model of the intended outcomes of the study that envisioned the type of maps intended to be produced.

The main potential model

was mainly developed to configure the optimal zones that meet the criteria of the urban development projects and reflect the needs of the targeted zones by extracting



Figure(5. 1) Establishment of the Conceptual framework

the data of the relevant population. The seeking results were different layers maps showing potential sites (categorized by best to worst sites) that could be suitable for building new water networks or new educational centers and schools, which was entitled as "ranked suitability map" because it shows a relative range of values demonstrating how suitable each location is on the map, taking into account the inserted weights of criteria that were included into the model.

### **5.2.2 Breaking the Main Scope of the Suitably Analysis :**

The second step was taken to compromise between the criteria extracted from the survey results ,and compared them with the GIS –Based Multi criteria analysis to set the appropriate criteria to be adapted in the layering maps.

When the main objectives of the analysis were defined and measured , it was preferable to locate new schools' areas after doing an assessment for the current located ones , by striding the zoning effects for its surroundings , locating in an area with the highest density of children of an appropriate age based on analysis from available statistics or the available data about the ground water quality .

Input dataset were uploaded for the model for: land use , children population and age per neighborhoods, data for existing schools,input dataset needed: location of existing schools

### **5.2.3: Exploring input datasets:**

After separating the potential needs into a series of objectives and process models and decided what datasets will be needed, investigate the input datasets to understand their content, thus features within and between datasets are that were important for solving the main objective and data trends .

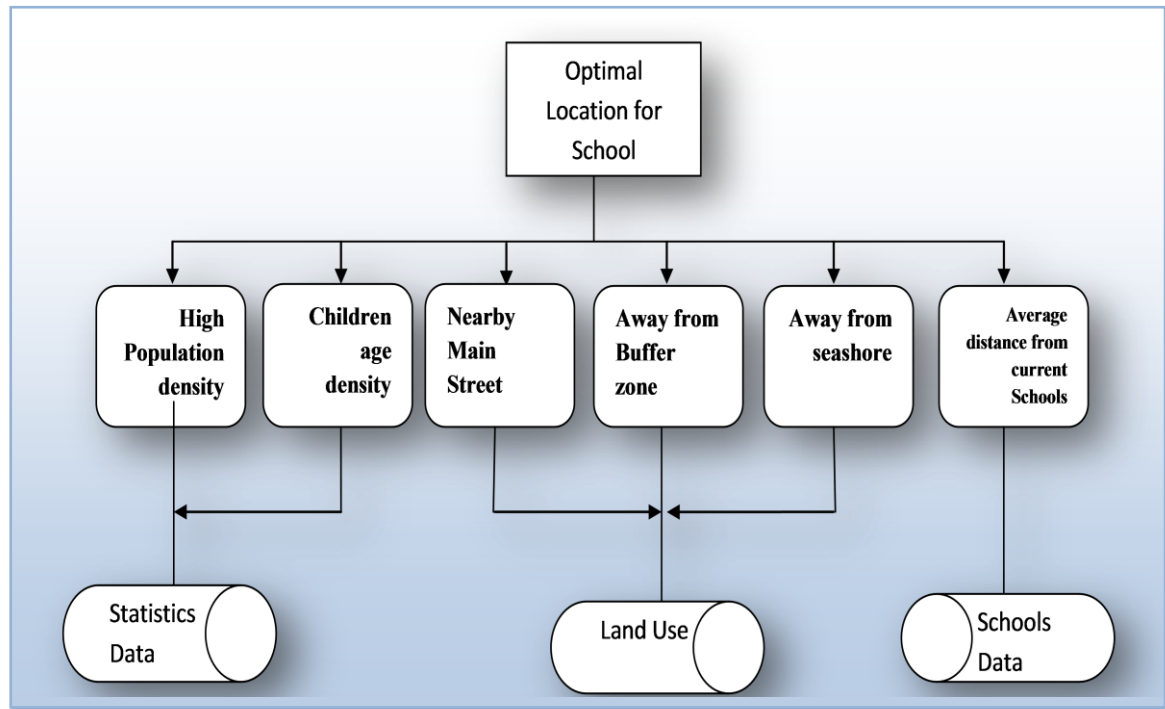
By exploring the data, enough insights can be gained about the areas in which they will be located, the weighting for input attributes, and alterations to the modeling process.

### **5.2.4: Exploring input datasets:**

After breaking down the concepts to extract per each requirement the special data into a series of objectives and process models and decided what datasets you will need.

The model was explored the input datasets to understand their content. This implicated perceptive which attributes within and between datasets are important for solving the problem and looking for trends in the data.

By exploring the data, insights were gained about the areas in which required to allocate different urban educational centers such as schools using the multi criteria analysis , the weighting for input attributes, and alterations to the modeling process.

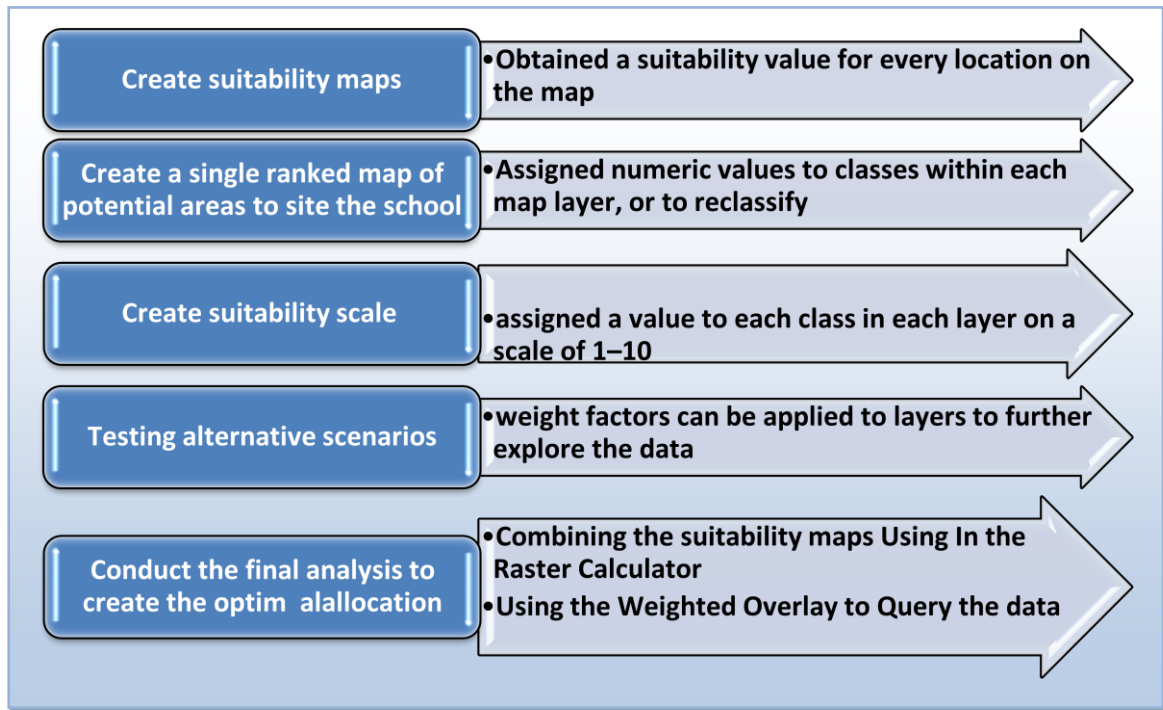


**Figure(5. 2) Exploring input datasets.**

### 5.2.5: Performing analysis

During the establishment of the conceptual framework of the produced model , the objectives, the elements and their interactions, the process models, required input datasets reformed the data to perform analysis.

The main approach used was illustrated in figure(5.3) which included the following steps: create suitability maps ,create a single ranked map of potential areas to site the school ,create suitability scale ,testing alternative scenarios and conduct the final analysis to create the optimal allocation



**Figure(5. 3) The Analysis Stages of the Conceptual Framework . Source(Researcher)**

Creating a suitability map was conducted using the Arc-GIS Spatial Analyst with Multi criteria analysis wizards ,which enabled to obtain a suitability value for every location on the map.

Sequential single ranked map of potential areas were created to compare the values of multi criteria between layers by assigning numeric values to classes within each map layer, or to reclassify. Each map layer was ranked by how suitable it is as a location for a new school or new wells .

For example, a value was assigned to each class in each layer on a scale of 1to 10, with 10 being the best, taking into consideration that having all measures on the same numeric scale gives them equal importance in determining the most suitable locations, while testing alternative scenarios.

Weighted factors can be applied to layers to further explore the data and its relationships. Reclassify function was used to rank this map as it was preferable to locate away from existing schools was also implemented to rank the map representing land use types as it is preferable to build on certain land use types due to the urban regional classification.

The final suitability map is produced by combining all the maps together. Weights were assigned at the same time as combining the suitability maps. One of the scenarios used while developing the suitability map was (rather than creating a suitability map) is to query the data. This was done by setting special equations that extract the data from the land use layers and the inserted statistics.

The final suitability map for locating sites for the school is shown in the coming section. Alternatively, the weighted overlay tool was used to connect geo-processing tools inside a model means having one model, then it can altered parameter values to experiment with different outcomes.

#### **5.2.6: Verifying the result**

Verification of the final spatial analysis was conducted to validate the accuracy of the results in term of having adequate presentation of the targeted community in parallel with the criteria that was intended to reflect the site allocation concepts of the two projects.

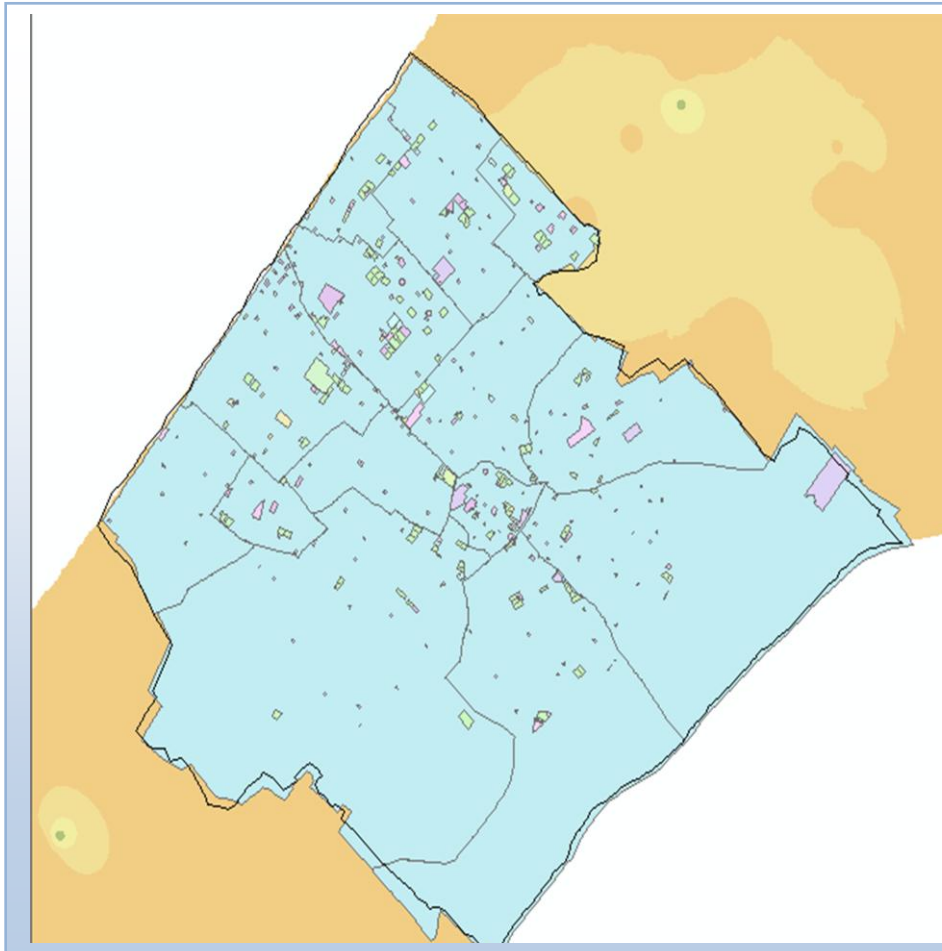
#### **5.2. 7: Implementing the result**

Building the queries with reclassifying the resulted maps created the final results which indicated the main zones of the proposed urban developmental projects for both water networks development and educational centers and schools development. (Esri,2012)

### **5.3 Establishment of GIS-Based Multi Criteria Conceptual framework for two prioritized Urban Development Projects in Gaza city.**

In the following section, the conceptual GIS Based Multi criteria system will be illustrated to show the main three prioritized urban development projects in Gaza which are the establishment of water wells and water networks development projects and educational schools.

The three conceptual frameworks were developed using the previous steps in this chapter with some differences that be illustrated.



**Figure (5. 4) creating the main Geo-database for developing projects called 'Developing Project Database'. Original data source(PWA)**

### **5.3.1 Establishment of GIS-Based Multi Criteria Conceptual Framework for Water Networks Development Projects in Gaza city.**

In Palestine, water is a precious natural resource and its relative scarcity is a major constraint to economic development. The increase of urban planning is a strong agent in increasing the pollution of water. This applies throughout the region, which is generally characterized by aridity and water scarcity. With the majority of the region's water resources being shared by more than one country, the allocation and management of water resources assumes great importance.

Global climate change may further magnify the pressure on the water system in the Occupied Palestinian Territories through increased temperatures and evaporation rates and lower and more erratic rainfall . the existing water resources are inadequate water wells and limited to the ground water wells, other problems includes poor pressures in the water networks during the supply time and very complicated intermittent supply which are mainly due to limitation in the networks infrastructure and water resources,



this is rapidly increasing demand due to population growth and expected urban development in the Gaza city

The above mentioned reasons and justification raises the importance of having adequate understanding of having the water development urban projects as the prioritized projects besides having it as the first ranked urban projects based on the survey results.

Based on an recent analytical report submitted by the Palestinian Water authority , Gaza Municipality is supplied by 30 wells with an average yearly production of 27.5 MCM. The supplied water is pumped directly into the provided networks due to the insufficient infrastructure and water facilities .

The wells' pumps have to provide the head losses in the networks , consequently , the capacity of these wells decreased . This supply system configuration is changing according to the demand variation in summer and winter and based on the daily consumption of the inhabitants of the Gaza city.

The system is controlled manually through valves located in the main feeders that are located in the high ground elevations , Down town areas (Southern of Gaza), and Sheik Eglieen which is suffering from the rapid urban growth in the past ten years.

It can be noticed that Ground Water is characterized by pollution of the groundwater that the is a major problem in Gaza Strip. Not only there are numerous sources of pollution, but also the aquifer of the Gaza Strip is highly vulnerable to pollution. The increasing nitrate content of the groundwater illustrates the pollution problem. The chloride and nitrate concentrations of the water exceeds the WHO standards in most of the area.(PWD, 2011 ).

The domestic water is becoming more saline every year and average chloride concentrations of 500 mg/l or more is no longer an exception. The permissible limits for nitrate are exceeded by a factor of 8 for a number of public wells; most of the public water supply wells don't comply with the drinking water quality standards. With the limited rainfall and high evapotranspiration of the Gaza Strip it may take hundreds of years to restore fresh water conditions in the aquifer.

Contamination of soil is often linked to risks of groundwater contamination.

At sites, both in Gaza Strip were solid and hazardous wastewater is dumped without sanitary measures, the risks for soil pollution is high. Even after the Wastewater has been removed, this polluted soil may cause human health problems

as a result of direct exposure to the polluted soil, or may result in further groundwater pollution. There are indications that irrigation areas in the Gaza Strip have been affected by salinity build up as a result of excessive irrigation and water logging.

Large areas in the eastern part of Gaza Strip are at present under-utilized due to the vanishing agricultural activities there.

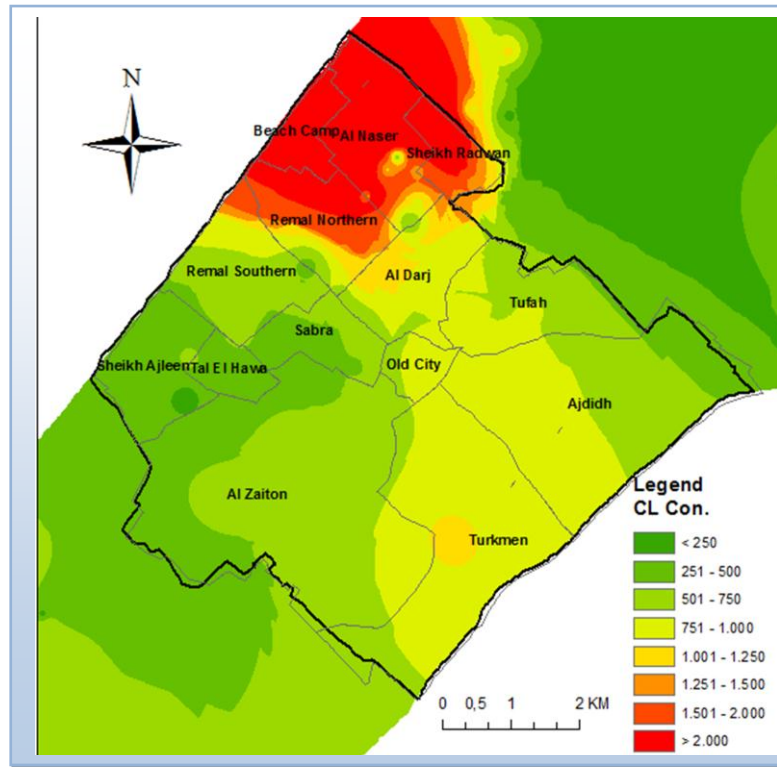
The sand resources in Gaza Strip, especially the coastal sand dunes, represent important environmental values. These dunes traditionally protect the coastal areas against the sea, secondly, the sand dunes have a natural water cleaning capacity, they are the habitat for meanwhile a total amount of at least 25 MCM of sand is estimated to have been excavated - mainly for building purposes - in the last 20 years, from an area of about 5200 dunums. Only 12 % of the sand excavations are licensed. Sand mining occurs without serious planning or regulation; it is hardly recognized as an activity responsible for large scale destruction of natural landscape in Gaza Strip.

Inland sites with potentials for outdoor recreation have not been, till now, recognized as such and are subject to further deterioration of their landscape values. This holds particularly for the coastal dunes between the southern limits of Gaza city, where agricultural expansion and sand mining, and possibly harbor development, could destroy a nearby recreation area for Gaza. Causes for landscape distortion may be summarized as follows: The unsound exploitation of quarries , and sand mines in Gaza Strip, and The uncontrolled land use, especially in the coastal zone of Gaza Strip.

The proposed developmental plans of the water networks in Gaza City ,will continue supporting the 30 main municipal wells , besides giving recommendations for wells that should be closed due to exceeding the Nitrate and Chloride value in the supplied water , giving recommendations for new areas with good quality water after implementing the conceptual computerized program to identify the areas that are suitable for having water wells .According on having water development project as the first priority , it was essential to select the optimum places for water networks to have water within the WHO water international standards . (PWD,2011 ).

#### **5.3.1.1 Establishment of GIS based Multi-Criteria System for Water projects based on water quality in Gaza City:**

The optimum allocation for water wells development projects were developed using the data from The Palestinian Water Authority data, .



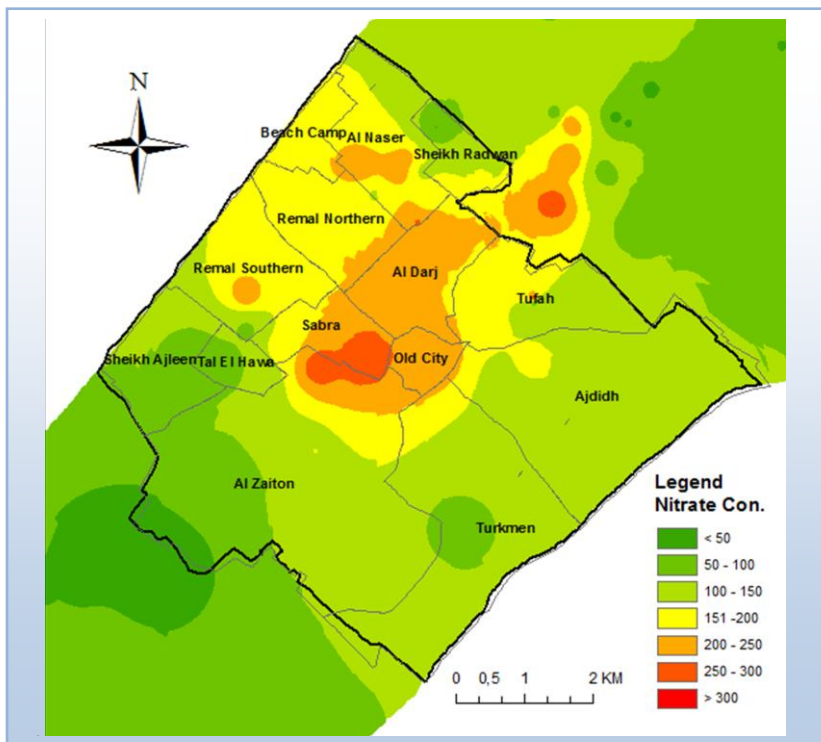
**Figure (5. 5) Spatial Analysis for Chloride concentration in Gaza Strip (2011). Data source(PWD,2011)**

Based on the last updated data 2011 , The interviews that were done to strengthen the final resulted allocation criteria, since the experts gave more specific weights for each criteria .

**❖ Data Input and processing**

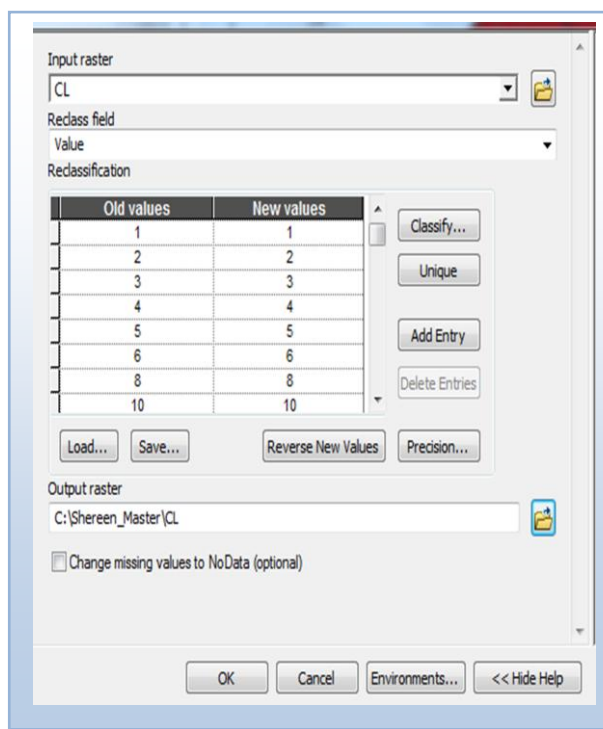
The processes has been illustrated above were implemented to form multi-criteria analysis aligned with GIS software to form the multi layers .

Each of them had it own criteria weights , in addition the layer itself has individuals weights comparing to other data. The overlay weighting was done to sum all the weights and enable having clear vision about the best locations for water well developmental projects in Gaza City after analyzing the Chloride , Nitrate and water level comparing to the urban expansion in Gaza Neighborhoods.



**Figure (5. 6) Spatial Analysis of Nitrate concentration in Gaza city (2011) using Inverse Distance Weight (IDW). Original**

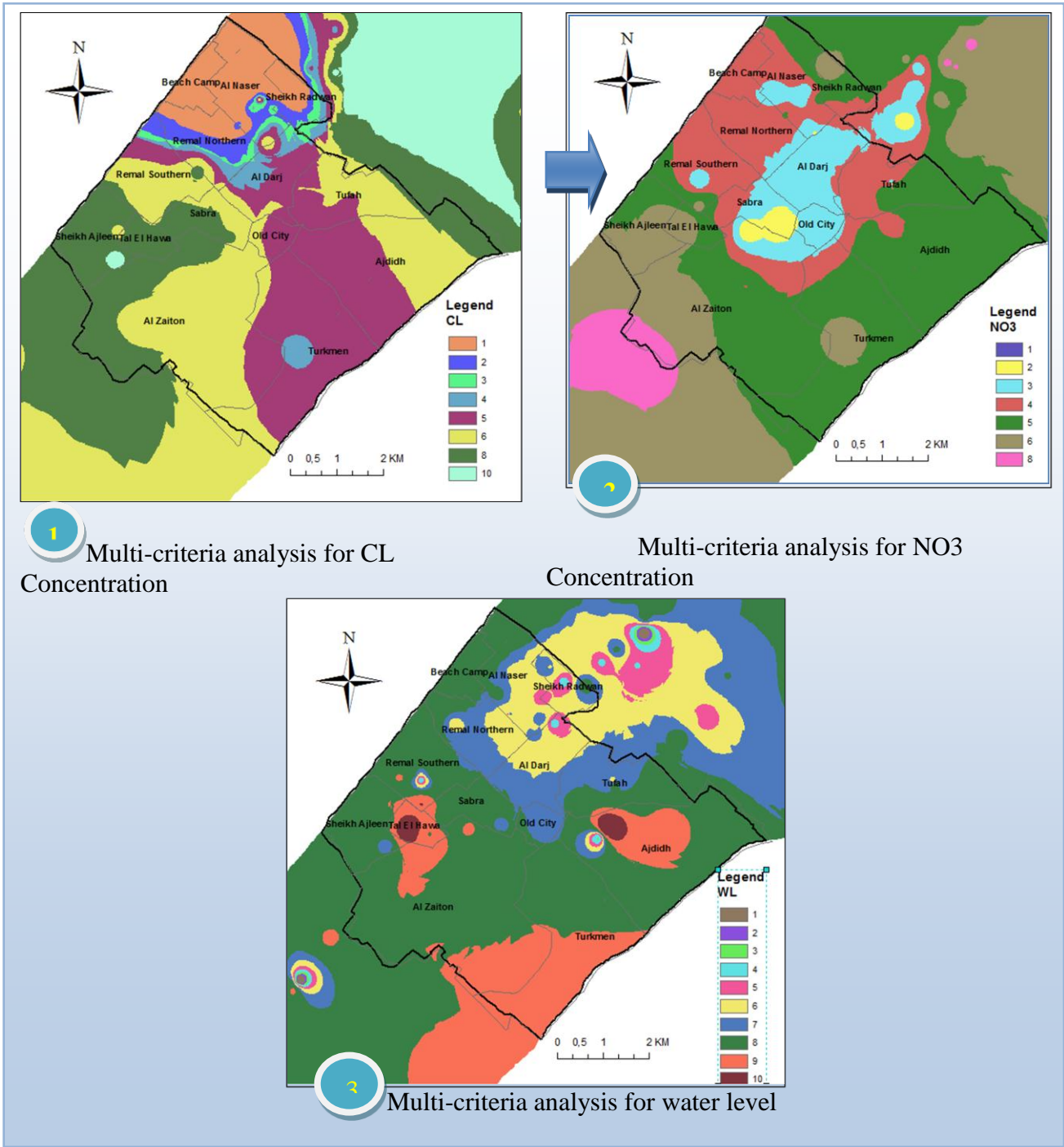
- ❖ **Reclassify Process** :A remap table that defines how the values will be reclassified. Reclassify raster files based on criteria values.



**Figure (5. 7) Sample for classifying raster data set for Chloride concentration in Gaza**

**Table (4.16) Justified Water Developmental Projects Site Selection Criteria's Weights.**

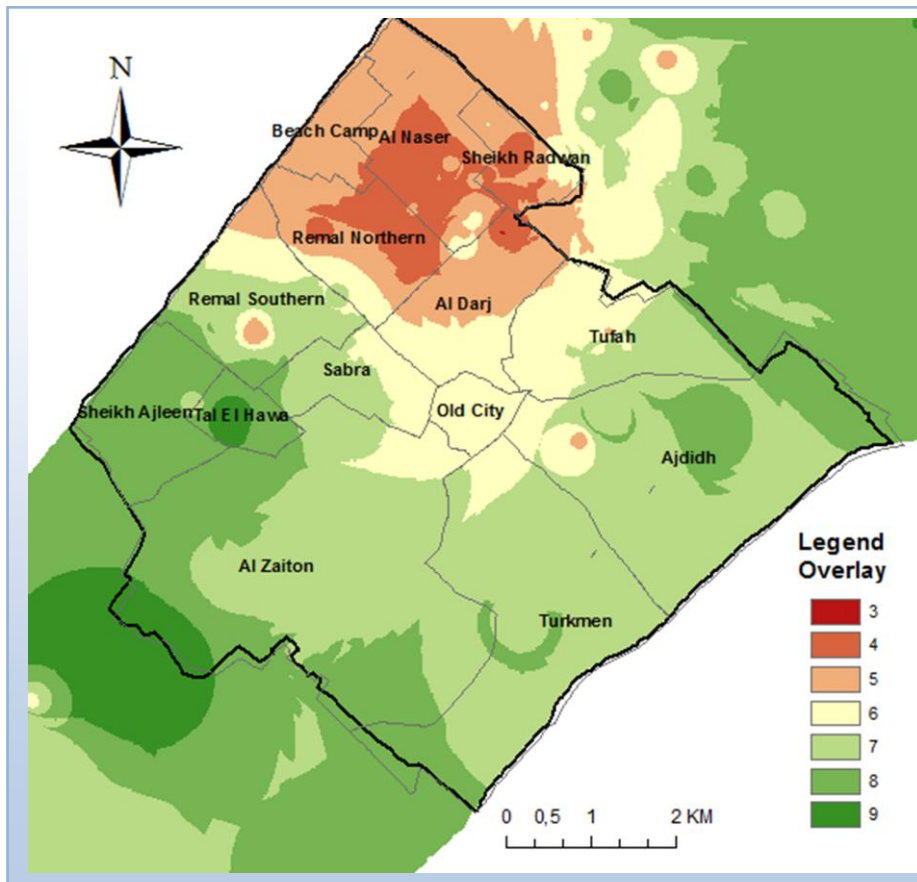
|                                 | Mean Difference |
|---------------------------------|-----------------|
| Land Slope                      | 9.0             |
| Aquifer level                   | 7.5             |
| Nitrate concentration           | 7.4             |
| Chloride concentration          | 7.4             |
| High Population density         | 7.3             |
| Type of the soil                | 7.2             |
| City / area                     | 7.0             |
| Nearby Main Streets             | 6.5             |
| Close to seashore               | 6.3             |
| Location type eg. Camps         | 5.9             |
| Away from crowded zones         | 5.5             |
| Mixed land-use (please specify) | 5.5             |
| Having high location            | 5.1             |



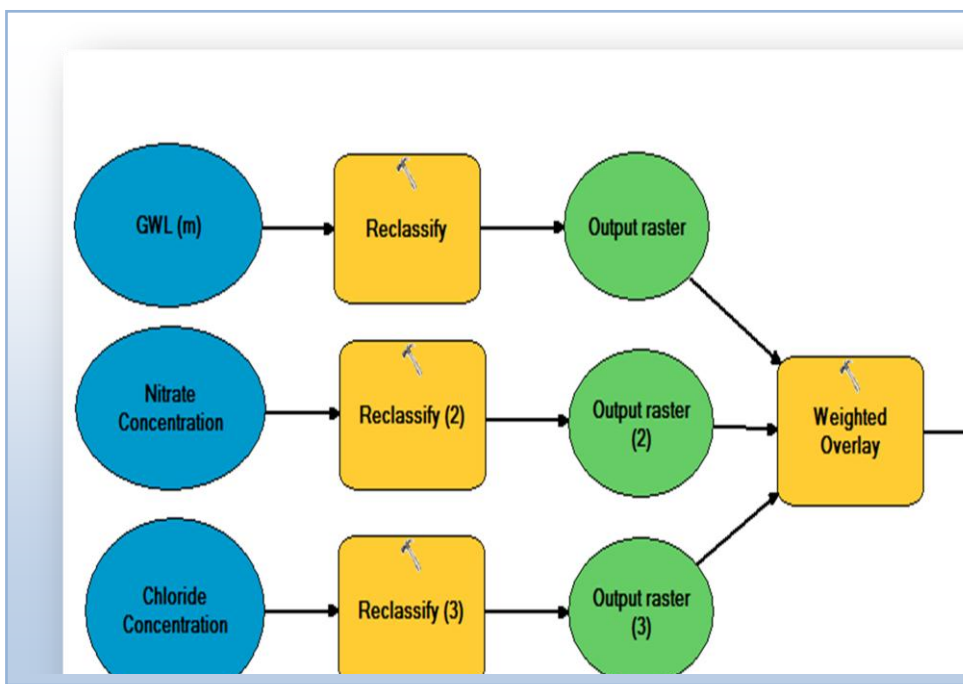
Figure(5. 8) Reclassifying process to all Weighted maps related to CL, NO3 and water level.

❖ Weighted overlay table

The weighted overlay table allows the calculation of a multiple-criteria analysis between several rasters.



**Figure(5. 9)Spatial Overlay map based on multi-criteria analysis system which built in main Geo-database**



**Figure (5. 10) Geo-database Model for creating best location for water well based on water quality of ground water of Gaza City.**

# 1. Water developmental projects

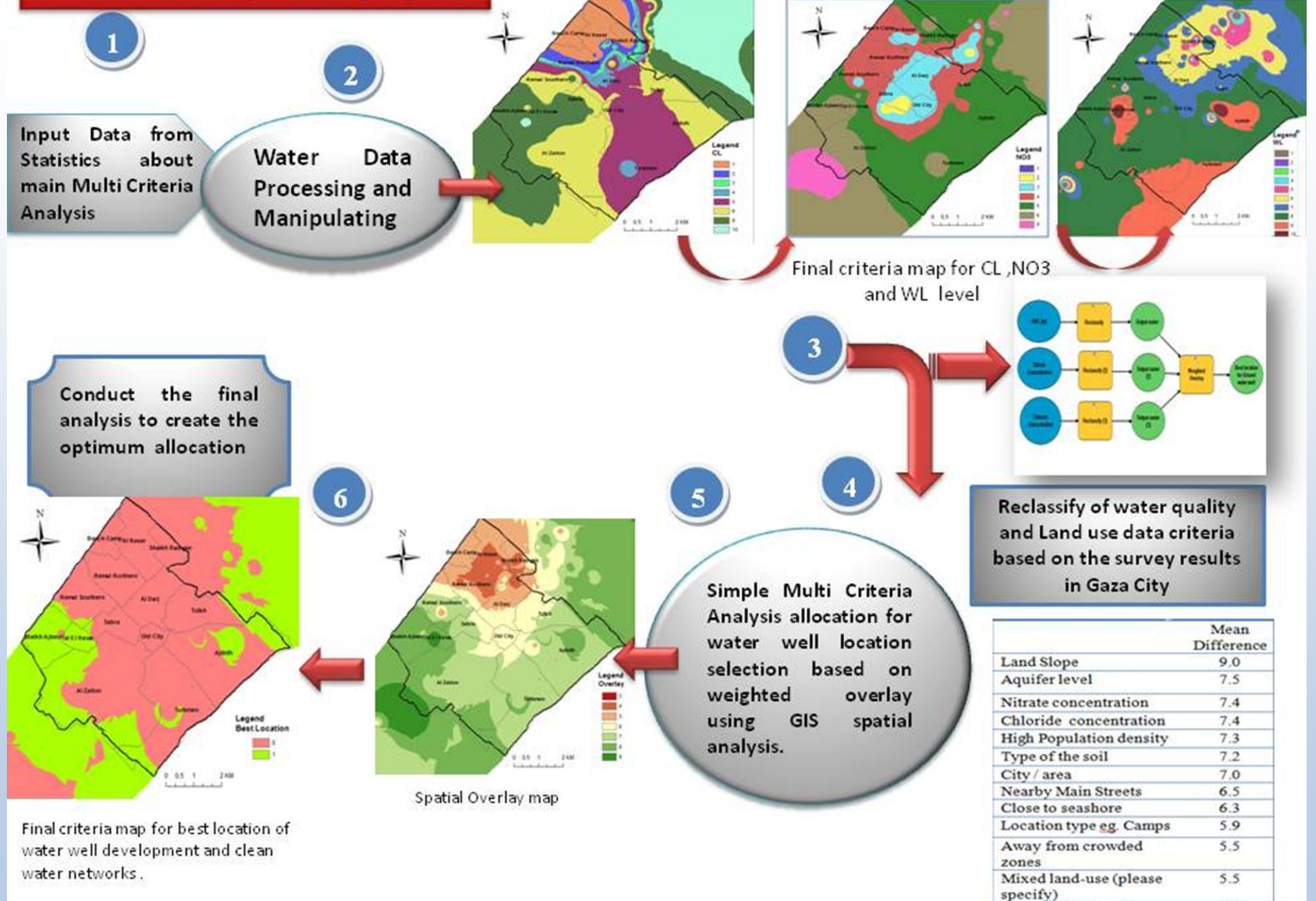


Figure (5. 11) The conceptual Frame Work Chart for Water networks and well development

### 5.3.1.2 Establishment of GIS based Multi-Criteria System for Water Network projects in Gaza City:

Multi criteria analysis was conducted to the water development projects allocation criteria that was gained through the survey results in addition to the criteria that were taken from the experts in the Palestinian Water authority to have precise weight based on the demands .

the criteria was developed and the data were entered into the GIS-Based Multi-criteria analysis based on the previous steps illustrated in this chapter . the data processing , manipulating and analysis took place to conduct the analysis to see which networks needs development based on their current status .

Reclassify Processes were conducted to remap tables that defines how the values will be reclassified.

| OBJECTID | ID  | LABEL | ID 1 | Label 1 | Length | Sc | Start Node | Stop Node | Diameter | Material        | Hazen Will | Has |
|----------|-----|-------|------|---------|--------|----|------------|-----------|----------|-----------------|------------|-----|
| 1        | 109 | P-554 | 1093 | P-554   | 263,05 |    | J13-91     | J13-92    | 101,6    | PVC             | 150        |     |
| 2        | 109 | P-173 | 1094 | P-173   | 182,58 |    | J2-03      | J2-97     | 101,6    | Steel           | 140        |     |
| 3        | 109 | P-107 | 1095 | P-107   | 500,92 |    | J4-06      | J3-009    | 147,6    | PVC             | 150        |     |
| 4        | 109 | P-42  | 1096 | P-42    | 547,57 |    | J28-13     | J28-15    | 101,6    | PVC             | 150        |     |
| 5        | 109 | P-189 | 1097 | P-189   | 119,52 |    | J6-05      | J6-08     | 101,6    | Steel           | 140        |     |
| 6        | 109 | P-502 | 1098 | P-502   | 188,72 |    | J29-93     | J26-091   | 282      | Steel           | 140        |     |
| 7        | 109 | P-372 | 1099 | P-372   | 386,3  |    | J25-09     | J25-14    | 101,6    | PVC             | 150        |     |
| 8        | 110 | P-19  | 1100 | P-19    | 947,09 |    | J3-006     | J3-022    | 101,6    | Steel           | 140        |     |
| 9        | 110 | P-51  | 1101 | P-51    | 686,79 |    | J28-18     | J28-17    | 101,6    | PVC             | 150        |     |
| 10       | 110 | P-15  | 1102 | P-15    | 396,1  |    | J17-021    | J17-091   | 147,6    | PVC             | 150        |     |
| 11       | 110 | P-563 | 1103 | P-563   | 406,11 |    | J18-008    | J18-010   | 101,6    | PVC             | 150        |     |
| 12       | 110 | P-516 | 1104 | P-516   | 43,14  |    | J6-05      | J6-04     | 101,6    | Steel           | 140        |     |
| 13       | 110 | P-561 | 1105 | P-561   | 152,12 |    | J23-90     | J24-01    | 97,6     | Asbestos Cement | 140        |     |
| 14       | 110 | P-133 | 1106 | P-133   | 181,73 |    | J26-030    | J26-032   | 147,6    | Steel           | 140        |     |
| 15       | 110 | P-140 | 1107 | P-140   | 285,42 |    | J3-009     | J3-094    | 101,6    | Steel           | 140        |     |
| 16       | 110 | P-146 | 1108 | P-146   | 400,99 |    | J9-14      | J9-16     | 97,6     | Asbestos Cement | 140        |     |
| 17       | 110 | P-118 | 1109 | P-118   | 531,67 |    | J9-18      | J10-90    | 101,6    | PVC             | 150        |     |
| 18       | 111 | P-185 | 1110 | P-185   | 438,39 |    | J1-47      | J1-45     | 101,6    | PVC             | 150        |     |
| 19       | 111 | P-443 | 1111 | P-443   | 174,89 |    | J20-02     | J20-08    | 147,6    | PVC             | 150        |     |
| 20       | 111 | P-217 | 1112 | P-217   | 109,14 |    | J17-019    | J17-017   | 234      | Steel           | 140        |     |
| 21       | 111 | P-104 | 1113 | P-104   | 372,83 |    | J27-08     | J27-10    | 101,6    | Steel           | 140        |     |
| 22       | 111 | P-520 | 1114 | P-520   | 66,15  |    | J11-09     | J11-08    | 101,6    | PVC             | 150        |     |
| 23       | 111 | P-453 | 1115 | P-453   | 718,14 |    | J22-05     | J22-27    | 101,6    | PVC             | 150        |     |
| 24       | 111 | P-394 | 1116 | P-394   | 20,09  |    | J17-095    | J17-094   | 69       | Steel           | 140        |     |

**Figure(5. 12)Developing an Integrated geo-database for water network based on Palestinian Water Authority database. Source(PWD,2011)**



Chapter (5), Prioritization of Urban Development Projects by GIS Based Multi-Criteria Conceptual Framework

The weighted overlay table allows the calculation of a multiple-criteria analysis between several rasters. The final map indicated the current situation and the proposed solution after doing multi weighted criteria .

The process was done by overlaying layers with multi-weighted layers to form the final stage of the analysis and perform the analysis which took several stages to precisely allocate the networks that needs development. Figure(5.14) indicated the criteria index in the last highlighted column that had been conducted to facilitate the final results .

| Material        | Hazen Will | Flow L s | Velocity | Length U | OUTERDIAME | Pressure | age | age Index | Mat code | CIndex |
|-----------------|------------|----------|----------|----------|------------|----------|-----|-----------|----------|--------|
| PVC             | 150        | -0,29    | 0,04     | 263      | 102        | 0        | 25  | 7         | 3        | 31     |
| Steel           | 140        | -0,9     | 0,11     | 184      | 102        | 4        | 27  | 7         | 4        | 37     |
| PVC             | 150        | -2,02    | 0,12     | 501      | 148        | 4,1      | 25  | 7         | 3        | 65     |
| PVC             | 150        | 0,05     | 0,01     | 547,5    | 102        | 3,6      | 25  | 7         | 3        | 51     |
| Steel           | 140        | 0        | 0        | 119,5    | 102        | 0        | 27  | 7         | 4        | 37     |
| Steel           | 140        | -59,38   | 0,95     | 188      | 282        | 4,3      | 32  | 5         | 4        | 80     |
| PVC             | 150        | 2,02     | 0,25     | 386,5    | 102        | 1,3      | 25  | 7         | 3        | 41     |
| Steel           | 140        | 0,94     | 0,12     | 947      | 102        | 0        | 27  | 7         | 4        | 37     |
| PVC             | 150        | 0,07     | 0,01     | 687      | 102        | 3,7      | 25  | 7         | 3        | 51     |
| PVC             | 150        | -4,74    | 0,28     | 398      | 148        | 2,8      | 25  | 7         | 3        | 55     |
| PVC             | 150        | -8,21    | 1,01     | 406      | 102        | 1,6      | 25  | 7         | 3        | 51     |
| Steel           | 140        | 0        | 0        | 41,5     | 102        | 0        | 27  | 7         | 4        | 37     |
| Asbestos Cement | 140        | -1,88    | 0,25     | 147      | 98         | 2,6      | 18  | 12        | 1        | 58     |
| Steel           | 140        | 3,46     | 0,2      | 181,5    | 148        | 3        | 30  | 2         | 4        | 56     |
| Steel           | 140        | 0,15     | 0,02     | 286,5    | 102        | 4,1      | 27  | 7         | 4        | 67     |
| Asbestos Cement | 140        | 2,03     | 0,27     | 401      | 98         | 2,9      | 18  | 12        | 1        | 58     |
| PVC             | 150        | 4,18     | 0,52     | 531,5    | 102        | 2,1      | 25  | 7         | 3        | 56     |
| PVC             | 150        | -8,55    | 1,05     | 438,5    | 102        | 0        | 25  | 7         | 3        | 41     |
| PVC             | 150        | 4,42     | 0,26     | 175      | 148        | 2        | 25  | 7         | 3        | 35     |
| Steel           | 140        | 99,93    | 2,32     | 109      | 234        | 3,6      | 32  | 5         | 4        | 72     |
| Steel           | 140        | 3,11     | 0,38     | 373      | 102        | 4        | 27  | 7         | 4        | 42     |
| PVC             | 150        | 0,18     | 0,02     | 66       | 102        | 1        | 25  | 7         | 3        | 41     |
| PVC             | 150        | 1,86     | 0,23     | 718      | 102        | 1        | 25  | 7         | 3        | 41     |
| Steel           | 140        | -22,41   | 5,99     | 20       | 69         | 3,3      | 27  | 7         | 4        | 59     |

**Figure (5. 13) Creating water criteria index (C-index) ranking condition based on urban water network age as an example**

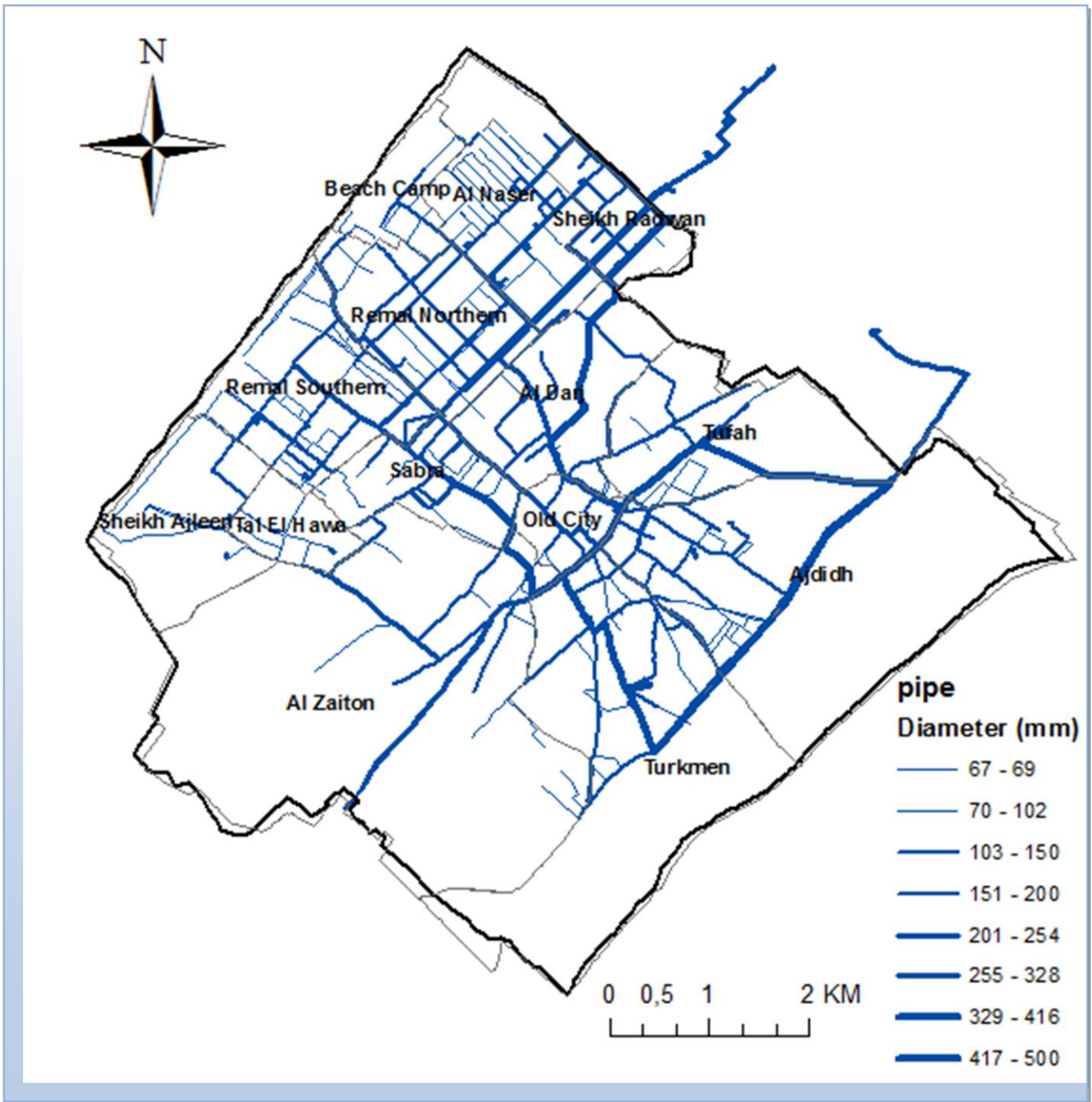


Figure (5. 14) Water pipe classification in Gaza Strip .original data source (PWD,2011)

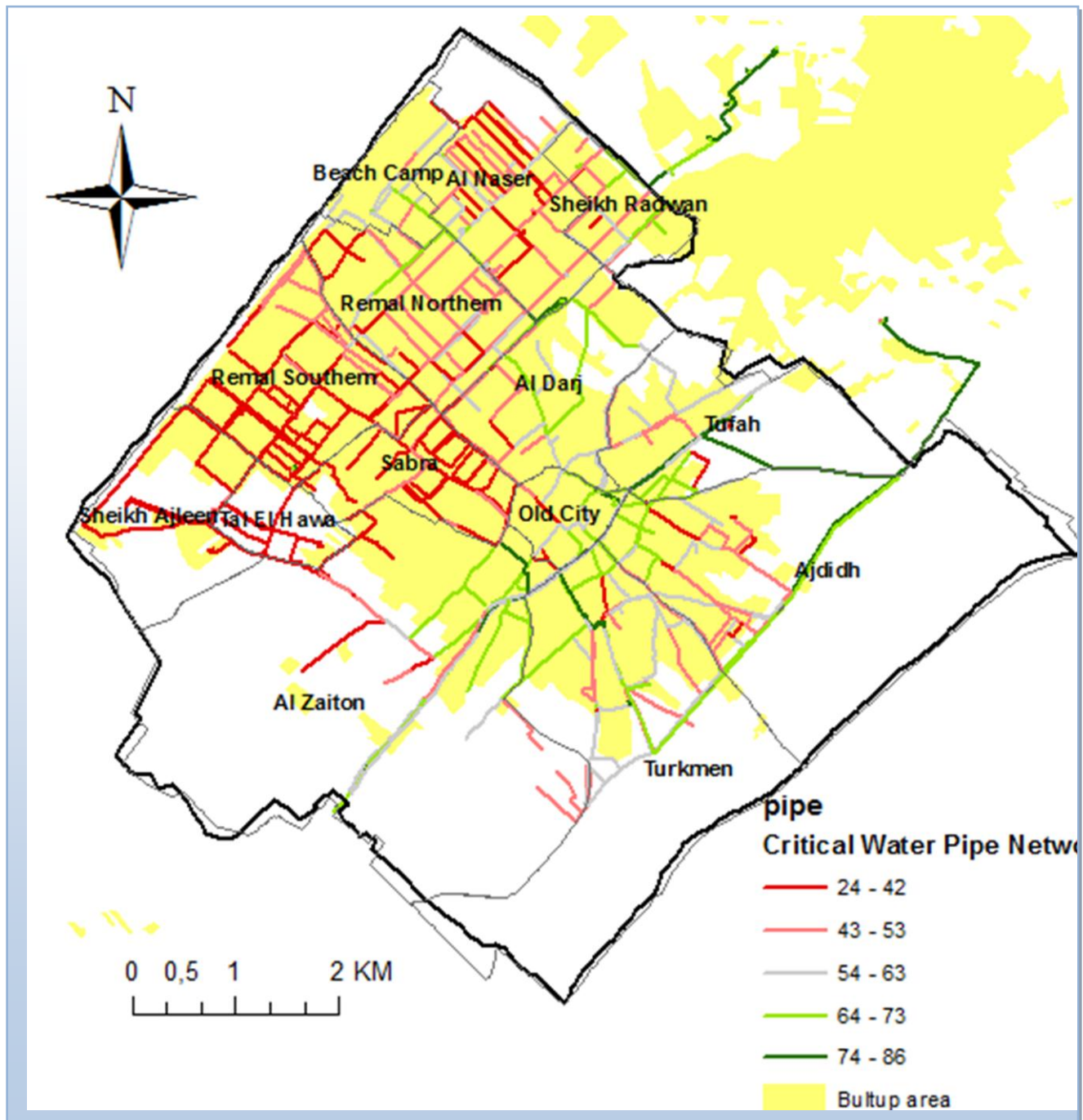


Figure (5. 15) Final Result: Critical Water Pipe Network have been determined using multi-criteria analysis system .

## 2. Water Network projects

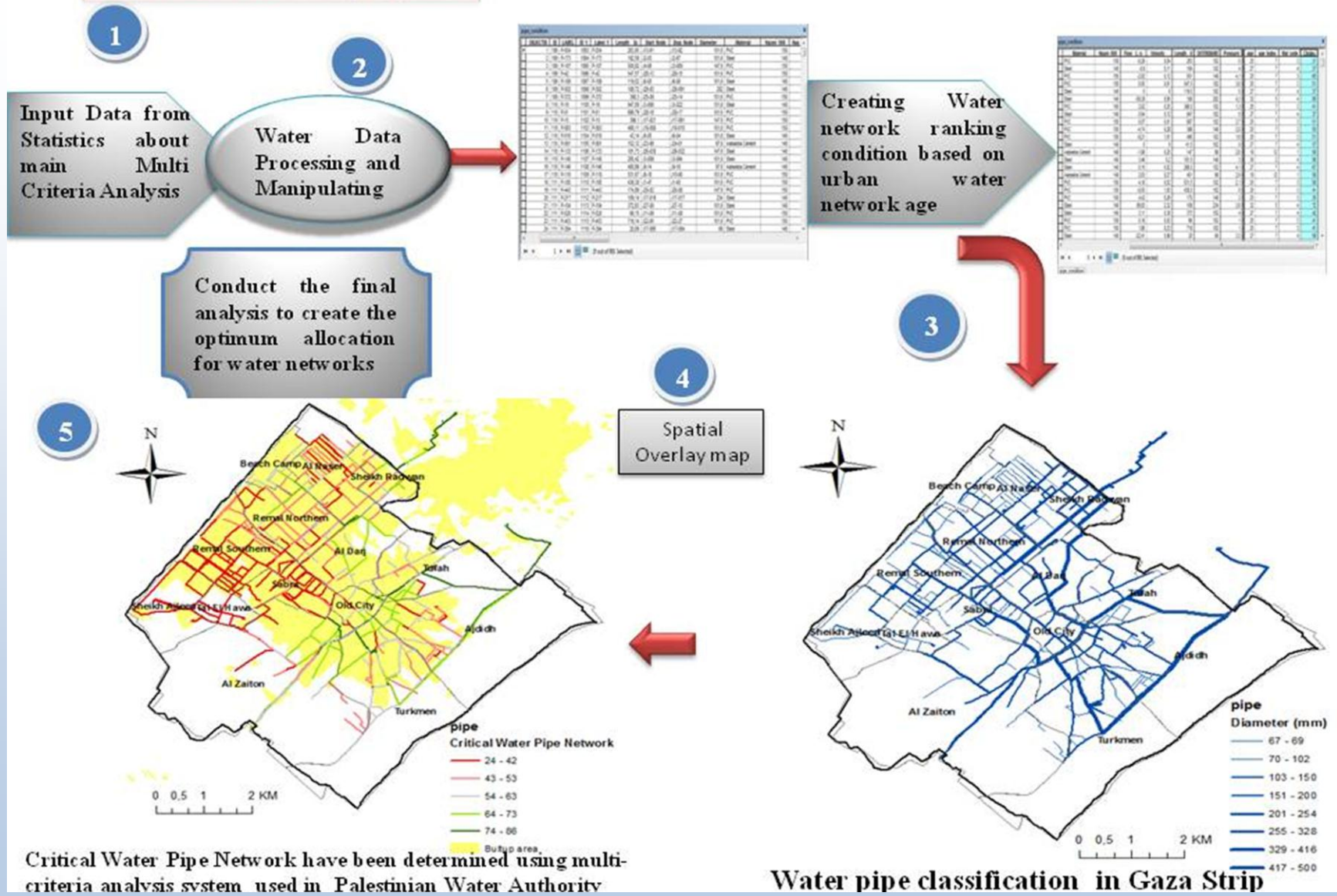


Figure (5. 16) The conceptual frame work chart for water networks' development

### **5.3.1.2 Main Results of Water Developmental Projects Conceptual Framework:**

- 1) It can be noticed from the final overlaid maps , that the areas that are appropriate for establishing water projects are so limited , such as Turkeman , Tal El hawa and Sheik Ejleel Neighborhoods, which confirmed the fact that raised recently that Gaza City will be facing serious water crises in the coming five years
- 2) It was essential to refer to the experts after implementing the GIS model to validate the data .It was noticed that the outcomes were matching the initial needs encountered by the experts with greater achievement in term of deep analysis .The areas that needed maintenance in the water networks were eventually in need , thus the data were validated.
- 3) Selection criteria set by experts and professionals besides the ones weighted from the survey results were sufficient to place Ground water Management in the precise locations from the environmental, geological and socio- cultural standards.
- 4) It was noticed based on the interviews results that Information sharing between municipalities, village councils and UNRWA were not up to the standards when planning for Ground water Management.
- 5) Sitting of Ground water Management were relatively in the right location, taking into consideration the ground water, geological, environmental and socio-cultural aspects as integrated comprehensive task.
- 6) Taking into consideration the water level analysis during the applications of GIS sitting of water developmental location was effectual tool as it seems that ground water figures were of great influential.
- 7) A spatial and vertical re-distribution of pumping zones of the municipal wells is a necessity now to avoid the seawater imposition and upcoming phenomena.
- 8) The agriculture sector, which is the largest water consumer in Gaza, water demand should be managed through the more efficient use of water, through adopting new crop patterns and utilization of alternative water resources (low water quality & treated Wastewater).
- 9) Deployment of treated Wastewater is an important renewable and potential resource would lead to gradually reduce the abstraction of the coastal aquifer.

- 10) Licensing, metering of wells and introduction of an appropriate tariff are matter of urgency to improve water conservation.
- 11) Pollution control program should be conducted in parallel with using new water resources.
- 12) Improve crop selection to lower water requirements and salt tolerance crops to free large quantities of water to meet the increasing needs for domestic and industrial purposes. In addition to generalize modern irrigation and conservation techniques in the irrigated agriculture.
- 13) Intensive education campaigns and public awareness should be extended and provided to aware the public and farmers about the water value.
- 14) Promote appropriate water resources management in the new liberated areas.

### **5.3.2 Establishment of GIS-Based Multi Criteria Conceptual Framework for School Development Projects in Gaza city.**

Several assessment procedures were conducted to the current situation of the urban development and plans for the education sector in Gaza City ,as it has been chosen from the Survey analysis's results one of the focal priorities of urban planning to be taken in place . Palestinian children continue to be deprived of their right to education. Existing schools are massively inadequate for the growing needs of students,” Richard Falk, the Special Reporters on the situation of human rights in the Palestinian territories occupied since 1967.

Gaza students suffer not only from a shortage in education facilities and materials but also from the absence of safe learning environments. Since the beginning of the second Intifada almost 977 children (most of them school students) were killed in Gaza during the Israeli military operations there. There are 79 schools located in border areas, which are classified as dangerous zones as they come under daily fire from Israeli forces. Almost six Higher education institutions were severely damaged during the Cast Lead Operation on the Gaza Strip. (UNOCHA,2012).

This situation requires urgent intervention from the international community to put an end to the Israeli breaches to its obligations under international law and to press Israel for the immediate lifting of Gaza Siege.

Gaza strip is one of the most densely populated areas in the world, with 1.59 million residing in 365 square km. It is considered a young society, with 56.08% of its residents under the age of 19. The children of the marginalized areas in Gaza City are

suffering from their current situation of the schools because of the closure of the road as a result of rain or maintenance work .

This fact presents useful data related to the right to prioritize education urban planning in Gaza City under Israeli siege which also demonstrate how the Minimum standards are not being met in the current context. It will present facts about school education, higher education, and vocational education that show how the access and learning environment are being greatly compromised, which in turn has impacts on the teaching and learning processes.

There are 688 schools in the Gaza Strip, of which 397 of them are governmental schools, 243 UNRWA schools, 48 private schools, and three vocational schools. (MOE, 2012).

Gaza's schools are not enough to meet the increasing demand for education, which reached 481,000 students in 2011. Almost 90% of the government schools and 80% of the UNRWA schools are working two shifts a day to cope with the shortage in schools.

The classrooms are overcrowded, with more than 37 students a class, which has severe impacts on the academic achievements of the students

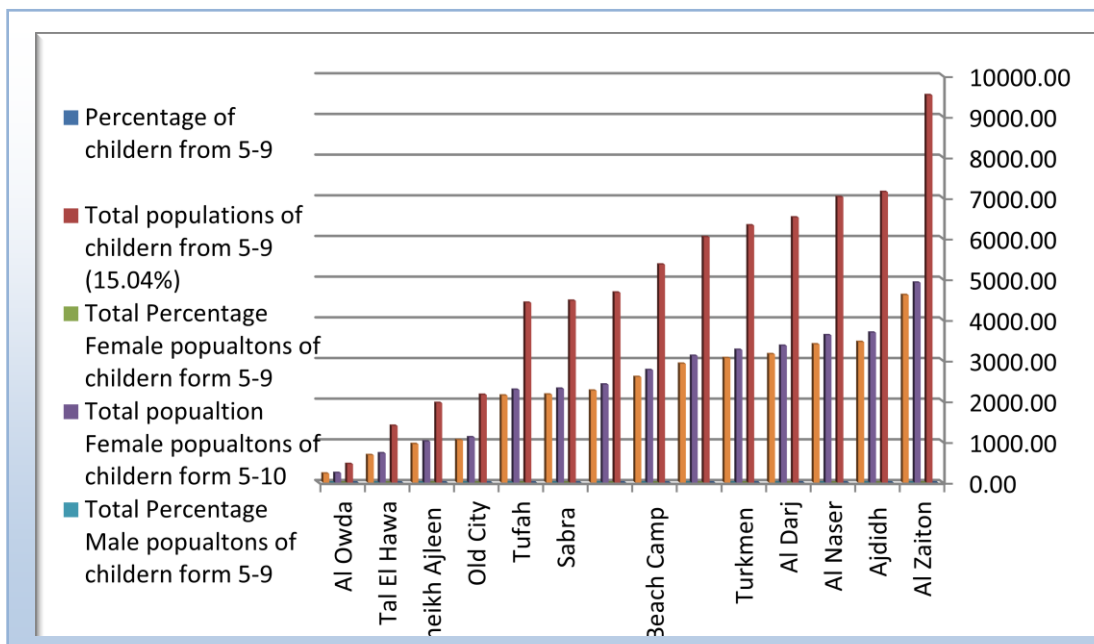
At least 200 more schools are needed to redeem the shortage in classrooms in the Gaza Strip.

There are 29 documented cases of attacks on schools by Israeli occupation forces (IOF) in the Gaza strip, which resulted in severe damage to many schools' buildings. (UNOCHA , 2011).

Because of the shortage of classrooms in the UNRWA schools, 40,000 Palestinian refugee children (who are supposed to study in UNRWA schools) have been forced to enroll in government schools . (UNRWA,2012).

Some of UNRWA schools in Gaza City started this year learning in containers instead of concrete class rooms. This undermines the learning environment as children are more vulnerable to suffering from the summer heat and winter cold temperatures.

There is a shortage in education tools and facilities in both governmental and UNRWA schools, which includes a shortage in school books and stationary, in addition to shortage in lab tools and materials.



**Figure (5. 19) Statistics that were used in the Conceptual frame work for Schools Development projects per neighborhood. Data Source Original data of Gaza City as whole was adapted from Palestinian Central Bureau of Statistics)**

According to PCBS in 2012 , all information were extracted about the targeted population age group and were unified in several data sets per after conducting the proportional equations to extract the percentages and precise population sizes per neighborhoods in the Gaza city , it can noticed that more than 90% of Gaza's population over the age of 10 know how to read and write .Of the city's population, were 140.848 enrolled in schools (39.8% in primary schools, 33.8% in secondary schools, and 26.4% in public secondary schools .(Some 11.134 people bachelor's or master's and doctoral degrees .It can be obviously stated that the Israeli occupation authorities are considered the main obstacle to the development of schools, because of frequent closures of the Gaza crossings, preventing entry of construction materials which also prevent building new schools or expansion in the construction of classrooms. The sector has been observed need of children and women, youth and people with special needs for more interventions compared to other sectors especially in their schools urban development.( PCBS,2012)

The Islamic Welfare association in cooperation with all INGOS and governmental organizations called for in its report to give marginalized areas a priority in the construction of schools covering the needs of residents in the service of basic education, as called for intensification of construction for schools to cover the deficit of education and support projects to improve the quality of education, with an estimated need of public education schools 105 schools with an estimated need



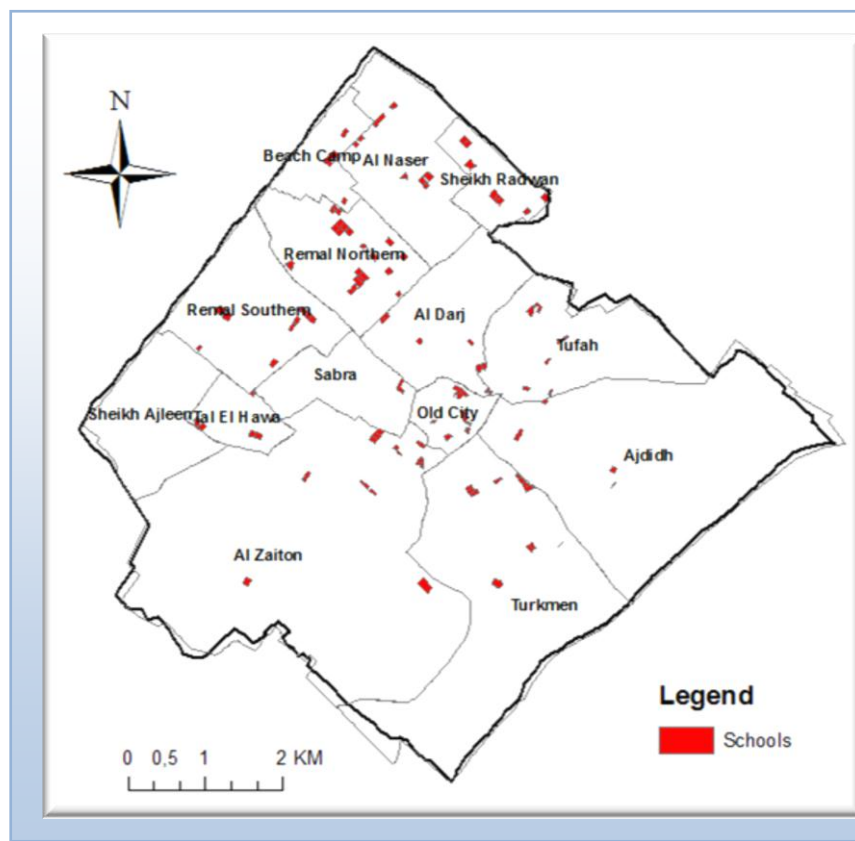
UNRWA's 119 schools, to be later building 20 - 25 public school year to absorb the annual increase in the number of students, aligned with UNRWA needs to build 10 schools annually.(UNRWA,2011)

### 5.3.2.1 Establishment of GIS based Multi-Criteria System GIS School System

Multi criteria analysis was conducted to the school development projects allocation criteria that was gained through the survey results that were confirmed by experts in the Ministry of Education to have precise weight based on the demands , the criteria was developed and the data were entered into the GIS-Based Multi-criteria analysis based on the previous steps illustrated earlier .

#### ❖ Data Input and processing

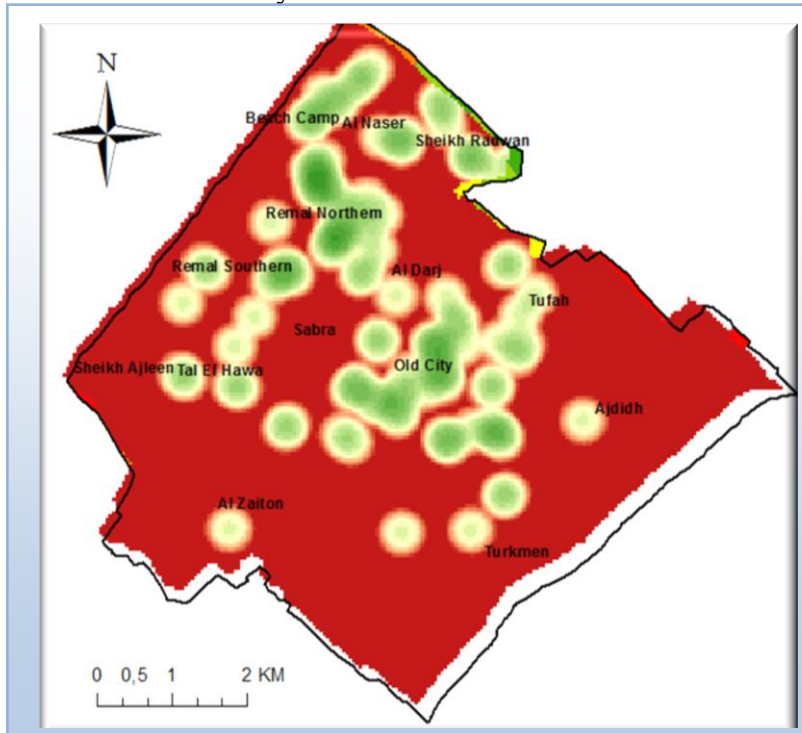
The data processing of major data of the targeted zones were entered into the system , such as the population density , children density per age disaggregated by neighborhoods, and other data that were relevant to allocate the schools in Gaza city .



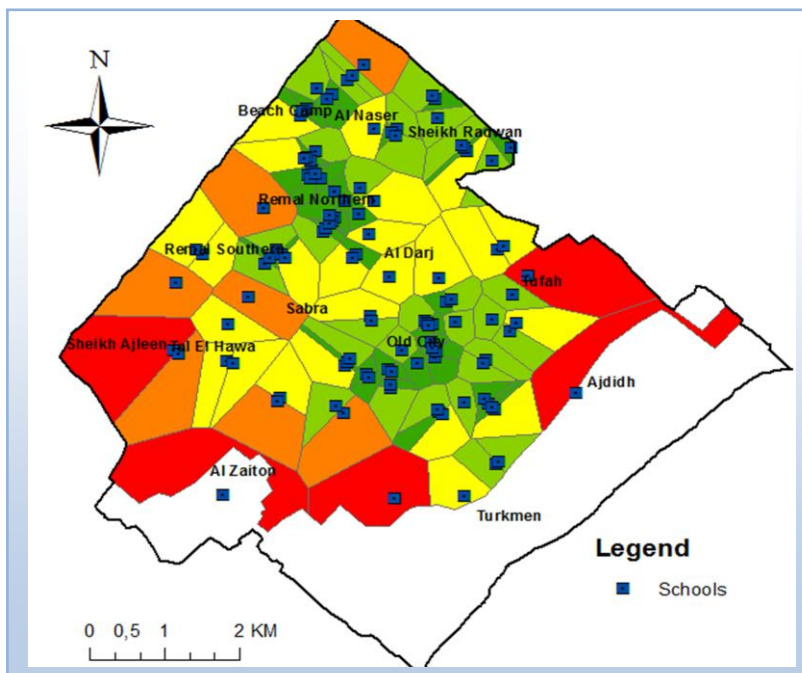
**Figure(5. 20) Location Map for schools in Gaza City**  
Source(Researcher)

The processes as been illustrated above were implemented to form multi-criteria analysis aligned with GIS software to form the multi layers , each of them had it own criteria weights , in addition the layer itself has individuals weights comparing to other data, the overlay weighting was done to sum

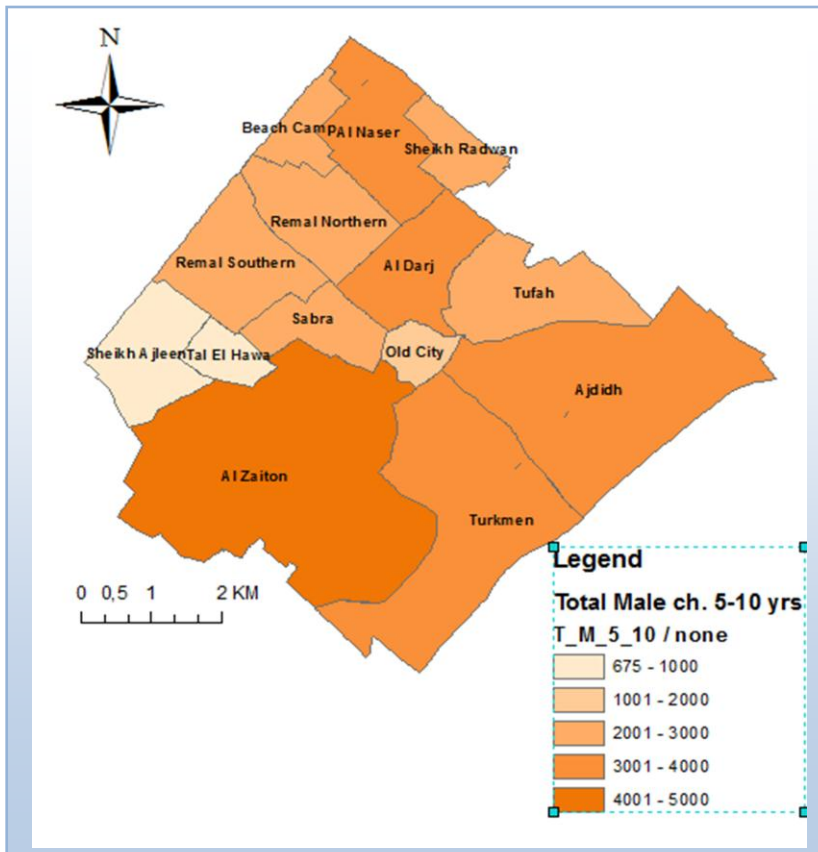
- ❖ **Reclassify Process : Thiessen polygons map for schools allocation in Gaza city.** Re-mapping tables was done to define how the values will be reclassified. Reclassify raster files based on criteria values.



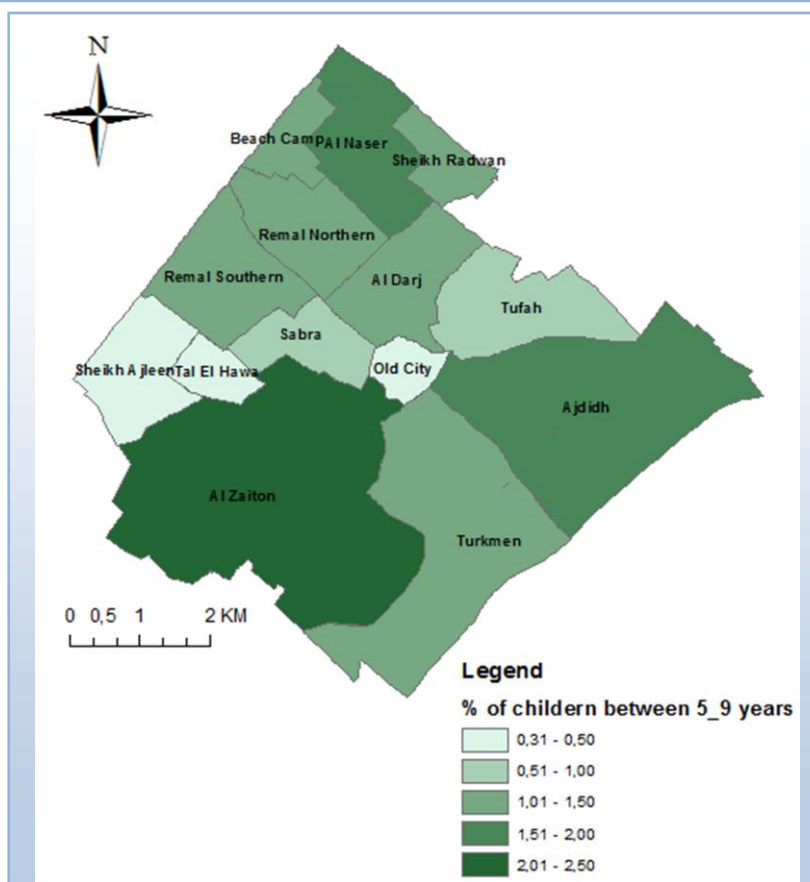
**Figure(5. 21)Density of schools in Gaza City using spatial analysis tools in ArcGIS.**



**Figure(5. 22)Creating Thiessen Polygons for schools in Gaza city to show the represented area for each school .**



Figure(5. 23)Density of Children in Gaza City



Figure(5. 24)Density of Children in Gaza City.

### ❖ Weighted overlay table

The weighted overlay table allows the calculation of a multiple-criteria analysis between several rasters. The weighted overlay table allows the calculation of a multiple-criteria analysis between several rasters.

The main ranking allocation criteria were as follows: 20% for Student density between 5-9 years, 20% for Student density between 10-18 years, 35% for school density in Gaza city, 25% for Land use criteria in Gaza city. The figures indicated the stages that had been conducted to facilitate the final results. Figure (5.23) shows the specific ranking per category.

| Code | Field               | Scale Value |
|------|---------------------|-------------|
|      | <b>PROTECTION</b>   |             |
|      | Nature Reserve      | 6           |
|      | Important Natural   | 8           |
|      | Recreation          | 8           |
|      | Natural Resource    | 1           |
|      | Existing Industrial | Restricted  |
|      | Cultivated          | 6           |
|      | Built-up            | 10          |
|      | Tourism Develop     | 8           |
|      | Waste Water Treat   | Restricted  |
|      | Free Trade Zone     | Restricted  |
|      | Proposed Industri   | Restricted  |
|      | Soild Waste Dispo   | Restricted  |
|      | Natural Resource    | 8           |
|      | Mawasi              | 8           |
|      | Airport             | Restricted  |
|      | Harbour             | Restricted  |
|      | Fisheries Site      | Restricted  |

**Figure(5. 25)Justified Ranking of Land-use criteria in Gaza Strip.**

**Table (4.17)Justified Education Developmental Projects Site Selection Criteria's Weights**

|  |     |
|--|-----|
| High Population density                                  | 7.6 |
| Children density 5-9                                     | 7.1 |
| Children density 10-18                                   | 6.0 |
| Number of surrounding school and zoning circle they had. | 6.6 |
| Nearby Main Streets                                      | 6.3 |
| Environmental consideration                              | 6.0 |
| Regional classification as housing zones                 | 5.9 |
| Away from Buffer zones( secure place)                    |     |

| Old values          | New values |
|---------------------|------------|
| 0,310884 - 0,49218  | 1          |
| 0,49218 - 0,673476  | 2          |
| 0,673476 - 0,854772 | 3          |
| 0,854772 - 1,036068 | 4          |
| 1,036068 - 1,217364 | 5          |
| 1,217364 - 1,39866  | 6          |
| 1,39866 - 1,579956  | 7          |
| 1,579956 - 1,761252 | 8          |

| Raster      | % Influence | Field  | Scale Value |
|-------------|-------------|--------|-------------|
| Student_5_9 | 20          | VALUE  |             |
|             |             | 1      | 1           |
|             |             | 4      | 4           |
|             |             | 5      | 6           |
|             |             | 6      | 7           |
|             |             | 7      | 8           |
|             |             | 8      | 9           |
|             |             | 10     | 10          |
|             |             | NODATA | NODATA      |
| Stud_10_18  | 20          | VALUE  |             |
|             |             | 1      | 1           |
|             |             | 4      | 4           |
|             |             | 5      | 5           |
|             |             | 6      | 6           |
|             |             | 7      | 7           |
|             |             | 8      | 8           |
|             |             | 10     | 10          |
|             |             | NODATA | NODATA      |
| sch_density | 35          | VALUE  |             |

Figure(5. 27)Reclassify of student density allocation in Gaza City.

Figure(5. 27)Ranking of weighted overlay land use criteria in Gaza Strip.

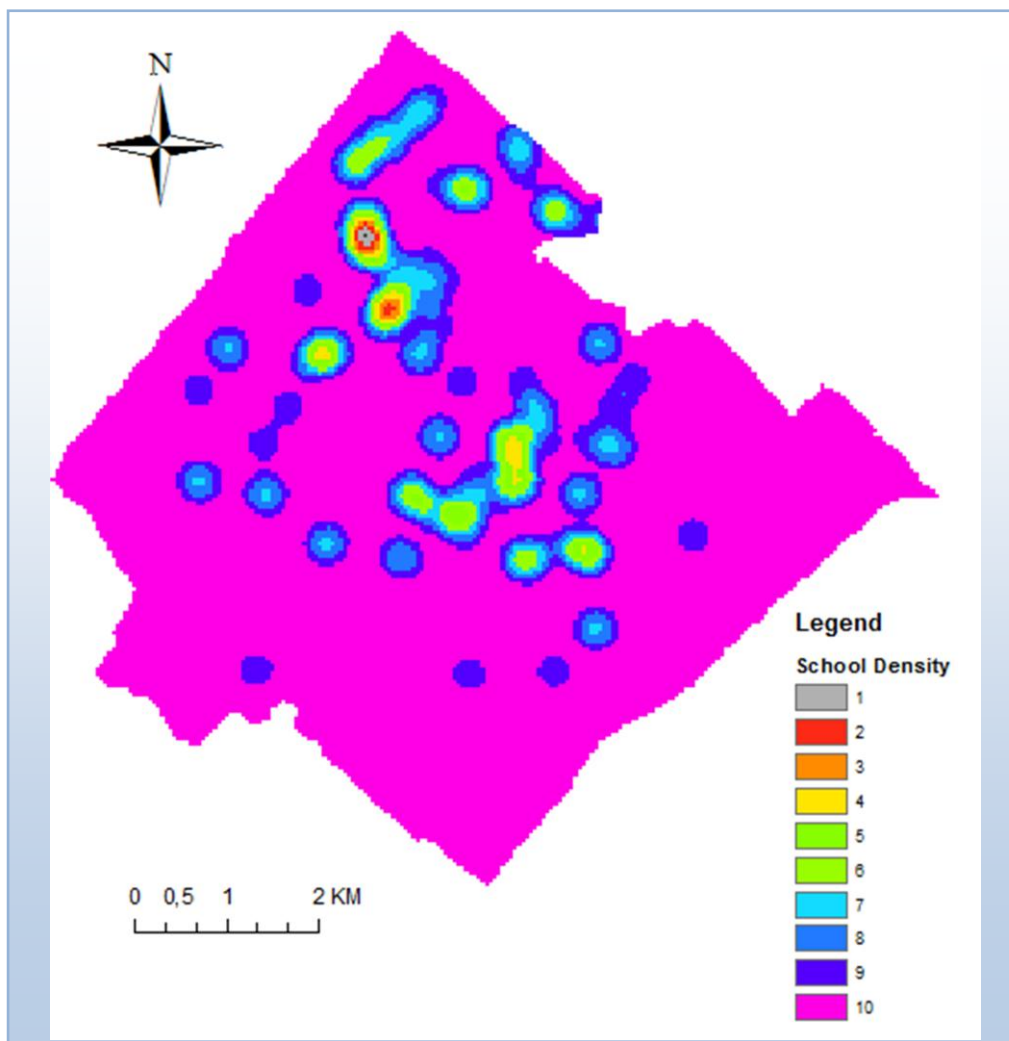


Figure (5. 28) School Density in Gaza strip

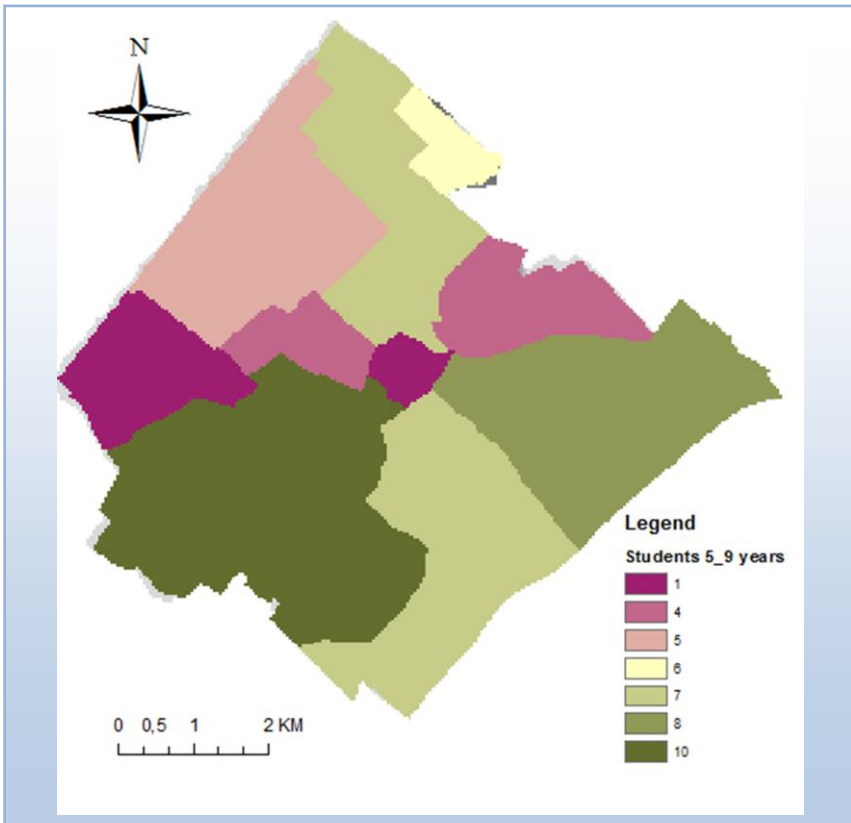


Figure (5. 30) Student age allocation between 5 and 9 years old

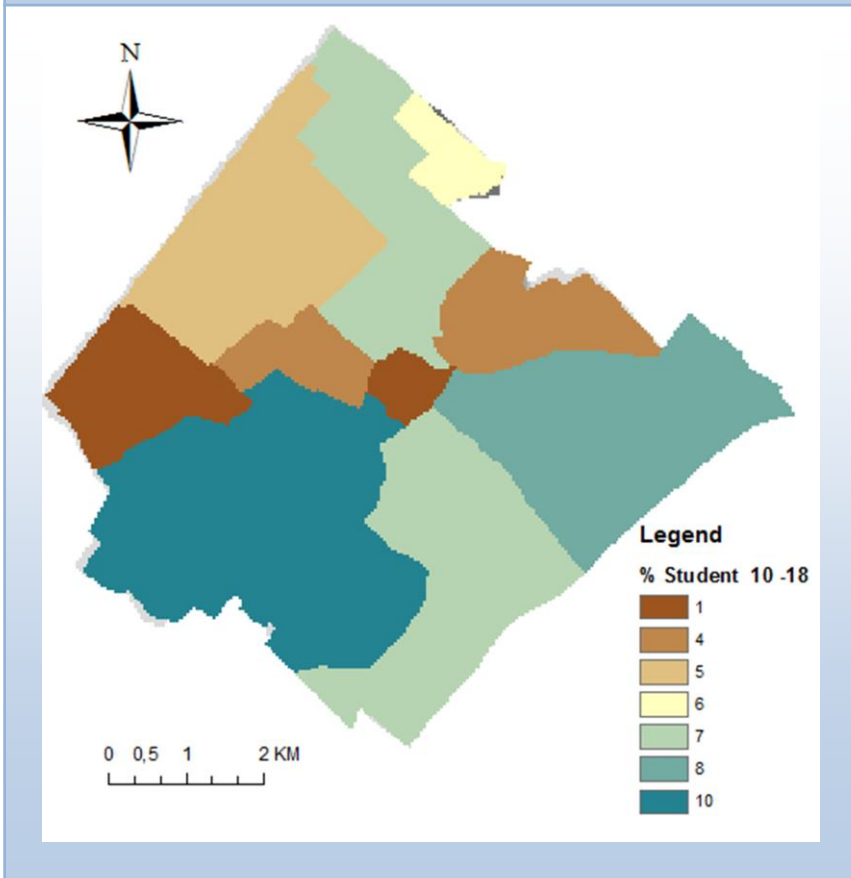
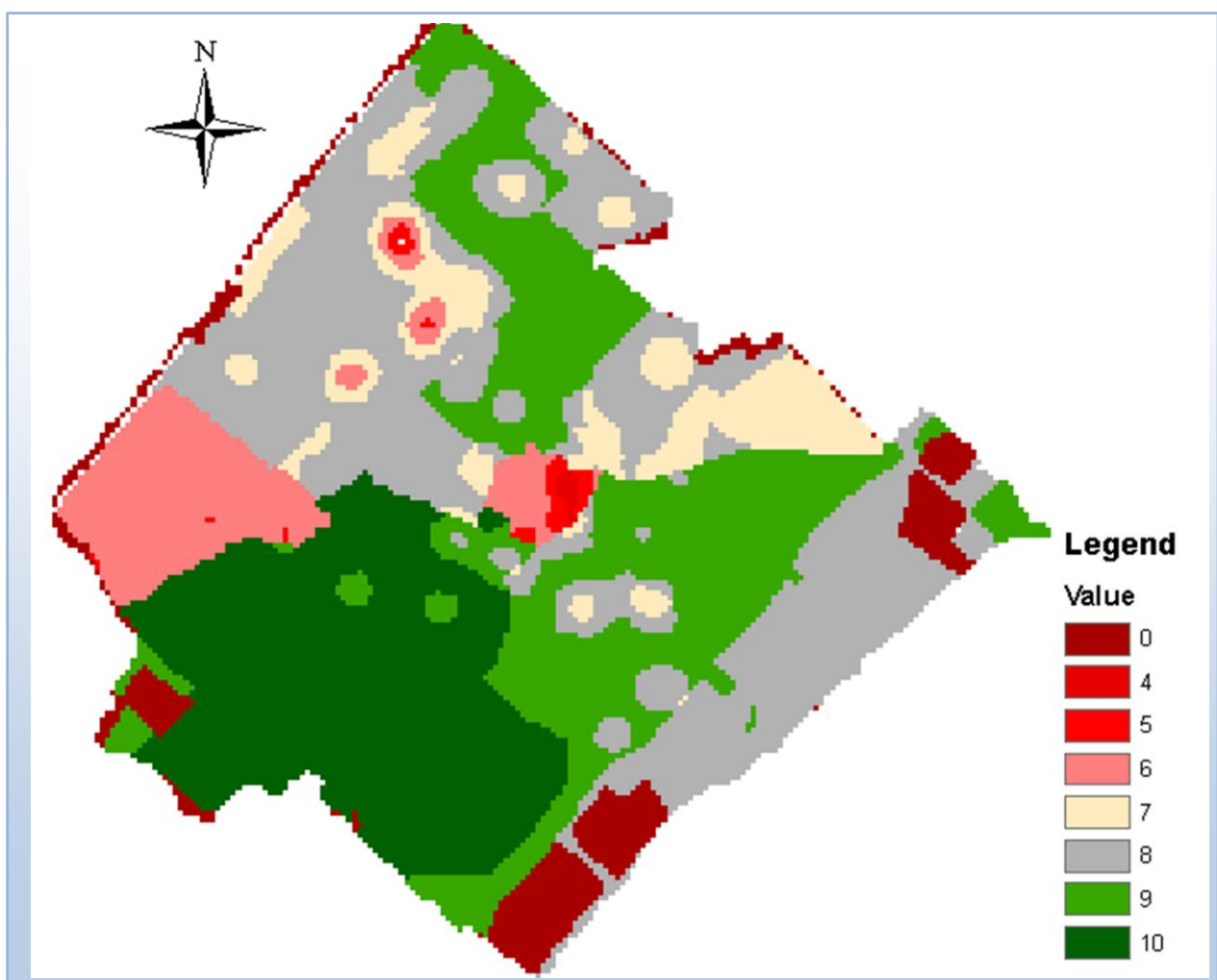


Figure (5. 30) Student age allocation between 10 and 18 years old based on ranking from (1-10) .

The final map in figure(5.29) indicated the current situation and the proposed allocations of schools based on the multi-weighted criteria , and overlay them with multi-weighted layers to form the final stage of the analysis .

The analysis took several stages of trial and errors to precisely allocate the zones that needs establishment of new schools for the specific ages based on the targeted population represented data. The final map indicated that Zaiton zone was one of the mostly needy regions of new schools' establishment. This fact was validated by the urban planners and experts in the Ministry of Educations who agreed and validated this results.

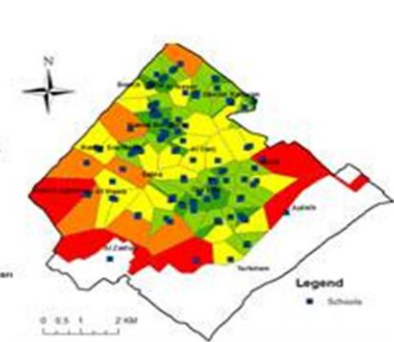
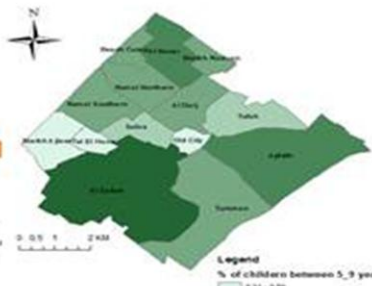
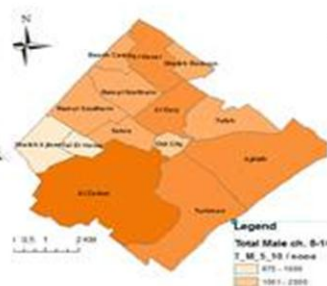
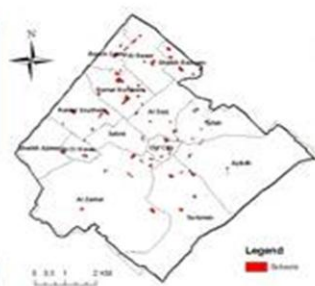


**Figure (5. 31) Final criteria map for best location of educational schools based on ranking from 0 NO need at all to 10 highly needs schools .**

### 3. Education Projects

1 Input Data from Statistics about main Multi Criteria Analysis

2 Water Processing and Data Manipulating



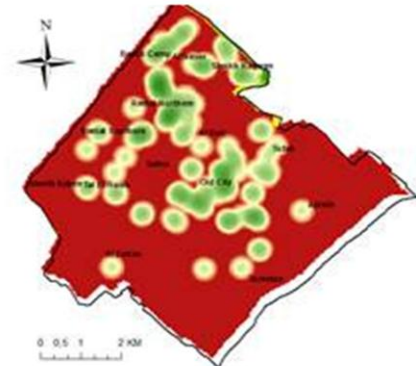
3

Density of Children in Gaza City

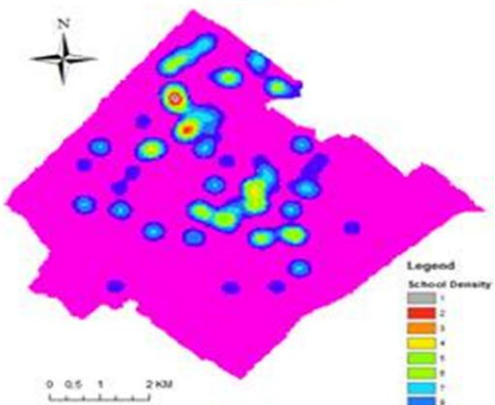
5

Simple ranking allocation for school location selection based on weighted overlay using GIS spatial analysis

4



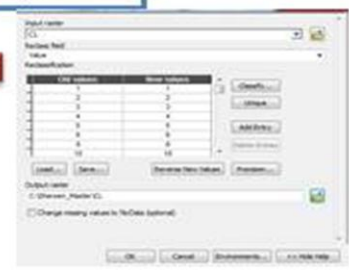
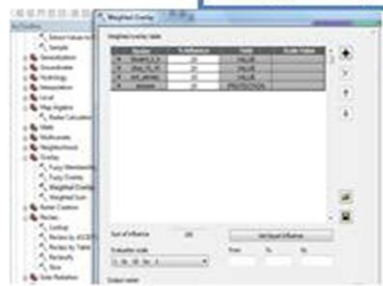
Ranking of Land-use criteria in Gaza



School Density in Gaza City

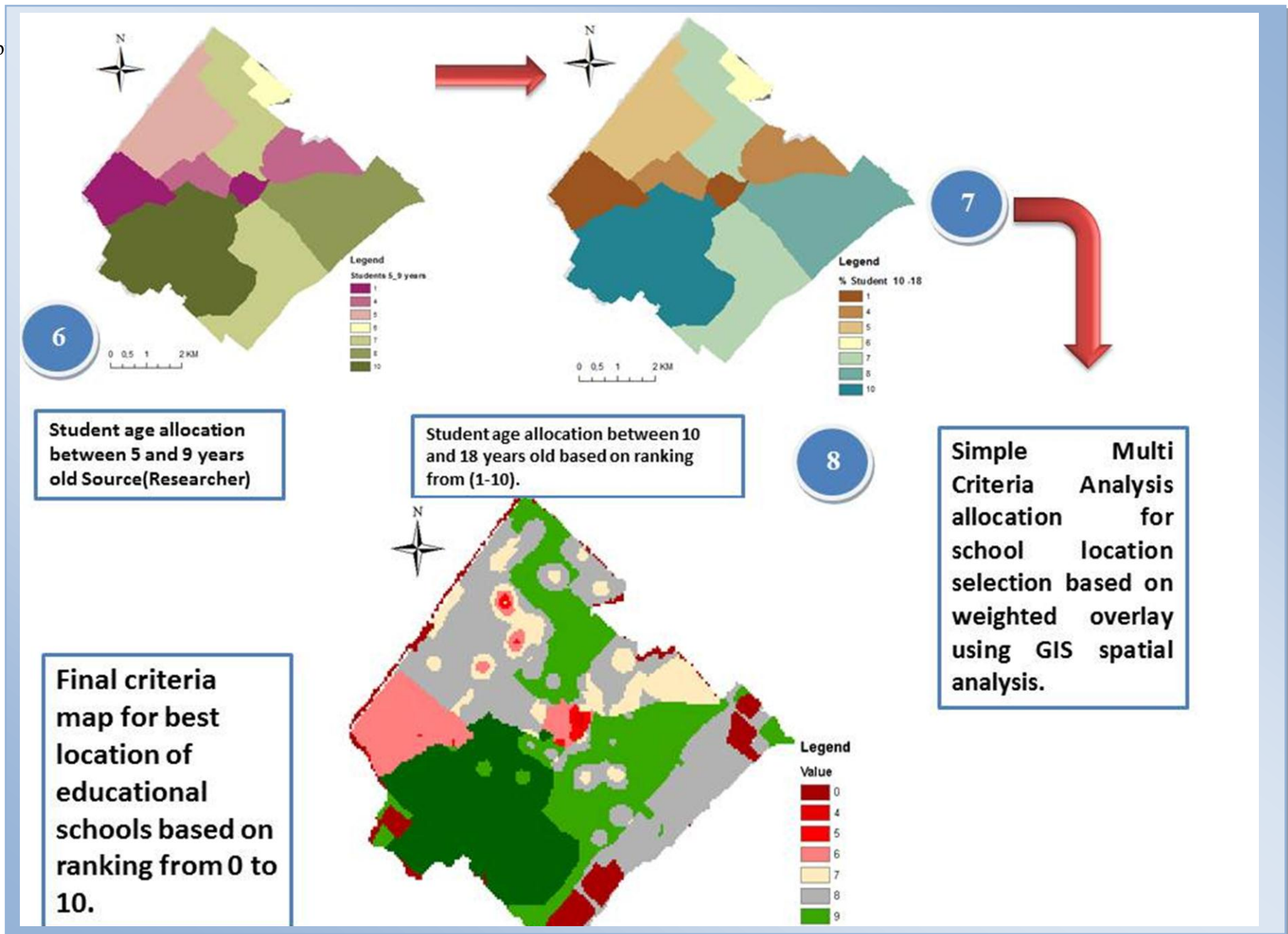


Land use allocation for Gaza City



Figure(5. 32)The conceptual Frame work Chart for allocating the educational Schools.





Figure(5. 33)The Final Suitability mapping for allocating the educational Schools.

**Conclusion:**

The sites allocation criteria varied based on different areas and circumstances, the main approach can be determined as follows : determine the main framework through stating the main needs of the targeted population, set measurable indicators to evaluate the nominated sites , set out an appropriate mechanism to filter proposed lands and design proper architectural forms that complement the main strategy of selection and based on the appropriate land

# Chapter (6) Conclusions and Recommendations

## 6.1 Conclusion

The Thesis visualized a conceptual framework based on a systemic approach in urban planning for developmental Projects. This paper has presented a GIS-based multi-criteria analysis approach to assess site allocation for urban developmental projects.

The results had showed pragmatic shift from the classic urban planning design to the modern approach. Subsequently ,the study determined a frame work for all Governmental and INGOS which used sophisticated tools to analyze and measure multi- criteria in indicators levels in master plans of Palestinian strategic plan .

The conceptual frame work represented a differentiated reference for many other Palestinian NGO , local governmental organizations and INGOs in targeting the Palestinian society effectively.

It reflected accurate public needs to develop systematic approach in urban planning and strategic development plans to enable having constant fundraising to the urban developmental projects .

Based on the results, it can be concluded that the implementation of this framework can be valid for next 5 years , as per the current strategic plans and circumstances.

Prioritizations procedures that were accomplished in the study had proven track records in developing projects' selection criteria , and elaborated the results to improve systematic site allocation strategy aligned with the conceptual framework of the study( GIS based Multi-Criteria analysis).

Site selection allocation Criteria is a fundamental and comprehensive process that could considerably impact of available resources, factors and constraints .The ten proposed urban developmental projects were ranked based on the survey results , according the highest five prioritized urban projects were ranked in the presence of the sites allocation differentiation , thus the case study was obtained for two sample projects which were highly ranked from targeted population of stakeholders to

substantiate the public participation to identify the urgent demands of their respective communities.

The conceptual frame work comprised of four steps: establishment of weighting suitability criteria, Gaza City Sites' screening merging the data available statistics , establishment of the Multi –criteria weights and evaluation criteria, and site Evaluation.

An integrated system was developed to aid the analyst in finding the optimum site for the facility sought. The system integrated two major tools (GIS and Multi Criteria ) in a manner that attain the correct solution to assist the decision makers in extracting appropriate weights for the physical suitability criteria.

The system was successfully tested in determining the optimum land suitability for three urban developmental projects as examples to reflect the main procedure of the conceptual framework , subsequently, e the water networks development , wells , and schools and educational centers in the Gaza city.

The value-focused approach MCDA, applied in this study, helped in the design, evaluation, and also provides improvements to the three alternative networks. The crucial intentions of the research were lucratively met the overall development trends in Gaza City region to year 2020.

It also replicated as a rational mechanism of addressing, impending and providing a forum for exchange of knowledge , cooperation, and final selection of several urban developmental projects option.

The final selection represented an accurate presentation of the chronological procedure to end up with final selection regions and lands based on the actual needs of the population in these regions , that was contiguous to the economic, engineering, environmental, institutional and social objectives as seen by the relevant municipalities, urban planners and the respective stakeholders.

Prospective comparison between the determined achievements against the stated criteria which were converted to measurable indicators to enable decision makers and stakeholders to see how the several options can be facilitated in the context of the priorities against each criteria .

The analysis showed that although different groups of stakeholders, and planning authorities, had their differences in the importance of various criteria of different developmental projects, they all agreed upon the dominance of the conceptual frame work as an option over the others in urban and strategic planning .

The structured spatial analysis scenarios comparisons as applied in this study has proven its ease of use within limited time-constraints in the conceptual framework.

The overall recommendation in GIS Based Multi-Criteria analysis may take different forms, according to the manner in which a problem is stated.

From the previous three case studies that the major steps can be summarized in selecting a set of alternatives criteria for the urban developmental project , sorting: assigning alternatives to different classifications , ranking: classifying alternatives from best to worst with eventually equal positions and describing the alternatives and their follow-up results.

This GIS Based Multi-Criteria analysis approach contributed to have easy access to feedback to evaluators, it easy usage for non-experts to recognize, and provides a mechanism of decision making exploration that depended on the variation of criteria weights for different urban project that affected the outcomes and the final results spatially and quantitatively.

The three case studies had provided effective results based on this approach. They helped to recognize the major zones that are suitable locations for schools development and water networks development .The results will be presented to respective governmental organization and other donors for their consideration in the future since it applies the MCA framework to incorporate stakeholders' assessment and public participation into sites allocation assessment with GIS to determine the overall appropriateness of zones for the establishment of schools , water networks and new water pumping stations .

The synthesis of MCA within Arc-GIS environment enhanced the predictable module, advanced the reliability of MCDM outcomes, and broadened GIS functionalities towards the implementation of tool enables decision makers to follow a comprehensive yet comprehensible processes to inspect weight sensitivity in both criteria and geographic allocation.

## **6.2 Recommendations for decision makers in the water networks' development planning departments.**

- 1) It is recommended to take the advantage of the usage of GIS-MCA to assess the current situation of ground water sites.

- 2) Urban planners should take the outcomes of this research into consideration while planning new developmental projects to eliminate the effect of urban expansion on the quality of ground water and enable having optimum solutions of water developmental projects.
- 3) Improving the municipalities' water network system (system efficiency) is a considerable key to achieve a fair distribution all over the Gaza City.
- 4) It's highly recommended by municipal engineers, solid Wastewater managers, Ground water operators, GIS experts and UNRWA engineers to use GIS as a decision support tool to identify the appropriate locations of future and expansion of Ground water Management.

### **6.3 Recommendations for decision makers in the Educational development planning departments:**

Based on the results of the conceptual frame work , it can be concluded that the systematic approach of developing and selection of educational sites especially schools configures a potential need. It can be noticed that the criteria of sites' selection differentiated depending on the type of schools and from one site to another. The following recommendations were driven enhance the conceptual frame work were summarized as follows :

- 1) Identify the needy population for such schools based on available statistics such as density , age of children in the targeted schools , number of schools in the zones ,etc , by developing data base for all schools in the targeted zones with the ARG\_GIS modeling techniques aligned with the main strategy of the Ministry of Education in Gaza City.
- 2) Update the site allocation criteria weight based on the nature of the targeted area .
- 3) Take in to consideration the present and future needs of the educational projects
- 4) Study the current situation of the present schools in order to know which areas require more schools by developing zoning to the available schools.

### **6.4 Recommendations for Governmental / local level and donors**

- 1) Local economic development should be promoted by integrating the governmental , non-governmental and private sectors to activate the role of

concerned stakeholders in their respective local community to address their needs of new development of urban projects.

- 2) Having limited access to self-reliance of the local economics and shortage in the development of new urban projects confirm that necessity of having accurate representation of targeted community's needs , implementing the conceptual framework will facilitate the configuration of which areas that needs the urgent intervention ,
- 3) Enable effective prioritization of the limited fund sources in comparison to the continuous needs of the Gazan inhabitants to collaborate efforts in having transparent locally oriented suitability and needs mapping process based on community priorities to optimize the limited resources.
- 4) Enable having effective system of fundraising for the urban development planning by having systematic approach of reaching the respective donors showing them communities needs and priorities with the suitability mapping produced by the effectual usage of the GIS-Based Multi criteria framework.
- 5) It is recommended to the donors to collaborate with respective stakeholders to emphasis on the assessing the current strategic plans for Gaza city and other cities in the Gaza Strip which were produced by the SDIP and complement their previous efforts by the usage of GIS-Based Multi Criteria to have accurate simulation of the urban area's needs .
- 6) It is highly important for donors to take into account organizations which is using systematic approach of suitability mapping and make it as main criteria of fundraising grants .
- 7) The computerized model can be adapted by International INGOS to address the needs of non-urban developmental projects , such as the cash for works programs, against poverty projects and many other kinks , where the presentation of the actual needs of the targeted communities can be taken into account while considering the beneficiaries' selection process .

### **6.5 Recommendations for Further researches**

- 1) It recommended for further researches to address other developmental projects that were not addressed in the research.
- 2) It is recommended to activate the usage of the computerized model to be uploaded into online Access database linked with GIS and multi criteria analysis.

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## Annexes

### Annex – I : Questionnaire; Arabic modified version after involving pilot sample and approving it form committee of experts



الجامعة الاسلامية - غزة

كلية الدراسات العليا

قسم الهندسة المعمارية

ماجستير هندسة معمارية

تعتمد المنظمات الدولية غير الحكومية والمنظمات الحكومية على الأساليب التقليدية في تحديد احتياجات التخطيط الحضري، نتيجة لذلك تعتمد المشاريع التنموية على استهداف مناطق جغرافية غير الضرورية في بعض الأحيان دون وجود إطار واضح تقوم على دراسة جميع العوامل المؤثرة في هذه المناطق الحضرية مثل معدلات الفقر، والموارد المتاحة، والمشاريع التنموية الحالية، ومعدلات البطالة، وتوزيع الشباب في المناطق الحضرية، والجنس و توزيع والأعمار وجميع العوامل ذات الصلة التي ينبغي أن تؤخذ في عين الاعتبار عند القيام بتقييم الاحتياجات للمشروعات التنموية البشرية.

لذلك و من هذا المنطلق، فإن المشاريع التي تمولها الجهات المانحة أو المؤسسات المحلية لا يتم دمجها بشكل صحيح في نظام التخطيط الحضري الشامل التي تتوافق دائما مع احتياجات المجتمع المحلي. لذا، لا بد من تطوير طريقة لتحديد أولويات المشاريع المطلوبة على أساس استراتيجيات التخطيط الحضري المتوفرة في وزارة التخطيط والبلديات المحلية. ان هذا الاستبيان هو جزء من منهجية رسالة ماجستير بإشراف الدكتور فريد القيق و الذي يهدف الي تحديد الأولويات لتحسين وتهيئة البرنامج الأمثل لتسهيل الحصول على قياس هذه المؤشرات. وسوف تستند هذه المنهجية للبحث في تحديد المؤشرات ذات الصلة، ووزن كل واحدة، بالإضافة إلى الطبيعة المترابطة للعلاقة بينهما.

يستهدف الاستبيان أصحاب المصلحة و صناع القرار الذين لديهم القدرة في تحديد احتياجات مجتمعهم في المؤسسات الحكومية و الدولية و المحلية في مدينة غزة كحالة دراسية، ينقسم الاستبيان الى ثلاثة اقسام رئيسية و لن يستغرق تعبئته اكثر من 15 دقيقة.

ان مشاركتكم الفاعلة في تعبئة هذا الاستبيان ستكون موضع تقدير كبير لانها ستضيف الكثير الى قيمة البحث و يرجى العلم بأن الردود ستبقى قيد البحث و لن يتم اطلاع أحد عليها.

شكرا لكم

الباحثة المهندسة شيرين عبيد

#### المعلومات العامة:

|  |
|--|
| إسم المؤسسة  |
| .....: الاسم.....  |
| العمر:..... ذكر <input type="checkbox"/> أنثى <input type="checkbox"/> المسمى الوظيفي:..... عدد سنين |
| الخبرة:.....   |

ما هو تصنيف عمل المؤسسة:

- سلطة حكومية
- سلطة محلية
- لجنة حي
- جمعيات أهلية غير ربحية
- نقابات و اتحادات
- قطاع خاص
- أخرى

|   |                               |                                |                                |                                     |
|---|-------------------------------|--------------------------------|--------------------------------|-------------------------------------|
| سنوات عمل المؤسسة في دعم الاقتصاد المحلى                      | <input type="checkbox"/>      | سنة                            |                                |                                     |
| عدد المشاريع التي تم تنفيذها في الخمس سنوات الاخيرة :         |                               |                                |                                |                                     |
| <input type="checkbox"/> أقل من خمسة                          | <input type="checkbox"/> 10-6 | <input type="checkbox"/> 15-11 | <input type="checkbox"/> 20-16 | <input type="checkbox"/> أكثر من 20 |
| <u>القسم الأول: تقييم عام لمشاريع التطوير الحضري الحالية:</u> |                               |                                |                                |                                     |

### 1.1 الرجاء إختيار الجواب الانسب:

#### 1. مصادر التمويل للمشاريع الخاصة بالمؤسسة:

- المنح
- القروض
- السلطة المحلية
- أخرى : الرجاء التحديد

#### 2. أكثر أنواع المشاريع حيوية في المؤسسة ، الرجاء تحديد نوع او اربعة على الاكثر من التالي

1. تطوير شبكات المياه
2. تطوير شبكات مياه الصرف الصحي
3. تطوير النقل و المواصلات
4. المشاريع الترفيهية
5. مراكز التعليم
6. مشاريع صحية
7. إدارة الموارد وتطوير استخدام الاراضي
8. مشاريع اسكان
9. مشاريع تحسين البيئة
10. مشاريع تطويرية للتخلص من النفايات والتلوث
11. أخرى الرجاء التحديد: .....

#### 1.2 الى أي مدى تعتقد ان الوضع الحالي للمشاريع التطويرية يعكس وجود تخطيط نوعي مدروس:

|  |                                      |                                       |                                      |  |
|--|--------------------------------------|---------------------------------------|--------------------------------------|--|
| <input type="checkbox"/> بدرجة كبيرة جدا | <input type="checkbox"/> بدرجة كبيرة | <input type="checkbox"/> بدرجة متوسطة | <input type="checkbox"/> بدرجة ضعيفة | <input type="checkbox"/> بدرجة ضعيفة جدا |
|--|--------------------------------------|---------------------------------------|--------------------------------------|--|

#### 1.3 من خلال خبرة مؤسستكم ، ما هي ضرورة وجود نظام فعال لتحديد أوليات المشاريع التطويرية :

|  |                                      |                                       |                                      |  |
|--|--------------------------------------|---------------------------------------|--------------------------------------|--|
| <input type="checkbox"/> بدرجة كبيرة جدا | <input type="checkbox"/> بدرجة كبيرة | <input type="checkbox"/> بدرجة متوسطة | <input type="checkbox"/> بدرجة ضعيفة | <input type="checkbox"/> بدرجة ضعيفة جدا |
|--|--------------------------------------|---------------------------------------|--------------------------------------|--|

#### 1.4 الرجاء تقييم أهمية المشاريع التطويرية الحضرية التالية :

| الأهمية بحسب الاحتياجات الحالية |                          |                          | الوزن بحسب الأهمية (الرجاء تحديد الوزن من الأكثر 1 إلى الأقل 10) | المشروع                                 |
|---------------------------------|--------------------------|--------------------------|--|---|
| ضعيفة                           | متوسطة                   | كبيرة                    |  |   |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 1. تطوير شبكات المياه                   |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 2. تطوير شبكات مياه الصرف الصحي         |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 3. تطوير النقل و المواصلات              |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 4. المشاريع الترفيهية                   |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 5. مراكز التعليم                        |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 6. مشاريع صحية                          |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 7. إدارة الموارد وتطوير استخدام الاراضي |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 8. مشاريع اسكان                         |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 9. مشاريع تحسين البيئة                  |
| <input type="checkbox"/>        | <input type="checkbox"/> | <input type="checkbox"/> |  | 10. مشاريع اخرى.....                    |

القسم الثاني: تحديد أوليات المشاريع :

2.1 بناءا على الاحتياجات المحلية للمجتمع في مدينة غزة ، الرجاء تحديد اكثر أربع مشاريع تشكل أهمية كبرى في الوضع الحالي :

المشروع التطويري الاول:.....

المشروع التطويري الثاني:.....

المشروع التطويري الثالث:.....

المشروع التطويري الرابع:.....

2.2 الرجاء توضيح أهمية كل من المعايير التالية للتحديد اوليات المشاريع المقترحة و وضع نقاط (وزن) من (صفر الى 10) لكل من المعايير التالية بحسب ارتباطها بالمشروع الذي تم تحديده و اهميته ( صفر=لا وزن ، 1= وزن ضعيف ، ..... =10 أقصى وزن)

| المعايير                                 | المشروع المقترح الاول | المشروع المقترح الثاني | المشروع المقترح الثالث | المشروع المقترح الرابع |
|--|-----------------------|------------------------|------------------------|------------------------|
| 1. حاجة المجتمع للمشروع                  |                       |                        |                        |                        |
| 2. عدد فرص العمل المستحدثة               |                       |                        |                        |                        |
| 3. عدد المستهدفين في المشروع             |                       |                        |                        |                        |
| 4. نوعية الفئة المستهدفة                 |                       |                        |                        |                        |
| 5. توفر عناصر الاستدامة                  |                       |                        |                        |                        |
| 6. الاعتبارات البيئية                    |                       |                        |                        |                        |
| 7. حجم الميزانية المطلوبة                |                       |                        |                        |                        |
| 8. مساهمة المؤسسة في ميزانية المشروع     |                       |                        |                        |                        |
| 9. العمر الافتراضي للمشروع               |                       |                        |                        |                        |
| 10. مدة تنفيذ المشروع                    |                       |                        |                        |                        |
| 11. إجماع غالبية اهل المنطقة على المشروع |                       |                        |                        |                        |

Annex – I : Questionnaire; Arabic modified version after involving pilot sample and approving it form committee of experts

| المقترح |  |  |  |  |
|---------|--|--|--|--|
| 12.     | وجود مشاركة من المؤسسات الأخرى                           |  |  |  |
| 13.     | الاعتماد في المشروع على مواد محلية                       |  |  |  |
| 14.     | وجود مصدر للتمويل  |  |  |  |
| 15.     | وجود مشاريع للمؤسسة مشابهة                               |  |  |  |
| 16.     | خبرة المؤسسة في مثل هذه المشاريع                         |  |  |  |
| 17.     | خبرة القائمين من المؤسسة                                 |  |  |  |
| 18.     | مشاركة المرأة في تنفيذ المشروع                           |  |  |  |
| 19.     | مدى اعتماد المشروع على مواد خام مستوردة                  |  |  |  |
| 20.     | قدرة المشروع على تطوير قدرات المجتمع فنيا وعلميا وإداريا |  |  |  |
| 21.     | مساهمة المشروع في تحسين الناتج الوطني في الاكتفاء الذاتي |  |  |  |
| 22.     | رفع كفاءة المؤسسة و تحسين أداء العاملين                  |  |  |  |
| 23.     | معايير أخرى  |  |  |  |
| 24.     |  |  |  |  |
| 25.     |  |  |  |  |
| 26.     |  |  |  |  |

القسم الثالث: تحديد معايير الاختيار المكاني للمشاريع :

3.1 الرجاء وضع وزن (نقاط) لكل من المعايير التالية للاختيار المكاني للمشاريع المقترحة و ذلك لإختيار أفضل مكان مناسب ، الرجاء إضافة معايير جديدة طبقا لنوع المشروع نفسه.

| المعايير                            | المشروع المقترح الاول | المشروع المقترح الثاني | المشروع المقترح الثالث | المشروع المقترح الرابع |
|-------------------------------------|-----------------------|------------------------|------------------------|------------------------|
| 1. كونه في مدينة - قرية             |                       |                        |                        |                        |
| 2. وجود كثافة سكانية عالية          |                       |                        |                        |                        |
| 3. وجود كثافة سكانية للأطفال        |                       |                        |                        |                        |
| 4. طبيعة المكان مخيم ام مدينة       |                       |                        |                        |                        |
| 5. قربه من الشوارع الرئيسية         |                       |                        |                        |                        |
| 6. كون الموقع مرتفع                 |                       |                        |                        |                        |
| 7. قرب المكان من البحر او الساحل    |                       |                        |                        |                        |
| 8. بعد الموقع عن الاماكن المزدحمة   |                       |                        |                        |                        |
| 9. ان يكون الموقع متعدد الاستعمالات |                       |                        |                        |                        |
| 10. إضافة معايير: .....             |                       |                        |                        |                        |
| 11. إضافة معايير: .....             |                       |                        |                        |                        |
| 12. إضافة معايير: .....             |                       |                        |                        |                        |
| 13. إضافة معايير: .....             |                       |                        |                        |                        |
| 14. إضافة معايير: .....             |                       |                        |                        |                        |
| 15. إضافة معايير: .....             |                       |                        |                        |                        |
| 16. إضافة معايير: .....             |                       |                        |                        |                        |

|  |  |  |  |                        |
|--|--|--|--|------------------------|
|  |  |  |  | 17. إضافة معايير:..... |
|  |  |  |  | 18. إضافة معايير:..... |
|  |  |  |  | 19. إضافة معايير:..... |
|  |  |  |  | 20. إضافة معايير:..... |

3.2 هل تفضل استخدام برنامج محوسب لتحديد اوليات المشاريع التطويرية الحضرية ؟

أوافق بشدة   
 أوافق   
 لا أعرف   
 لا أوافق   
 لا أوافق بشدة

3.2 هل تفضل استخدام برنامج محوسب لتحديد اماكن الانسب للمشاريع التطويرية الحضرية ؟

أوافق بشدة   
 أوافق   
 لا أعرف   
 لا أوافق   
 لا أوافق بشدة

شكرا لكم



**Annex – II : Questionnaire; Approved English version.**

The Islamic University Gaza  
Higher Education Deanship  
Faculty of Engineering  
Architectural Engineering Department  
Master of Architectural Engineering



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Introduction**

International Non-Governmental and governmental Organization are adapting traditional approaches in identifying the needs of urban planning. As a result, development projects sometimes targeting unneeded geographical zones without having a clear framework that are based on studying all factors of urban zones in term of poverty rates, available resources, current developmental projects, unemployment rates, youth distribution in the urban zones, gender share, ages and all related factors that should be taken into consideration while doing the needs assessment for Human Developmental Projects.

Therefore, projects funded by donors or local institutions do not always properly integrate into a comprehensive planning system that correspond consistently with local community needs. So, it is crucial to develop a method for prioritizing the required projects based on the urban planning strategies available in the Ministry of planning and local municipalities. This survey is part of a Master Degree research study supervised by Dr. Farid AL Qeeq aiming to assess and to identify priorities for improvement and to create an optimized program to facilitate access to the measurement of these indicators. The methodology of the research will be based on identifying relevant indicators and the weight of each one, in addition to the interrelated nature of the relationship between them.

The survey is designed for stakeholders from governmental NGOs , INGOs and civic institutions in Gaza city as a case study, having roles affecting (community needs) and divided into five sections and may take about 30 minutes to complete.

Your contribution towards this study is greatly appreciated, as it will add significantly to the value of the research. Your responses will be kept securely and will remain confidential.

**Thank you**

**Eng.Shereen Obaid**

**General Information**

Institution name: .....Your Name:.....  
Age :..... Gender:  Male  Female  
Your position: ..... Years of experience.....

How can you categorize your institution within following:

- Central authority Local
- Government Neighborhood committee
- Non-governmental organization
- Unions and associations
- Private sector and investors
- Others (please clarify)

Your institution supported local economy for:  years

Number of projects implemented by your institution in last five years

- <5       6-10       11-15       16-20       >20

**Section 1: General Assessment of Current Developmental Projects:**

**1.1 Please select the most appropriate answers:**

**1- Fund sources of projects in your institute**

- Donation
- Loans
- Local government
- Others Specify:.....

**2- Most common action line in your institute; you can only choose one to four from the following:**

- Water network development
- Waste Waterwater network development
- Transportation development
- Recreational development
- Education centers
- Resource management and land use development
- Recreational development
- Housing development Anti-poverty strategies..
- Environmental projects development
- Wastewater disposal and pollution control development
- Others Specify:.....

**1.2 To what level do you think that the current situation reflects adequate planning of developmental projects development?**

- Very high  High  Middle  Weak  Very weak

**1.3 From your institution experience, what is the importance of having effective model to prioritize and implement development projects?**

- Very important  Important  Middle  Not important  Not at all

**1.4 Please propose and assess the following urban developmental projects:**

| Projects | Weight(Ranking from (1 Max Importance 10 Min)) | Importance to the developmental needs |        |      |
|----------|--|---------------------------------------|--------|------|
|          |  | V. Important                          | Middle | Weak |
|          |  |                                       |        |      |

|   |  |  |  |  |
|---|--|--|--|--|
| 1) Infrastructure development                   |  |  |  |  |
| 2) Water network development                    |  |  |  |  |
| 3) Waste Water network development              |  |  |  |  |
| 4) Recreational development                     |  |  |  |  |
| 5) Education centers                            |  |  |  |  |
| 6) Health services development                  |  |  |  |  |
| 7) Resource management and land use development |  |  |  |  |
| 8) Transportation development                   |  |  |  |  |
| 9) Leisure and recreation development           |  |  |  |  |
| 10) Housing development                         |  |  |  |  |
| 11) Environmental development                   |  |  |  |  |

## **Section 2: Projects Prioritization Criteria**

2.1 Based on the community needs in Gaza City, please propose 4 mostly important developmental projects for the following development projects:

Development Project No 1 .....

Development Project No 2 .....

Development Project No 3 .....

Development Project No 4 .....

2.2 Please put score from (0 to 10) for each criteria based on the weight of the criteria for project selection. (0 = No weight, 1 = low weight ... 10 = max weight)

| S/N | Criteria   | Project 1 | Project 2 | Project 3 | Project 4 |
|-----|--|-----------|-----------|-----------|-----------|
| 1   | Community need for the project   |           |           |           |           |
| 2   | Number of jobs created   |           |           |           |           |
| 3   | Number of target group   |           |           |           |           |
| 4   | Type of target group   |           |           |           |           |
| 5   | Availability of sustainable factors  |           |           |           |           |
| 6   | Environmental consideration  |           |           |           |           |
| 7   | Required budget  |           |           |           |           |
| 8   | Total project budget   |           |           |           |           |
| 9   | Institution contribution   |           |           |           |           |
| 10  | Projects life span   |           |           |           |           |
| 11  | Project implementation duration  |           |           |           |           |
| 12  | Region consensus on project  |           |           |           |           |
| 13  | Other institution involvement in project (selection and/or implementation) |           |           |           |           |
| 14  | Project will use local materials   |           |           |           |           |
| 15  | Available fund resource  |           |           |           |           |
| 16  | Repetition of similar projects in the area                                 |           |           |           |           |

|    |   |  |  |  |  |
|----|---|--|--|--|--|
| 17 | Institution similar experience                                    |  |  |  |  |
| 18 | Institution administration team repetition                        |  |  |  |  |
| 19 | Woman involvement in project identifying                          |  |  |  |  |
| 20 | Woman involvement in maintaining project                          |  |  |  |  |
| 21 | Project will use exported materials                               |  |  |  |  |
| 22 | Project contributes in capacity building of local human resources |  |  |  |  |
| 23 | Project contributes in NDG for self sufficiency                   |  |  |  |  |
| 24 | Project strengthen the relations between local stakeholders       |  |  |  |  |
| 25 | Institution enhancement   |  |  |  |  |
| 26 | Others (clarify please)   |  |  |  |  |

**Section 3: Project Location selection Criteria**

3.1 Please put the weight of the criteria for each project in order to have the most suitable places of the proposed projects; please add new criteria based on the type of the project itself.

| S/N | Criteria                                 | Project 1 | Project 2 | Project 3 | Project 4 |
|-----|--|-----------|-----------|-----------|-----------|
| 1   | City area                                |           |           |           |           |
| 2   | High Population density                  |           |           |           |           |
| 3   | Children density                         |           |           |           |           |
| 4   | Location type eg. Camps                  |           |           |           |           |
| 5   | Nearby Main Streets                      |           |           |           |           |
| 6   | Having high location / Close to seashore |           |           |           |           |
| 7   | Away from crowded zones                  |           |           |           |           |
|     | Mixed land-use (please specify)          |           |           |           |           |
| 8   | Add Criteria .....                       |           |           |           |           |
| 9   | Add Criteria .....                       |           |           |           |           |
| 10  | Add Criteria .....                       |           |           |           |           |
| 11  | Add Criteria .....                       |           |           |           |           |
| 12  | Add Criteria .....                       |           |           |           |           |
| 13  | Add Criteria .....                       |           |           |           |           |
| 14  | Add Criteria .....                       |           |           |           |           |
| 15  | Add Criteria .....                       |           |           |           |           |

3.2 Do you prefer using a computerized model to prioritize projects?

Annex – II : Questionnaire; Approved English version.

strongly agree  agree  don't know  don't agree  Strongly don't agree

3.3 Do you prefer establishment of computerized model to coordinate efforts towards economy empowerment?

strongly agree  agree  don't know  don't agree  Strongly don't agree

**Thank you**

### **Annex – III : List of sampled organizations:**

- 1- Abu Shamalah for contractors.
- 2- Al Madaen for Engineering and Development
- 3- Al Noor for Investment
- 4- ANERA
- 5- Beqdar
- 6- Caritas
- 7- Catholic Relief Services
- 8- Centre of Engineering and Planning (CEP)
- 9- CHF
- 10- Coastal municipalities' utilities in different sections
- 11- Consultant office
- 12- Consultants in Engineering and Administration company
- 13- Emad Al Ashqar for Consultancy Company
- 14- Family Development Association
- 15- Future Generations Association
- 16- Gaza Municipality in different sections
- 17- Infra for consultant
- 18- International Medical Relief
- 19- International Red Cross Committee.
- 20- IOCC
- 21- Islamic Relief in different sections
- 22- Ma'alem for Consultancy
- 23- Masood And Ali Contractor
- 24- Mercy Corp
- 25- Ministry of Education Ministry of Planning in different sections
- 26- Ministry of Health in different sections
- 27- Ministry of Housing in different sections
- 28- Ministry of local Governance in different sections
- 29- Ministry of Transportation in different sections
- 30- Municipal Development and Lending Fund (MDLF)
- 31- NRC
- 32- OCHA
- 33- OXFAM
- 34- Palestinian Commission for Development
- 35- Palestinian Red Crescent Society
- 36- Save the Children
- 37- Save Youth Future Association
- 38- The Palestinian Economical Council for Development and Rehabilitation
- 39- UNDP in different sections
- 40- UNISEF in different sections
- 41- UNRWA in different sections
- 42- Water Authority in different sections
- 43- WFP in different sections

Annex – III : List of sampled organizations: