The Islamic University

Faculty of Engineering

Deanery of Graduate Studies

Engineering Projects Management

Improving the classification system of consulting firms in Gaza Strip

تحسين نظام تصنيف المكاتب والشركات الهندسية في قطاع غزة

Researcher:

Safaa Abu EL-Aish

Submitted to:

Dr. Mamoun Al-Qedra Dr. Mohammed Arafa

Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Construction Management

The Islamic University of Gaza-Palestine

2016

إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Improving the classification system of consulting firms in Gaza Strip

تحسين نظام تصنيف المكاتب والشركات الهندسية في قطاع غزة

أقر بأن ما اشتملت عليه هذه الرسالة إنما هو نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وإن هذه الرسالة ككل أو أي جزء منها لم يقدم من قبل لنيل درجة أو لقب علمي أو بحثي لدى أي مؤسسة تعليمية أو بحثية أخرى.

DECLARATION

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification

Student's name:	اسم الطالب/ة: صفاء نافز أبو العيش
Signature:	التوقيع: Safaa
Date:	التاريخ: 23 / 3 / 2016

بسم الله الرحمن الرحيم

الجامعة الإسلامية – غزة
The Islamic University - Gaza

مكتب نائب الرئيس للبحث العلمي والدراسات العليا هاتف داخلي 1150

الرقم Ref ج.ن.غ/35/.....

التاريخ Date 2016/03/07

نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحثة/ **صفاء نافز عقيل أبو العيش** لنيل درجة الماجستير في **كلية *الهندسة*** **قسم الهندسة المدنية- إدارة المشروعات الهندسية** وموضوعها:

تحسين وتطوير تصنيف المكاتب والشركات الهندسية في قطاع غزة

Improving the classification system of consulting firms in the Gaza Strip

وبعد المناقشة التي تمت اليوم الاثنين 27 جمادى الأولى 1437هـ، الموافق 2016/03/07م الساعة الواحدة والنصف ظهراً، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

د. مأمون عبد الحميد القدرة	مشرفاً و رئيساً	.....
د محمد حسني عرفة	مشرفاً	.....
د. خالد عبد الرؤوف الحلاق	مناقشاً داخلياً	.....
د. نادين نبيل أبو شعبان	مناقشاً خارجياً	.....

وبعد المداولة أوصت اللجنة بمنح الباحثة درجة الماجستير في **كلية *الهندسة*/ قسم الهندسة المدنية- إدارة المشروعات الهندسية.**

واللجنة إذ تمنحها هذه الدرجة فإنها توصيها بتقوى الله ولزوم طاعته وأن تسخر علمها في خدمة دينها ثم وطنها.

والله ولي التوفيق،،،

نائب الرئيس لشئون البحث العلمي والدراسات العليا

أ.د. عبدالرؤوف علي المناعمة

P.O. Box 108, Rimal, Gaza, Palestine fax: +970 (8) 286 0800 فاكس Tel: +970 (8) 286 0700 هاتف ص.ب. 108 الرمال، غزة، فلسطين
public@iugaza.edu.ps www.iugaza.edu.ps

DEDICATION

I would like to dedicate this
work to my husband, kids; Ahmed and Aya and to my
family for their endless and
generous support.

Safaa Abu EL-Aish

ACKNOWLEDGMENTS

- I would like to express my deepest gratitude to my direct supervisors Dr. Mamoun Alqedra and Dr. Mohammad Arafa for their professional guidance, useful advice, continuous encouragement, and motivated support that enabled me accomplishing this thesis.
- Sincere thanks to the staff of Civil Engineering department for their keen academic supervision and assistance during my study at The Islamic University-Gaza.
- My best wishes to the experts Dr. Jawad El Agah, Eng. Yahia El khatab and Eng. Ali El Nakala.
- Kind gratitude and sincere acknowledgment to Association of Offices And Engineering Firms in Engineering Syndicate for assistance and provided valuable information for this study.

Abstract

Classification of engineering firms is not a routine or an automatic approval, nor is it simply an additional bureaucracy and paperwork. it's an important step to create a professional record and statistical which documenting professionalism and expertise level of the engineering offices and consulting firms.

Classification is an essential process in developing the construction industry in any country. In the classification process, the clients would save the time and efforts by selecting competent firms to implement their projects upon their requirements.

Most of the construction implementing agencies in Gaza Strip depend on the classification system issued by the Association of Engineering Offices And Engineering Consulting Firms (AEOF). Some agencies adopt specific levels of classification, other has a short list classification of firms.

This study aims at investigating the current classification system issued by (AEOF) in Gaza Strip. The investigation process comprises studying the current classification system: classification criteria, classification levels and technical specializations. The Analytical Hierarchy Process (AHP) was used to propose a modified classification system based on assign weights to the main influencing criteria of the classification.

This research has been conducted through literature review of the topics related to classification process, followed by a field survey. The field survey consisted of conductive a questionnaire study to collect data by conducting meetings and interviews with of the (AEOF) and other relevant organizations in Gaza Strip. Modification of the questionnaire was fasted through pilot study, where expert engineer were interviewed. The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the required objectives of the study. One hundred and sixty eight questionnaires were distributed and seventy two questionnaires were received.

The results indicated that the (AEOF) classification is significant for most of the implementing agencies in Gaza Strip. The results indicated the importance of involvement of outside members such as an independent member from the syndicate or an observer member from governmental agencies in association's board of directors. Based on AHP, it was found that the total previous implemented projects of the office with weight 45% is the most important criterion with respect to its weight. Moreover, the experience of the offices' staff obtained a reasonable weight of 35%. On the other hand fixed term staff in office/company has a satisfactory weight equals 15%. Finally, resource and logistic of the office obtained a reasonable weight of 5%. The study also showed that AHP approach is an effective and flexible tool to determine the weights of classification criteria as well as the selection of the suitable firm.

الملخص

ان تصنيف المكاتب الهندسية ليست موافقة روتينية. كما أنها ليست مجرد بيروقراطية إضافية أو أعمال ورقية. بل هي خطوة هامة في عملية الاختيار لضمان المقترحات ذات جودة عالية لتقييم الاقتراح المرجو في أقصر وقت لمختلف المانحين / مالكين للاختيار النهائي للشركات المناسبة.

يعتبر التصنيف عملية أساسية في تطوير صناعة البناء والتشييد في قطاع غزة. كما أن عملية التصنيف ليست شيئاًغير مرغوب فيه، بل هي شرطاً أساسياً لأولئك الذين هم في موقع مسؤولية العمل.

تعتمد معظم الجهات المنفذة في قطاع غزة على تصنيف هيئة المكاتب الهندسية والشركات الاستشارية .بعض الجهات تعتمد مستويات محددة من التصنيف اخذة في عين الاعتبار تصنيف هيئة المكاتب الهندسية والشركات الاستشارية و هناك جهات أخرى لديها قائمة قصيرة من الشركات. مع ذلك فإن كل هذه الإجراءات المعتمدة لم تمنع الفشل المستمر للشركات في تنفيذ المشاريع وتحقيق أهداف المالكين.

تهدف هذه الدراسة على نظام التصنيف الحالي لهيئة المكاتب الهندسية والشركات الاستشارية في قطاع غزة، وتشمل دراسة النظام الحالي: ومعايير التصنيف، ومستويات التصنيف، والتخصصات الهندسية، وتم استخدام اسلوب التحليل الهرمي لتحديد أوزان المعايير المهمة في عملية التصنيف.

أجريت هذه الدراسة من خلال استعراض الأدبيات من المواضيع المتعلقة بعملية التصنيف ثم أتبعت بمسح ميداني، والتي تمثلت في مقابلات مع هيئة المكاتب والشركات الهندسية وخبراء لهم علاقة بالمجال، بهدف جمع المعلومات اللازمة لتصميم الاستبيان. تم تحكيم الاستبيان بالعرض العشوائي على خبراء لتعديله، وذلك لتحقيق الأهداف المنشودة من الدراسة. وُزع الاستبيان على المكاتب الهندسية والشركات الاستشارية .تم استخدام الاستبانة لجمع البيانات المطلوبة من أجل تحقيق هدف البحث حيث تم توزيع مائة وثمانية وستون استبانة، وتم استرداد اثنان وسبعون استبانة.

أشارت النتائج إلى أن تصنيف هيئة المكاتب الهندسية والشركات الاستشارية مهم بالنسبة لمعظم الجهات العاملة في قطاع الإنشاءات في قطاع غزة، لكن النتائج أشارت إلى أهمية مشاركة أعضاء خارجيين في مجلس ادارة الهيئة مثل عضو مستقل من النقابة أو عضو مراقب من الجهات الحكومية، بالإضافة إلى ذلك، أظهرت النتائج أن اعتماد معايير لعملية تصنيف الشركات ذات أهمية عالية. بناء على عملية التحليل الهرمي وجد أن المشاريع المنفذة من قبل الطاقم (45٪) هو المعيار الأهم فيما يتعلق بوزنه .علاوة على ذلك فإن خبرة طاقم المكتب (35٪) .من ناحية الطاقم الثابت حصل على نسبة مرضية (15٪)، و أخيراً موارد ولوجستيات المكتب كانت أوزانها منخفضة نسبيا (5٪) .الدراسة أظهرت أيضا أن عملية التحليل الهرمي هي أداة فعالة ومرنة لقياس أوزان معايير التصنيف و كذلك اختيار المكتب/ الشركة المناسب.

ABREVIATIONS

AEOF	The Association Of Offices And Engineering Firms.
IESL	The Institution of Engineers Sri Lanka.
ACEI	The Association of Consulting Engineers of Ireland.
PEC	Palestinian Contractors Union.
SOM	Self-organizing maps.
AHP	Analytical Hierarchy Process.
UAE	United Arab Emirates.
ISO	The International Organization for Standardization.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

Introduction

1.1. Background:

The construction industry is complex in its nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals, (Gyadu, 2009). The local construction industry is one of the main economic engine sectors, supporting the national economy for any country.

In addition, the construction industry is a dynamic entity due to the level of uncertainties involved in technologies, budgets and development processes (Chan and Chan, 2004). According to Gyadu (2009), several developing countries at various levels of socio-economic development have recognized the need and importance of taking measures to improve the performance of their construction industry. One of the means to this end has been to ensure efficiency in role of consultants' performance in project execution.

Engineering offices and consulting firms in Gaza Strip work on projects that worth millions of US dollars annually in the fields of design and supervision. The quality of the services provided in this field has a major impact on the national economy through various aspects of these services, such as the lifetime of the projects, environmental effects, efficiency, the aesthetics of cities, and the social impacts of the projects. The development and growth of engineering consulting firms in Gaza Strip needs to keep pace with the growing need for the services provided by these firms, given the growing need for engineering projects to be completed in Gaza Strip and several massive development booms in recent years. The number of consultancy firms in Gaza Strip was very limited, with five firms, but on the eve of the establishment of the Palestinian Authority in 1994, the number of consultancy firms has grown tremendously and has risen to 40 firms/offices. In 2015 the number of engineering firms has risen to 168 firms/offices (Association of Engineers, 2015).

In general, every kind of company requires at least some kind of business license from the county, city or state in which it does business. First-time business owners often make the mistake of hanging out their shingle without securing the appropriate permits.

Classification of engineering offices and consulting firms is defined the certificate given to the engineering offices and consulting firms by the department that enables them to practice certain activities in any field in the category that it deserves according to its technical, managerial and financial abilities and experiences and in accordance with regulation provisions and instructions, (Municipal System of Abu Dhabi, 2015).

Classification is not a routine or automatic approval. Nor is it simply additional bureaucracy and paperwork. It entails a substantive review by a panel of experts of a

company's capabilities and qualifications. A company that does not meet the specified criteria will not be classified, (Raufaste and Callahan, 2002).

The current classification system in Gaza Strip will be studied. The research aims to improve the classification effectiveness in representing all requirements of the local and international agencies.

1.2. Statement of the problem:

The classification system of engineering consulting firms in Gaza Strip is issued by the Association of Engineering Offices And Consulting Firms (AEOF) which was established in 1994.

By studying the available literature, it is believed that there is a lack of studies which deal with the classification system of engineering consulting firms in Gaza Strip.

The Association of Engineering Offices And Consulting Firms (AEOF) in Gaza Strip is established under the legal framework of Engineers Syndicate doesn't have legal powers to implement its decision regarding the local and international institution, (Association of Engineers, 2015).

In many countries, the Ministry of Public Works And Housing or municipalities issue the classification system for engineering firms, (Gregory and Silvia, 2014).

The management board of offices and engineering firms in Gaza Strip consists of the owners of the engineering consulting firms, this would lead to some types of conflict of interests.

Several concerns that face the international funding agencies during the implementation of their projects in Gaza Strip, push them to establish their own pre-qualification system of engineering consulting firms for their projects and they do not consider the classification of the Association of Engineering Offices And Consulting Firms (AEOF) into a consideration, (World Bank, 2002)

1.3. Research aim and objectives:

The aim of the research is to study, evaluate and improve the current classification system issued by (AEOF) in Gaza Strip. The investigation process comprises studying the current classification system and its articles: classification criteria, classification levels and technical specializations. This aim will be achieved through the following objectives:

1. To investigate the current classification system issued by (AEOF) in Gaza Strip.

2. To study the available classification systems in international and regional institutions and compare it with the current local classification system in Gaza Strip.
3. Identify the strengths, weaknesses, concerns and difficulties and suggest points of improvement to the current classification system issued by (AEOF) in Gaza Strip.
4. Propose a modified classification system based on assign weights to the main influencing criteria of the classification by using AHP.

1.4. Research Methodology:

To achieve the objectives, the following phases will be executed:

The first phase includes a summary of comprehensive literature review. Literatures on several regional and international classification systems. Then, all data available on the current classification system issued by (AEOF) in Gaza Strip was collected.

The second phase of the research focused on conducting meetings and interviews with of the Association of Engineering Offices And Consulting Firms (AEOF) and other relevant organizations.

The third phase of the research focused on distributing the questionnaire to engineering offices and consulting firms. Modification was fasted through pilot interviews to experts (engineers, classification institution and other relevant organizations). The questionnaire was used to collect the required data in order to achieve the research objective. One hundred and sixty eight questionnaires were distributed and seventy three questionnaires were received.

The fourth phase the data was analyzed and discussed. Statistical Package for the Social Sciences, (SPSS) was applied to perform the required analysis.

The fifth phase the Analytical Hierarchy Process (AHP) was used to propose a modified classification system based on assign weights to the main influencing criteria of the classification. The final phase included the conclusions and recommendations.

1.5. Research structure:

The thesis consists of six chapters as follows:

Chapter 1: Introduction

This chapter has a general introduction to the subject of the thesis. It describes the rational of the research, research objectives, and the outline of the research methodology. The research scope and the outline contents are also stated in chapter1.

Chapter 2: literature review

This chapter provides background introduction of classification system and AHP, also some recent studies on classification topic and applications of AHP.

Chapter 3: Classification system in Gaza Strip

The available classification systems in international and regional institutions and compare it with the current local classification system issued by (AEOF) in Gaza Strip stated in Chapter3.

Chapter 4: Methodology

This chapter defines the process of the methodology that will be applied through the questionnaire.

Chapter 5: Results and Discussion

This chapter presents the results of the research and discusses it in details.

Chapter 6: Conclusion and Recommendations

This chapter states the conclusions and recommendations.

References and appendices.

CHAPTER 2

Literature review

2.1. Introduction:

The construction industry is the tool through which a society achieves its goals of urban and rural development. Construction work includes construction, restoration and destruction of buildings on, above or below ground. It also includes installation, repair, maintenance and dismantling of all services and prefabricated customized components. It also contains all the essential preparatory work such as site clearance, foundations, scaffolding and cranes and all the finishing works (painting, decorating, cleaning, etc.). It also includes constructions of roads, runways, railways, canals, pipelines, electricity, water and telecommunications pipe work and drainage works (Abu Rass, 2006).

Construction is a large, complex and a very vital sector of economy in developing countries (Behm, 2008). It encounters very complex practices, which includes: owners, consultants, general contractors, specialist contractors, suppliers and designers, (Larcher and Sohail, as cited in Enshassi, 2008).

Also mentions that the construction industry is a dynamic entity due to the level of uncertainties involved in technologies, budgets and development processes (Chan and Chan, 2004). According to Asiedu (2009), several developing countries at various levels of socio-economic development have recognized the need and importance of taking measures to improve the improve the License systems of their construction firms.

2.2. An engineering firms:

Engineers are people who solve problems and focus on making things work more efficiently and effectively. Engineers apply the theories and principles of science and mathematics to research and develop economical solutions to technical problems. Their work is the link between perceived social needs and commercial applications, (Dadzie et al., 2012).

An engineering firm is a business made up of professional engineers and consultants. These firms often specialize in construction, transportation, and environmental services. They offer consulting and technical services to contractors, architects, and municipalities. Some engineers may also specialize in other disciplines, including aerospace, industry, military, and genetics. In general, these specialty engineers work for private companies or government organizations, and not for engineering firms, (Behm, 2008).

Engineering firms are hired by architects, construction companies, and private clients to design or modify buildings, roads, and parcels of land. Civil and environmental engineers may design roads or develop site plans which satisfy the needs of developers while protecting the environment and the public. Mechanical and electrical engineers create technical system designs for residences, commercial buildings, and

sometimes entire cities. Structural engineers consider material weights, loads, and external forces to design safe and efficient structures, (Engineering Council UK, 2015).

According to The Institution of Engineers Sri Lanka (IESL) an engineering firm may offer services from a variety of engineering disciplines, or may focus on a single one. Larger firms may include civil, mechanical, electrical, and structural engineers who collaborate on single projects for a client. This provides a "one-stop shop" approach that helps to minimize communication errors and is also quiet convenient for the client. Smaller firms often specialize in a specific discipline, such as civil work. In these cases, there is an enormous amount of communication and collaboration required between the various engineering firms on the project.

The Association of Consulting Engineers of Ireland, (2015) mentioned that individuals and firms engaged in consulting engineering primarily offer independent technology-based intellectual services to clients for a fee, in the built, human and natural environment. Consulting engineers liaise with clients to plan and design construction projects, and supervise with the building of them.

Behm (2008) said that many consulting engineering firms consist of multi-disciplinary teams of qualified engineers and other building-related professionals and provide comprehensive services. Others specialize in a specific area of engineering, such as geotechnical, environmental, traffic or structural.

Engineering firms shoulder the responsibility for not only their work, but also for the lives affected by that work and must hold themselves to high ethical standards of practice. Licensure for a consulting engineering firm or a private practitioner is not something that is merely desirable; it is a legal requirement for those who are in responsible charge of work, be they principals or employees, (Chow and Ng, 2010).

2.3. Licensure for engineering firms:

A century ago, anyone could work as an engineer without proof of competency. In order to protect the public health, safety, and welfare, the first engineering licensure law was enacted in 1907 in Wyoming. Now every state regulates the practice of engineering to ensure public safety by granting only professional engineering firms the authority to sign and seal engineering plans and offer their services to the public. Practicing engineering without this permit is a violation of state law, (www.nspe.org).

Licensure for engineering firms in government has become increasingly significant. In many federal, state, and municipal agencies, certain governmental engineering positions, particularly those considered higher level and responsible positions, must be filled by licensed professional engineers, (Douglas et al., 2015) .

Engineering firms must continuously demonstrate their competency and maintain and improve their skills by fulfilling continuing specialty requirements depending on the state in which they are licensed.

Douglas et al (2015) mentioned that Regulation and licensure in engineering is established by various jurisdictions of the world to encourage public welfare, safety, well-being and other interests of the general public, and to define the licensure process through which an engineer becomes authorized to practice engineering and/or provide engineering professional services to the public.

As with many other professions, the professional status and the actual practice of professional engineering is legally defined and protected by law. In some jurisdictions, only licensed engineers (sometimes called registered engineers) are permitted to "practice engineering," which requires careful definition in order to resolve potential overlap or ambiguity with respect to certain other professions which may or may not be themselves regulated (e.g. "scientists," or "architects"). Relatedly, jurisdictions that license according to particular engineering discipline need to define those boundaries carefully as well so that practitioners understand what they are permitted to do, (American Society of Civil Engineers, 2001).

According to Mandatory Classification Requirements for Engineers and Contractors in Abu Dhabi all companies conducting activities involving engineering or contracting should immediately investigate whether the licensed activities currently on the company's trade license require classification. The same applies to persons planning to set up new companies doing business in these sectors.

Unless the concerned authorities have a change of heart and grant further extensions to implementing the requirements, classification cannot be avoided except where a company is willing to remove all activities requiring classification from its license, which in turn will limit the scope of the company's permitted business activities, (Jadid, 2013).

Some companies have found that the classification requirements are too difficult or too expensive to meet and made a business decision to remove all such activities form the license, even if it meant giving up on certain lines of business, (Gregory and Silvia ,2014).

2.4. Important of consultants classification:

The client should select an appropriately skilled and experienced consultant to undertake the work. Many clients have a long established and satisfactory relationship with their consultants and have no need to look for alternatives. In some cases, word-of-mouth recommendations may be satisfactory. Some clients have well proven procedures but may want (or for a particular project need) to take a fresh approach.

(ACENZ, 2004) presented a number of methods for selecting the most suitable consultant for the project when the client wishes to adopt a formal selection process. Competent advice in the early stages of a project, coupled with innovative design and project management, can make much larger savings in the overall cost of the project than the cost of the advice. Typically, the cost of consultancy services for larger projects is less than 10% of the capital cost of a construction project and about 1% to 2% of the project's lifetime cost. For smaller projects, these percentages are often higher. More importantly, most of the decisions which will determine a project's life cycle costs, savings and success are made at the conceptual and design stages. It is therefore important to select the consultant who will contribute most to the overall success of the project.

Classification of consulting firms has following inherent benefits not only for the client formations but also for the consulting profession and the consultants themselves (PEC, 2009):

- Encourages consultants to prepare high quality proposals.
- Increases the possibility of selecting most suitable consultants.
- Facilitates a closer and meaningful evaluation of Technical Proposals.
- Reduces time for evaluation of proposals.
- Reduces the chances for extraneous influences.
- Reduces the cost of business development of consulting houses which is part of consultant's overhead costs and ultimately chargeable to the clients.

2.5. Previous studies for consulting firms classification:

Jadid (2013), represented that Saudi Arabia consultancy firms need to increase their levels of performance to compete seriously in the market and they need to comply with the latest qualification requirements specified by the Saudi Council of Engineers, as well as following the rules and standards set by the Ministry of Commerce and Industry. This paper is based on a study of engineering consultancy firms in the Saudi Arabia, which includes more than 1440 firms distributed throughout the country. This study focused on applying a scientific approach to the classification of engineering consultancy firms using self-organizing maps (SOMs). A survey was conducted using several consultancy firms and a database was constructed. A template was created using Microsoft Word to summarize the information collected, which included the prequalification data for firms and the levels of projects they handled. The summaries were converted into Excel format and used to feed an artificial neural network program. Using this program, the required information was extracted with a type of Kohonen network known as an SOM.

Al Wahaidi, (2012) stated that most of the implementing agencies in Gaza Strip depend on the Palestinian Contractors Union (PCU) classification and consider it as a prequalification process. This study aims at investigating the existing prequalification

practices in Gaza Strip, setting prequalification criteria, applying the Analytical Hierarchy Process (AHP) to determine its weights, conducting case study by AHP. This research has been conducted through literature review of the topics related to prequalification process, followed by a field survey. The field survey consisted of two questionnaires. In the first questionnaire, eighty managers, experts, and engineers were asked to fill in the questionnaire that covers topics related to the prequalification of the contractors in Gaza Strip. In the second questionnaire, a group of experts was asked to fill in the questionnaire that based on AHP to determine the weights of the prequalification criteria and sub criteria.

AL-Shobaky (2008) recognized the local selection methods for consultant selection problems in Gaza Strip, according to decision makers working with the clients. To achieve the first study goal a questionnaire no. (1) was designed, so that the researcher was able to determine the main and sub criteria needed to solve consultant selection problems in Gaza Strip. To achieve other study goals a questionnaire no. (2), based on the analytic hierarchy process (AHP), was designed and distributed to a specialized committee of decision makers working with the clients, to obtain the weights of the important criteria that have been identified from the results of the analysis of questionnaire No. (1), and the relative importance for these criteria. Another conclusion of this study is that there are three main criteria in the selection process of consulting offices, namely: the general experience of the office, the consultant staff, and the methodology followed by the consultant office and how it is suitable to the terms of reference established by the clients. This study also demonstrates that there are 6 sub criteria for each main criterion. This study also identified the weight and relative importance for all main and sub criteria, and access to the general model for selection.

Dadzie J. et al. (2012), focused on project failures that occur in the whole spectrum of the project life cycle. It erupts from conception, formation, planning and control until implementation. Meanwhile there are supervising consultants who are engaged and paid to be responsible for thet of such important projects. Their role however, is to complement the effort of contractors to ensure a successful completion of such projects but to the contrary. Consequently, a report produced by Construction Industry Development Board in (2007), suggests that project failures are not solely caused by contractors. Architects and engineers (consultants) also contribute to the failure of overall project performance, with 50 percent of failures attributed to design faults, 40 percent being caused by construction faults and 10 percent from material faults. All these failures could be attributed to certain factors that hinder the consultant's performance. Moreover, this paper seeks to identify the significant factors that affect the performance of consultants on development projects.

In Saudi Arabia, the selection methods used by the public sector are the competitive bidding, direct selection, design competition method, and nomination with a percentage frequency of 66%, 48%, 39% and 30% respectively. Researchers

summarized consulting selection criteria into eight criteria as shown in Table (2-1) to be used in developing a practical and flexible consultant conceptual selection model (CCSM) in view of analytic hierarchy process (AHP), (Al-Mussallami,2000).

Table (2-1): Combined consulting selection criteria, (Al-Mussallami,2000).

No.	Criteria Description	Weight of Criteria %
1	Work Experience	20.2
2	Project Management, Capability	19.6
3	Staff and Qualification	11
4	Quality Performance	10.7
5	Past Performance	10.3
6	Quality Control	9.8
7	References	9.5
8	Firm Capacity	8.9

2.6. Consulting firms classification around the world:

2.6.1. United Arab Emirates:

According to the Ministry of Municipality and Urban Planning in the United Arab Emirates Mandatory (2014), the requirements are onerous and will vary from case to case. For example, a local engineering consultancy seeking classification in the Special Category (which is the highest category for engineers and permits a company to perform contracts with a value of over 70 million dirhams) must meet, among others, the following criteria:

- The value of the capital and assets owned by the company should not be less than AED 4 million.
- The company is required to employ five specialized and registered engineers with at least one engineer having a minimum experience of 15 years, two engineers having a minimum experience of 12 years and the other two engineers having a minimum experience of 10 years each. This applies to each Special Category of engineering type the company requires to undertake, i.e., for civil engineering, it will be required to employ five civil engineers meeting the foregoing minimum experience; for mechanical engineering, it will be required to employ five mechanical engineers meeting the foregoing minimum experience; and so forth.
- The cumulative value of the previously executed projects must not be less than AED 480 million, provided that the value of each project submitted is not less than AED 60 million.
- The company must hold an ISO 9001 certificate.

2.6.2. The State of Qatar:

Classification of consulting firms in the State of Qatar is done by the Ministry of Municipality & Urban Planning ,Engineers & Consulting Offices, Accrediting Committee, according to the Low (19), Year 2005, For Regularizing the Practice of Engineering Professions In the State of Qatar, Table (2-2) show notes classification for the International offices (as an example).

Table (2-2) Notes of classification for the international offices, (according to the Low (19), 2005).

Insurance value	**(2 Million Qatari Riyals)** **The Policy should be issued at State of Qatar and valid for three years**
Office space	Office space not less than 200 m2
Business volume allowed	Project's value: Non-specific
	Construction's area: Non-specific
Fees	**Registration:** 25,000 QR. & 4000 QR. per each specialization
	Renewal (after two years): 20,000 QR.
Technical Staff	**Specialization:** All specialization
	Number of Engineers: • (1) In charge Engineer: Specialization in one of the branches of engineering is required under the Office • (3) engineers permanent in Office in Qatar.
	Years of Experience: • 10 years (First Category) 5 of them in the main office or any of the branches for non- Qatari. • 10 years for non- Qatari engineers.

International engineering offices or consulting firms:

- The firms should have been practicing the profession in the main office for ten years without a break.
- It should have four branches other than its native branch.
- Required completion of ten projects in five countries other than home country and availed at least (100) million riyals.
- If the office is owned by natural or legal partners, the share of the Qatari partners is not less than 51% and the non-Qatari partners should be registered at the engineers register.
- The office should be appropriate and Committee should be informed of its address and any change in the address within 30 days from the date of change.

- The registration certificate and any changes thereon should be hung at a visible place in the office.
- The owners of the consultancy offices, its partners and employees are not allowed to work at the State's departments, public corporations or contracting companies or to deal with the building materials.
- No assignment from the office license is allowed unless the approval from the Committee is obtained.
- Not work in any specialization or category for which the license is not granted.

2.6.3 Pakistan:

The Pakistan Engineering Council is a statutory body, constituted under the PEC Act 1976 amended up to 2011, to regulate the engineering profession in the country such that it shall function as key driving force for achieving rapid and sustainable growth in all national, economic and social fields. The council shall as its mission set and maintain realistic and internationally relevant standards of professional competence and ethics for engineers, and license engineers, and engineering institutions to competently and professionally promote and uphold the standards. Its main statutory functions include registration of engineers, consulting engineers, constructors/operators and accreditation of engineering programmes run by universities/institutions, ensuring and managing of continuing professional development, assisting the Federal Government as think tank, establishing standards for engineering products and services besides safeguarding the interest of its members. The Pakistan Engineering Council presented the registration procedure for consulting engineers as below:

1. For initial registration in accordance with these Bye-laws and subsequent annual renewals, the consulting engineers shall submit application to the Council on the form. The Council after scrutinizing the application and obtaining any further information or clarification from the consulting engineer as it may deem necessary, may register or renew the registration of the consulting engineer for the following year or refuse registration or renewal if the information supplied by the consulting engineer in the opinion of the Council does not meet the requirements of these Bye-laws.
2. A consulting engineer shall inform the Council of any events taking place following his registration or renewal therefore, which render him ineligible for continuation of registration in accordance with these Bye-Laws. On receipt of such information.
3. Any infringement of these Bye-laws by a consulting engineer shall render him liable to punitive action by the Council as it may deem fit.
4. Submission of information to the Council by a consulting engineer which is found to be false or intentionally misrepresented shall be considered as misconduct and such consulting engineer shall be liable to be punished in accordance with the provision of the Act.

5. Any person who practices the profession of consulting engineering in Pakistan without valid registration by the Council and any person who abets or helps such unauthorized practice or any person or organization who infringes or helps in the infringement of these Bye-laws shall be liable to be punished in accordance with the provision of the Act, (www.pec.org).

2.7. Models of consulting firms classification:

Classification of consulting firms is not an easy task, since the process includes comparing units with multiple criteria and qualitative information. The current practice of classification of consulting firms is characterized by the reliance on expert judgment and experiential knowledge. Previous studies identified that the information concerning consultant's features consists of both quantitative and qualitative types, while the assessment methods used for assessing qualitative information require a predictive judgment of the experts.

Ncube and Dean (2002) pointed that the basic principles of good decision-making are, first, a clear understanding of the decision itself and second the availability of appropriately focused information to support the decision. Decision-making techniques assist with both these problems. However, the techniques should be considered as aids to decision-making and not the replacements for it. Numerous decision-making techniques have been suggested as effective methods of ranking software products for selection for use as components in large-scale systems.

Models can be grouped based on the approach used: multi-criteria decision-support, linear, knowledge-based, multi-attribute and utility theory, artificial neural networks, fuzzy set theory, and various other methods (Fayek and Marsh, 2006). However, El-Sawalhi et al. (2007a) summarized all the used models in the prequalification process based on wide study of the previous research in this regard as follows:

- **Dimensional Weighting Aggregation (DWA):**

In this model, each criterion and its weight of significance are determined based on the decision-maker's requirements. The consultants are rated on a scale of 1-10 (1 – "Unsatisfactory", 10 – Excellent"), subjectively, with respect to these criteria based on the total score, which is calculated as a weighted sum of ratings over all the criteria

using the percentages determined by the owners. All the aggregate scores are then ranked. This method is considered compensatory since a high score in one criterion can compensate a low score in another criterion. To make a decision, this strategy applies a decision rule if the candidate score is less than or equal to a certain minimum score, then the decision is "no" and hence and so on.

- **Fuzzy Set Prequalification:**

Fuzzy set theory matches human thinking in its use of approximate information and uncertainty to make decisions. A fuzzy set can be mathematically defined as a collection in which each element is attributed a value representing their grade of membership in the fuzzy set. Since knowledge can be expressed in a more natural by using fuzzy sets, many engineering and decision issues can be greatly simplified. Fuzzy set theory carries out classes or groupings of data with boundaries that are not sharply defined. The advantage of this model is underlying in its ability to deal with qualitative and quantitative data. On the other hand, there are difficulties related to the formulation of the membership functions for classification criteria and the number of parameters and the complexity of the framework. In addition, the user should have extensive mathematical background to comprehend and run the analysis.

- **Analytical Hierarchy Process (AHP):**

The characteristic feature of AHP technique from the other multi criteria decision making techniques is that it does not necessitate a tangible numerical scale of ratio and can thus be used to the measurement of intangible criteria. The fundamental synthesis technique is additive. It also has a consistency test for encouraging enforcement of judgment transitivity. Moreover, AHP has been well researched and has been applied in hundreds of areas.

- **Multi-Attribute Utility:**

In this model, all decisions include choosing one, from several, alternatives. Typically, each alternative is assessed for desirability on a number of scored criteria. What relates the criteria scores to desirability is the utility function. The most common formulation of a multi-criteria utility function is the additive model. The model permits different kinds of consultant capabilities to be evaluated and deals with

uncertain data incorporates the risk of the decision maker. On the other hand, it is hard to retrieve the public client's preference via utility function; the decision-making process requires a long time and becomes boring if there are numerous criteria, and demands very good knowledge of probability.

- **Artificial Neural Networks (ANN):**

Artificial neural networks are data-driven self-adaptive approaches in which there are few theoretical assumptions regarding the models for problems under study. It is an extremely parallel processor made up of simple processing units, which has a natural tendency for storing experiential knowledge and making it available for use. The approach used to carry out the learning process is called the learning algorithm. It has a large number of nodes and connections. Each connection points from one node to another and is related with a weight.

- **Self-organizing maps (SOMs):**

Self-organizing maps, also known as Kohonen neural networks, Kohonen (2001) use an unsupervised learning process to modify the internal state of a network to model the features found in a training dataset. This type of network has two layers: an input layer to obtain information from the outside, and an output layer to send information to the outside. When information is provided to an SOM, an output neuron is selected as a winner. This neuron is the output of the network and it corresponds to one of the classified groups. An SOM is a type of neural network that has the ability to learn by detecting regularities and correlations in its inputs to predict future responses. This type of neural network model is to analyze and visualize high-dimensional data while preserving topological relationships. It projects a high-dimensional signal space onto a two-dimensional grid of nodes, so this type of network belongs to the class of competitive learning networks.

2.8. Advantages of Analytic Hierarchy Process (AHP):

Al Wahaidi (2012) stated that AHP has many advantages. Some of them are consistency, measurement, hierarchic structures, interdependence, complexity, unity, process repetition, judgment, consensus, tradeoffs, systematic and synthesis. Since each construction project is unique, final contractor selection through the AHP provides clients with the flexibility to add or reduce the elements of a problem hierarchy regarding an individual project. In addition, the strengths and weakness of each eligible contractor are exposed. The AHP is therefore applicable as a model for contractor selection (Fong and Choi, 2000).

Al-Harbi (2001) pointed that AHP permits group decision-making where group members can use their experience, values, and knowledge to decompose the contractor prequalification problem into a hierarchy and solve it by the AHP steps. El-Sawalhi (2007) briefed the advantages of the AHP model as follows:

- It permits group decision-making.
- It transfers subjective judgment into meaningful weights and ratios on which to base decisions.
- Various judgments by decision makers can be adapted by this technique, which synthesizes that judgment into a representative outcome.
- It Identifies inconsistencies made in the judgments.

Cheng et al. (2004) highlighted that the AHP is based on pairwise comparisons of elements in the same level of the hierarchical structure according to a nine-point ratio scale for obtaining decision-maker's degree of preferences. This nine-point scale is mainly applied to quantify linguistic preference expressions of the decision-maker and furthermore, comparisons performed by AHP can be valid in both weight elicitation and alternative valuation procedures AHP permits the decision-maker to compute the consistency of their judgments, because it uses an analytic procedure to process these

judgments. Another reason for using this method is the existence of convenient and user-friendly Expert Choice software (Topcu, 2004). The AHP method evaluates the weights to be assigned for the priorities of functions; subsequently, a consistency index check is conducted to determine whether the assignment of weights is acceptable (Bahurmoz, 2006).

By reviewing and studying the literature review, spatially the models of consulting firms classification and the advantages of Analytic Hierarchy Process (AHP) that represented in this chapter the researcher found that AHP technique is applicable and adaptable model among other used models in the classification process.

As one of the objectives of the current study is to propose a modified classification system based on assign weights to the main influencing criteria of the classification by using AHP, the following sections will explain the basics and steps of AHP technique.

2.9. Basics of Analytic Hierarchy Process (AHP):

The Analytic Hierarchy Process (AHP) is a multi-criterion decision-making approach (MCDM) developed by Thomas Saaty in 1971 (Saaty, 1996). AHP is a powerful decision-aiding tool that can deal with the intuitive, the rational, and the irrational when making decisions considering the suitability of large number of selection factors and alternatives. AHP is an appropriate MCDM approach for conducting both deductive and inductive evaluation that allows the consideration of several criteria and alternatives at a time, along with the benefit of a feedback mechanism and numerical tradeoffs. It is becoming a more popular and practical tools than the traditional multi-attribute utility theory, because it enables the decision-makers to resolve complex problems by simplifying and expediting the natural decision making processes. The AHP is usually done through the following steps:

Step 1: Breaking down the decision problem into a hierarchy of its elements:

In applying the AHP to a decision problem one structures the problem in a hierarchy with a goal at the top and then criteria (and often sub criteria at several levels, for additional refinement) and alternatives of choice at the bottom. The criteria can be subjective or objective depending on the means of evaluating the contribution of the elements below them in the hierarchy. Moreover, criteria are mutually exclusive and their priority or importance does not depend on the elements below them in the hierarchy (Bahurmoz, 2006).

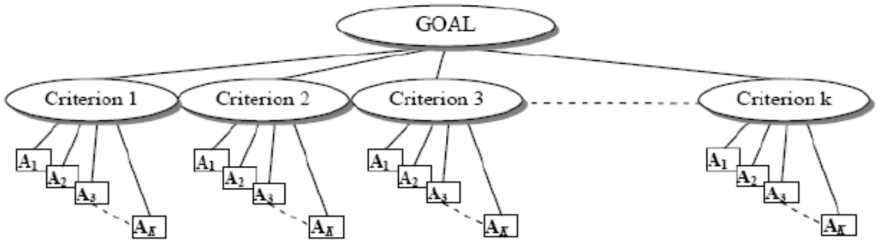


Figure (2-1): Structure of the AHP (Bahurmoz, 2006).

In Figure (2-1), where the structure of AHP elements is illustrated, it is shown that the goal is decided through a number of different criteria. These criteria determine the quality of achieving the goal using any of Alternatives (A_i, i=1... k). The A_i is different options, choices, or alternatives that could be used to reach the final aim of the project. Comparing these alternatives and defining their importance over each other are done using the pairwise comparison method. Giving importance ratios for each pair of alternatives, a matrix of pairwise comparison ratios is obtained.

In short, when constructing hierarchies one must include enough relevant details to represent the problem as thoroughly as possible, but not so much as to include the whole universe in a small decision. One need to consider the environment surrounding the problem, identify the issues or attributes that one feels influence, contribute to the solution, and identify the participants associated with the problem. Arranging the goals, attributes, issues, and stakeholders in a hierarchy serves three purposes:

1. It provides an overall view of the complex relationships inherent in the situation.

2. It captures the spread of influence from the more important and general criteria to the less important ones.

3. It permits the decision maker to assess whether he or she is comparing issues of the same order of magnitude in weight or impact on the solution.

Step 2: Collect input by a pairwise comparison of decision elements:

Elements in each level are compared pairwise with respect to their importance to an element in the next higher level, starting at the top of the hierarchy and working down, a number of square matrices called preference matrices are created in the process of comparing elements at a given level. Judgments of preference are made on pairs of elements in the structure using what Saaty defines as the fundamental scale of AHP, which is reproduced in Table (2-3).

The fundamental scale used in AHP enables the decision maker to incorporate experience and knowledge in an intuitive and natural way. This scale is insensitive to small changes in a decision maker's preference, thereby minimizing the effect of uncertainty in evaluations.

The criteria might also have different importance compared to each other. Therefore, a pairwise comparison matrix is considered for the criteria. Elements of this matrix are pairwise or mutual importance ratios between the criteria that are decided on the basis that how well every criterion serves and how important it is in reaching the final goal. In order to compare homogeneous elements whose comparison falls within one unit, decimals are used. If the elements of the pairwise comparison matrix are shown with c_{ji}, which indicates the importance of i_{th} criterion over j_{th}, then c_{ji} (Boroushaki & Malczewski, 2008).

Table (2-3): The fundamental scale of AHP (Bahurmoz, 2006)

Intensity of importance	Verbal judgment of preference	Explanation
1	Equally preferred	Two activities contribute equally to the objective
2	Equally to moderately	
3	Moderately preferred	Experience and judgment slightly favor one activity over another
4	Moderately to strongly	
5	Strongly preferred	Experience and judgment strongly favor one activity over another
6	Strongly to very strongly	
7	Very strongly preferred	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very strongly to extremely	
9	Extremely preferred	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	A reasonable assumption

AHP can be used to make relative measurements through paired comparisons of criteria and of alternatives as discussed above, or to make rating measurements of the alternatives with respect to the criteria. The ratings mode includes pairwise comparison of the criteria with respect to the goal. Then rating levels, such as excellent, very good, good, average, poor, and very poor, are specified for each criterion. Pairwise comparisons among the rating levels of each criterion are then conducted to yield a set of priorities (weights) for these levels. For each criterion, the rating level priorities are divided by the maximum rating weight of that criterion to yield scaled weights. Within each criterion, each alternative is assigned a rating level and the associated scaled weights. The final score of an alternative is the sum of the product of the criterion weights times the scaled weight with respect to that criterion, where the sum is taken across all the criteria (Saaty, 1996).

Step 3: Calculate the relative weights of the decision elements:

The AHP method employs different techniques to determine the final weights; two of them are explained and used in this thesis. The first is Lambda Max (λ_{max}) technique and the other is geometric mean. Saaty (1980) used the lambda max technique to obtain the weights of the criteria in the pairwise comparison method. Every matrix has a set of eigenvalues, and for every eigenvalue, there is a corresponding eigenvector. In Saaty's lambda max technique, a vector of weights is defined as the normalized eigenvector corresponding to the largest eigenvalue λ_{max}. If the weights are shown as a vector *w* consisted of *w*i (i=1…n), then the following formula shows how they are calculated.

$$C \times w = \lambda \times w \quad \ldots\ldots (1)$$

at which C is the pairwise comparison matrix of the criteria; *w* is the vector of weights and λ is the eigenvalue that in this method should be the maximum of them, i.e. λ_{max}. In this method, special mathematical conditions are required to guarantee that a unique answer is yielded. In addition, difficulties in calculating and finding the eigenvalues and vectors have led to use of an approximation to the lambda max method. As Gray and Little (1985) used in his book an approximation of the eigenvector associated with the maximum eigenvalue is calculated through a simple procedure, which is sometimes referred to as mean of normalized values.

Step 4: Aggregate the relative weight to obtain scores and hence rankings for the decision alternatives:

A matrix "M" is called consistent matrix if and only if $m_{ik}.m_{kj} = m_{ij}$ where the ij'th element is element of this matrix (Buckley 1985). However, in practice it is unrealistic to expect the decision-makers provide pairwise comparison matrices, which are exactly consistent especially in the cases with a large number of alternatives. Expressing the real feelings of the decision makers generally lead to matrices that are not quite consistent. However, some matrices might violate

consistency very slightly by only two or three elements while others may have values that cannot even be called close to consistency.

A measure of how far a matrix is from consistency is performed by Consistency Ratio (C.R.). Han and Tsay (1998) explained that having the value of λ_{max} is required in calculating the consistency ratio. This is obtained by calculating matrix product of the pairwise comparison matrix and the weight vectors and then adding all elements of the resulting vector. After that, a Consistency Index (C.I.) is introduced as:

$$CI = \frac{\lambda \max - n}{n-1} \quad \text{..... (2)}$$

at which n is the number of criteria and λ_{max} is the biggest eignevalue (Han & Tsay 1998; Malczewski 1999).

Random Index (R.I.) is the consistency index of a pairwise comparison matrix, which is generated randomly. Random index depends on the number of elements, which are compared, and as it is shown in Table (2-4); in each case for every n, the final R.I. is the average of a large numbers of R.I. calculated for a randomly generated matrix. The final consistency ratio is calculated by comparing the C.I. with the Random Index (Malczewski 1999).

$$CR = \frac{RI}{CI} \quad \text{..... (3)}$$

The consistency ratio is designed in such a way that shows a reasonable level of consistency in the pairwise comparisons if C.R. < 0.10. On the other hand, there is inconsistent judgments if C.R. ≥ 0.10.

Table (2-4): Random Inconsistency Index (RI) (Adapted from Saaty 1980)

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

2.10 Conclusion:

The literature review highlighted to the following points:

- Licensure for engineering firms in government has become increasingly significant. In many federal, state, and municipal agencies, certain governmental engineering positions, particularly those considered higher level and responsible positions, must be filled by licensed professional engineers.
- Consultants classification process encourages consultants to prepare high quality proposals, increases the possibility of selecting most suitable consultants, reduces the chances for extraneous influences, reduces the cost of business development of consulting houses which is part of consultant's overhead costs and ultimately chargeable to the clients.
- A number of classification models and criteria were identified.
- A brief overview of the classification systems worldwide was taken to illustrate the different systems of classification being used.
- The focus was more on the classification system in the UAE to be comparable with the system in Gaza strip since:
    - Classification system in Egypt, Jordan, Lebanon and Syria is similar to Gaza Strip classification system.
    - In Gulf states different and developed more than Gaza
    - UAE system is clear system and published on the internet accessible to all easily.
- Detailed explanation of AHP as decision-making tool indicating its importance in classification process.

CHAPTER 3

Comparison of the local &UAE classification systems

3.1. Introduction:

The engineering consulting profession is expected to play a crucial role in planning, designing, and implementing engineering projects in Gaza Strip. In developed countries, the consulting profession grew in stages during more than 200 years. They evolved with the growth of the education system, the emergence of engineering as an applied science, and the formation of professional societies and associations. Before its establishment as an independent profession, projects were designed and constructed primarily by government departments. As their capacity proved inadequate to meet the demands of rapid industrialization, opportunities opened for private enterprises to begin construction and consulting services on a major scale. Professional societies and association of consulting firms played a key role in disseminating knowledge and promoting high technical and professional standards, (Radwan, 2004).

3.2. Association of Engineers and Association of Engineering Offices And Consulting Firms (AEOF):

The Association of Engineers is non-profit association which was established in 1976 to develop engineering sector; reinforce the participation of engineers in the national development process and share knowledge and experience with regional and international associations. The association established many specialized centers such as Engineering Training Center, (AEOF), Materials & Soil Testing Laboratory, Engineers Rights Center, and Engineering Arbitration Center (www.enggaza.ps, 2015).

(AEOF) is one of the working centers under the umbrella of Association of Engineers, Gaza Governorates. It classifies and accredits the consulting and engineering offices/firms based on the Regulations of the Engineering Offices and Firms in Palestine (first approved in 1994, amended in 2000 and in 2003).

Before 1993, the number of domestic consulting offices in Gaza strip was only five offices. These offices provided consultancy services mainly to the private sector and the work mostly included the design of small residential buildings. On the eve of establishing the Palestinian Authority (PA) in the year 1994, the number of local consulting firms in the Gaza Strip grew phenomenally; the number rose to about 40 offices/firms, (AL-Shobaky, 2006). These firms were established to provide consultancy services to Palestinian institutions in the public and private sectors as well as to international and donor organizations operating in Palestine. According to Association of Engineering Offices And Consulting Firms (AEOF) the number of engineering offices and its classification in Gaza strip as shown in Table (3-1).

Table (3-1): The number of engineering offices in Gaza strip (2015).

Year	Engineer Office.	Engineering office B	Engineering office A	Consultant Office.	Total
1996	58	9	6	68	141
2000	7	20	33	31	91
2005	5	23	32	47	107
2010	8	27	56	48	139
2015	4	22	68	64	158

As shown in Table (3-1) after 1994 the firms were grew phenomenally. They were established to provide consultancy services to Palestinian institutions in the public and private sectors as well as to international and donor organizations operating in Palestine, (AL-Shobaky, 2008).. The firm's activities include regional and town planning, building systems, road and traffic engineering, water supply and distribution for domestic and irrigation uses, wastewater collection and treatment, housing and industrial development. The consulting activities also cover all stages of the construction project life cycle, namely:

- Projects appraisal and feasibility studies.
- Projects design and preparations of tender and construction documents.
- Site supervision and construction management.
- Monitoring and technical auditing during the projects implementation.
- Evaluation of programs and projects at completion.

Recently, local consulting firms have formed joint ventures with international and regional consultants to compete for projects requiring several fields of specialization. These joint ventures enabled local consulting firms to provide all the professional services required for designing and preparing large scale projects; multipurpose projects that need specialization in computer modeling, economic and financial analysis, and human resources development. On the other hand, these joint ventures created a channel to transfer the international knowledge and expertise to the local construction industry, (Radwan, 2004).

3.3. Comparison of the local UAE classification systems:

By reviewing and studying the applied regulation of classifying engineering offices in UAE (Regulation No. (1) of 2009 concerning classification of engineering consulting offices) and in the Gaza strip (Regulation No. (1) of 2003 concerning classification of engineering consulting offices), comparing the two regulations in some aspects and reviewing points of similarity and difference between the two regulations:

1. **Classification level:**

Companies licensed to conduct engineering or contracting activities in Abu Dhabi must be classified by the Contractors and Consultants Classification and Engineers Registration Office at the Abu Dhabi Department of Municipal Affairs, (Regulation No. 1, 2009). The applicable regulations setting out the classification requirements are not new and date back to 2009 but implementation has been delayed until 2015.

The active consulting offices in the Emirate shall take one of the following forms:

1. Local engineering office.
2. A branch of a foreign engineering office: is the office which is established in the Emirate by one of the foreign engineering offices in accordance with the applicable commercial company law.
3. Advisory engineer office: is the office owned by one or more natural person or persons to mainly perform some accurate specialized engineering consultations, and is limited to give advisory consultancies for local engineering offices, branches of foreign engineering offices or any official entities. The advisory engineer office shall be registered but not classified.

By reviewing the applied regulation in Gaza strip, it is considered amendment to regulation concerning association of engineering firms and offices in Gaza as of 2003 according to the approval of the council of union of engineers in Gaza governorates. The regulation stipulates that engineering offices are classified as follows:

1. Engineer Office.
2. Engineering office.
3. Consultant Office.
4. Advisory engineer office.

2. Prerequisites and bases of classification:

By reviewing the regulation in the Gaza strip, the article related to pre requisites and bases of classification is not obvious. However, the conditions and pre requisites are concluded for every classification and the regulation is classified on the basis of engineer experience (No. of years) only. As the regulations of U.A.E. " The prerequisites, bases, conditions and procedures of the consulting office classification shall be determined in accordance with Classification Instructions as follows:

1- Financial ratio.

2- Technical team.

3- Previous experience.

4- Standardization prerequisites.

5- Any other prerequisites determined in accordance with the classification instructions.

Local engineering office is classified in special, first and second categories, while foreign engineering office branch is classified in special and first categories. According to Emirate's regulation the conditions shown in Table (3-2) are necessary to classify a consulting office owned by a UAE national who is an engineer by profession in any of the following classification categories:

Table (3-2): Classification of engineering offices owned by a UAE national who is an engineer.

	Special	First	Second
Technical Team	Four specialized and registered engineers with at least two engineers having a minimum experience of 15 years and the other two having a minimum experience of 10 years.	Two specialized and registered engineers with at least 10 years of experience.	Specialized and registered engineer at least 4 years of experience.
Assets & capital Value	3 million AED	1.5 million AED	Not requested
Previous experiences	Completed projects of not less than AED 480 million in accumulated value provided that each project submitted should not have a monetary value of less than 60 million AED.	Completed projects of not less than AED 120 million in accumulated value provided that each project submitted should not have a monetary value of less than 15 million AED.	Not requested
Quality Requirements	ISO 9001 certificate	ISO 9001 certificate	Not requested

Classification of consulting offices owned by a UAE national who is not an engineer by profession will be according to Table (3-3):

Table (3-3): Classification of engineering offices owned by a UAE national who is not an engineer

	Special	First	Second
Technical Team	Five specialized and registered engineers with practical experiences not less than (10, 10, 10, 15, 15) years respectively.	Three specialized and registered engineers with at least 12 years of practical experience for each one of them.	Two specialized and registered engineers with practical experiences of (10, 4) years Respectively.
Assets & capital Value	(4) Million AED	(3) Million AED	(2) Million AED
Previous experiences	completed projects of not less than AED 480 million in accumulated value provided that each project submitted should not have a monetary value of less than 60 million AED.	completed projects of not less than AED 120 million in accumulated value provided that each project submitted should not have a monetary value of less than 15 million AED.	Not requested
Quality Requirements	ISO 9001 certificate	ISO 9001 certificate	Not requested

Foreign office will be classified only in the special and first categories according to provisions mentioned (**Owned by a UAE national who is an engineer)**.

Engineering peer review offices is not classified, but registered in the registry of engineering peer review offices.

As mentioned above, according to the regulation in the Gaza strip, the offices are classified in one of the four categories in line with the conditions that are summarized in Table (3-4):

Table (3-4): Categories of classification according to the regulation in the Gaza strip.

Classification categories	Prerequisites and bases of classification	
Engineer Office.	First	If the owner of the office is an engineer with experience not less than (11) years (5 years actual practice in design and preparation of drawings.

	Second	If the owner of the office is an engineer with experience not less than (7) years (3 years actual practice in design and preparation of drawings).
	Third, the lowest in terms of classification	If the owner of the office is an engineer with experience not less than three years (two years actual practice in design and preparation of drawings)
Engineering office	First	1- Every specialization is headed by an engineer with experience not less than 5 years (two years actual practice in design) 2- The number of full time engineers in the office is not less than 50% out of total No. of engineers in the office
	Second	1- Every specialization is headed by an engineer with experience not less than 7 years (Three years actual practice in design) 2- The number of full time engineers in the office is not less than 50% out of total No. of engineers in the office
Consultant Office.	1- Every specialization is headed by an engineer with experience not less than 11 2- The minimum number of engineers in design in consultant of office doubles the No. of registered specialization. 3- In case of the existence of civil or architectural specialization, the assistants should be in the same specialization 4- Full time engineers in office or consultant company are not less than 50 % out of No. of engineers in the office.	

Table (3-4) continued:

Advisory engineer office.	Advisory office is established by registered full time engineers in the union or those who have the following conditions: 1- He has an actual engineering experience not less than 15 years (8 years of design or practice) 2- He should be successfully responsible for designing and supervising or managing a distinctive engineering project. 3- He has nothing to do with commercial, industrial or enterprise activities that are directly related to specialized or general consultation he practices.

3. Technical specializations:

In Emirate's regulation engineering professions and technical specializations are specified according Table (3-5).

Table (3-5): Technical specializations according to UAE regulation.

Field	Engineering Specialization	Engineering Specialization Required
Engineering Consultancy in Public Utilities & Services	Power Station	Electrical Engineer
	Electrical Installations	Electrical Engineer
	Power Transmission and Distribution	Electrical Engineer
	Street lighting	Electrical Engineer
	Water Desalination	Civil or Mechanical Engineer
	Water Transmission and Distribution	Civil or Mechanical Engineer
	Meteorology and Aviation Instruments	Aviation Engineer or Meteorologist
	Survey Planning, Aerial photography & Information Management Systems	Civil or Surveying Engineer
	Sewage and Wastewater Collection & Disposal	Civil Engineer

Table (3-5) continued:

	Safety and Fire Protection Engineering	Safety or Fire Protection Engineer
	Medical & Laboratory Services	Electronics or Biomedical Engineer
Engineering Consultancy in Architecture		Architect or Civil Engineer
Civil Engineering Consultancy		Civil Engineer
Engineering Consultancy in Interior Design		Architect or Interior Designer
Engineering Consultancy on the Renovation and preservation of Antique Buildings		Architect or Landscaping Engineer
Engineering Consultancy in Landscaping		Architect or Landscaping Engineer
Civil and Transportation Engineering Consultancy	Airports & Air Transport	Civil Engineer
	Roads	Civil Engineer
	Internal Roads	Civil Engineer
	Bridges	Civil Engineer
	Tunnels	Civil Engineer
	Sea Ports & Sea Transportation	Civil or Marine Engineer
	Marine Survey Engineering	Marine Engineer
	Ship Construction Engineering	Marine or Mechanical Engineer
	Survey Engineering	Civil or Surveying Engineer
	Dams, Hydro-geological and geological Works	Civil or Geological Engineer
	Railways	Civil or Mechanical or Railway Engineer
	Foundation Engineering & Soil Mechanics Consultancy	Civil Engineer
	Traffic & Transportation Planning Consultancy	Civil or Traffic Engineer
	Geodesic Survey	Survey or Geological or
	Land Survey Engineering Consultancy	Civil or Surveying Engineer
Engineering Consultancy Electro Mechanical Works	Electrical Engineering	Electrical Engineer
	Electronics Engineering	Electrical Engineer
	Computer Engineering	Computer or IT Engineer
	Mechanical Engineering	Mechanical Engineer
	Communication Engineering	Communication or Electronics Engineer
	Power & Control Engineering	Mechanical or Electronics or Electrical Engineer
	Electronic Instruments Engineering	Electronics Engineer

Table (3-5) continued:

	Air Conditioning, Cooling, heating & Ventilation Engineering	Mechanical Engineer
	Liquid Mechanics Engineering	Mechanical Engineer
	Aviation Engineering	Aviation or Mechanical Engineer
	Mechanical Power Engineering	Mechanical Engineer
	Automobile Engineering	Mechanical Engineer
	Aviation Instruments Engineering	Electronics or Aviation Engineer
	Machinery Mechanics Engineering	Mechanical Engineer
	Heavy Machinery Engineering	Mechanical Engineer
Industrial Engineering Consultancy	Food Industries	Industrial Engineer
	Chemical Industries	Industrial or Chemical Engineer
	Mining Industries	Industrial or Mining Engineer
	Mineral Industries	Industrial or Mineral Engineer
	Building Materials Manufacturing	Industrial Engineer
	Plastic Engineering Consultancy	Chemical Engineer
	Industrial Production Engineering	Industrial or Mechanical Engineer
Engineering Consultancy in Urban and Master Planning		Architect or Urban Planning Engineer
Engineering Consultancy in Cultivation, Animal and Fish Resources	Cultivation and Agricultural Mechanization	Agricultural or Mechanical Engineer
	Irrigation & Water Resources	Agricultural or Civil or Geological Engineer
	Soil Survey & Classification	Agricultural or Civil or Geological Engineer
	Land Reclamation & Soil Improvement	Agricultural or Civil or Geological Engineer
	Animal Resources	Agricultural Engineer
Engineering Consultancy in Energy, Oil and Gas	Oil and gas Facilities	Petroleum or Mechanical Engineer
	Oil & gas Transmission	Petroleum or Mechanical Engineer

Table (3-5) continued:

	Alternative Energy Resources	Specialized Engineer as per research nature
	Conservation of Energy	Specialized Engineer as per energy type.
	Petroleum Refinery Engineering	Petroleum or Chemical Engineer
	Petroleum & Chemical Engineering	Petroleum or Chemical Engineer
	Oil & Gas Tank Piping Construction Engineering Consultancy	Mechanical Engineer
	Petroleum Refinery Units Engineering	Petroleum or Chemical Engineer
	Gas Extraction Engineering	Chemical Engineer
	Petrochemical Engineering	Petroleum or Chemical Engineer
Engineering Consultancy in Project Management	Construction Project Management	Masters degree in Project Management after obtaining a bachelor degree in engineering, or an engineer having experience in construction project management
	Industrial Project Management	Masters degree in Project Management after obtaining a bachelor degree in engineering, or an engineer having experience in industrial project management
	Agricultural Project Management	Masters degree in Project Management after obtaining a bachelor degree in engineering, or an engineer having experience in agricultural project management
Engineering Consultancy in Planning	Feasibility Studies	As per the nature of the study
	Claim Analysis	As per the nature of the claims
	Arbitration for Engineering Projects	As per the nature of the project
	Quantity Surveying	Civil or Quantity Surveying Engineer

Table (3-5) continued:

	Environmental Planning	Environmental Engineer
Mines, Minerals and Geology Engineering Consultancy	Mines & Mining Engineering and geological Engineering	Geological or Mining Engineer
	Minerals Engineering	Minerals Engineer
	Mining and Mineral Equipment Engineering	Petroleum or Mechanical Engineer
	Geophysics, Geo mechanic and Geo chemistry Engineering	Geophysical or Geological or Chemical or Mechanical Engineer
	Excavation, Storage & Production Engineering	Chemical or Petroleum or geological or Mechanical Engineer
Physical Engineering Consultancy		Physical Engineer
Nuclear Engineering Consultancy *		Nuclear or Chemical Engineer

*Will be classified only in the Special Category after acquiring the necessary approvals from the responsible authorities.

On the other hand, engineering offices in the Gaza strip are classified in one of the specializations shown in Table (3-6):

Table (3-6): Technical specializations according to the regulation in the Gaza strip.

Field	Engineering Specialization Required
Soil Mechanics and Foundations.	• Chaired by a civil engineer or geologist engineer. • Assistant engineer experience not less than(3) years.
Project management	• Chaired by an engineer specializing in programming and project management. • Assistant engineer experience not less than(3) years.
Environment and pollution.	• Chaired by an environmental Engineer. • Assistant engineer experience not less than(3) years.
Any other specializations are approved by the union council and concerned bodies	

4. Violation of regulations:

According to Emirate's regulation, if the consulting office or any of its staff violates the provisions stipulated herein or the classification instructions, the Chairman may impose any of the following sanctions on the consulting office; he may:

1. Issue a warning.

2. Suspend it from performing any new engineering consultations for not less than 6 months and not more than 1 year.
3. Degrade the category of its classification, one or more grades.
4. Revoke its classification (If the classification of a consulting office is revoked , it shall not be reclassified once again for a period of not less than (3) years from the date classification has been revoked.

On the other hand, according to the regulation in the Gaza strip (Article 30), the violator is final more than 200 Dinars and less than 1000 Dinars or he is punished as follows or he receives fines and punishment together:

1. Issue a warning.
2. Issue a reprimand
3. Suspend it from performing any new engineering consultations for not more than 1 year.
4. Revoke its classification

5. Classification of the foreign engineering consulting office branch:

According to Emirate's regulation, the following conditions are required:

1. The head office of the foreign engineering firm should be at least established five years before the date of application.

2. Full-time, registered engineer shall undertake the office management and he/she must have at least 10 years of practical experience if he/she is a foreigner and 4 years if he is a UAE national.

3. At the country of origin, the head foreign engineering office must provide proof that the office had undertaken a number of projects of financial and technical value commensurate with the required category of classification, and submits with the application a detailed statement about these projects in addition to official and approved contracts and completion certificates notarized and attested from the related authorities

4. Office branch in the emirate should be established according to the applicable laws and regulations of the emirate and the country.

Concerning the regulation in the Gaza strip, the details in this connection are not mentioned except "Office branch in the Gaza strip should be established according to the applicable laws and regulations of the Gaza strip and the country."

3.4 Summary of the comparison of the local UAE classification systems:

The summary of the comparison of the local UAE classification systems shown in Table (3-7):

Table (3-7): Comparison of the local UAE classification systems.

#	Field	Gaza strip system	UAE system
1	**Date of modification**	Regulation No. (1) of **2003** concerning classification of engineering consulting offices.	Regulation No. (1) of **2009** concerning classification of engineering consulting offices.
2	**Classification level**	1. Engineer Office. 2. Engineering office. 3. Consultant Office. 4. Advisory engineer office.	1. Local engineering office. 2. A branch of a foreign engineering office. 3. Advisory engineer office.
3	**Prerequisites and bases of classification**	Technical team	1- Financial ratio. 2- Technical team. 3- Previous experience. 4- Standardization prerequisites.
4	**Technical specializations**	Three main specializations	Eighteen main specializations and more than one hundred sub specializations.
5	**Violation of regulations**	The violator is final more than 200 Dinars and less than 1000 Dinars or he is punished as follows: 1. Issue a warning. 2. Issue a reprimand 3. Suspend it from performing any new engineering consultations for not more than 1 year. 4. Revoke its classification	1. Issue a warning. 2. Suspend it from for not less than 6 months and not more than 1 year. 3. Degrade the category of its classification, one or more grades. 4. Revoke its classification (not less than (3) years from the date classification has been revoked.

CHAPTER 4...
METHODOLOGY

4.1 Introduction:

This chapter describes the methodology that was used in this research. The information about the research design, research population, questionnaire design, statistical data analysis, content validity and pilot study, structured interviews contents are presented in this chapter.

4.2 Research Strategy:

Research strategy is the way in which the research objectives can be questioned. There are two types of research strategies, namely, 'quantitative research' and 'qualitative research' (Naoum, 2007). Data may be narrative information (qualitative data) or numerical values (quantitative data) (Polit and Hungler, 1985). Quantitative research is 'objective' in nature and it is defined as an investigation into a social human problem, based on testing a hypothesis or a theory composed of variables, measured with numbers, and analysis with statistical procedures. It investigates facts and tries to establish relationships between these facts. Qualitative research is 'subjective' in nature. It emphasizes meanings, experiences and description and takes the form of an opinion or view (Naoum, 2007).

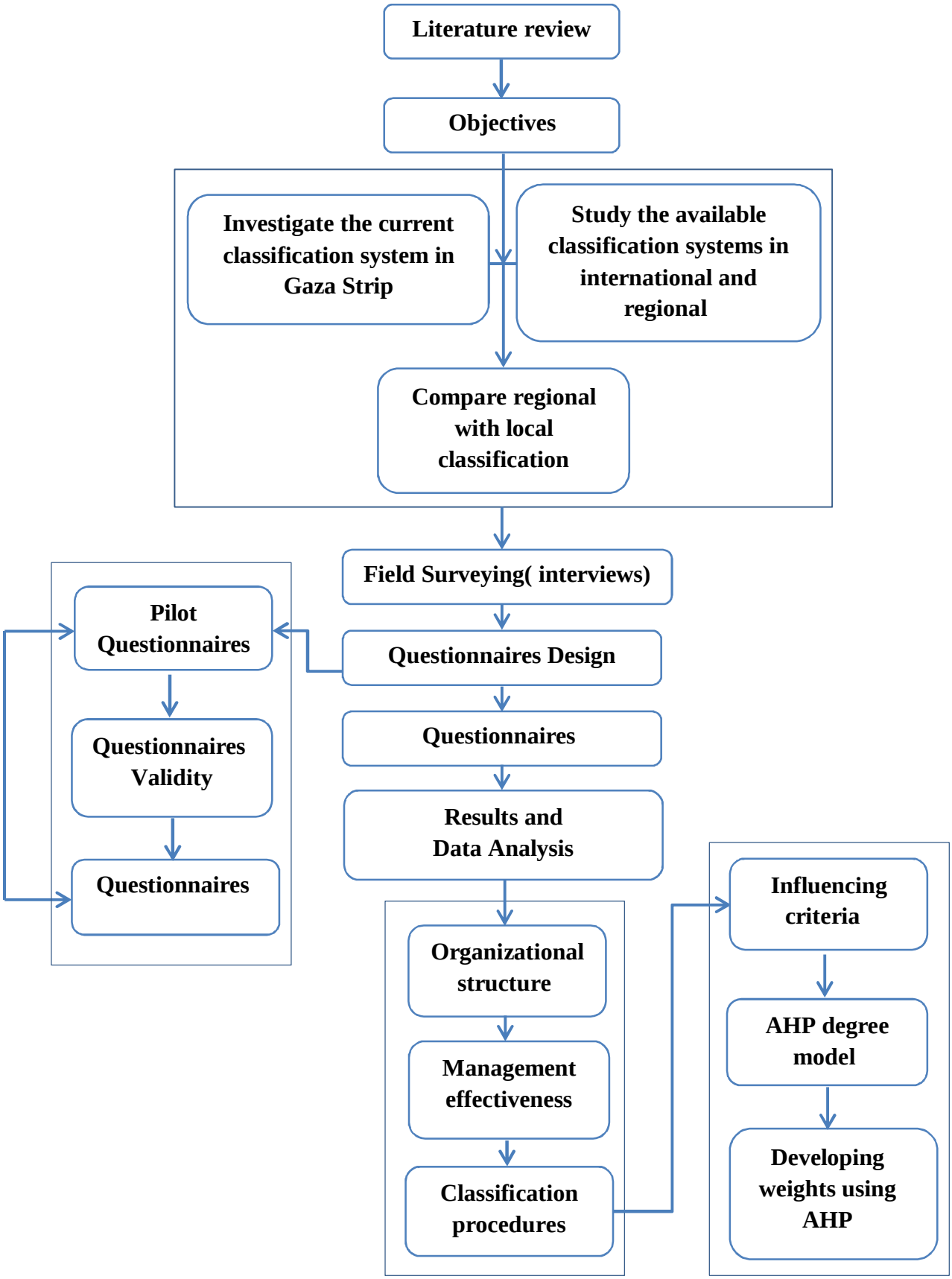
In this research both qualitative and quantitative approaches were used to achieve the main aim of the study which is evaluating and improving the current classification system issued by (AEOF) in Gaza Strip and its articles: classification criteria, classification levels and technical specializations and finally propose a modified classification system based on assign weights to the main influencing criteria of the classification by using AHP. Figure(4-1) shows the methodology flowchart, which leads to achieve the research.

Qualitative approach through interviews to investigate the current classification procedures in the (AEOF) and propose a more effective classification procedures and quantitative approach through questionnaire to evaluate classification procedures in the (AEOF) and identify the weaknesses, strengths and the needs of development of the (AEOF) procedures.

4.3 Research methodology:

4.3.1 Data Collection:

In order to collect the needed data for this research , the secondary resources were used in collecting data such as books, journals, statistics and web pages, in addition to preliminary resources that not available in secondary resources through distributing questionnaires on study population in order to survey their opinion and evaluate classification procedures in the (AEOF) in Gaza strip and on case studies and interviews.



Figure(4-1): Illustrates the methodology flow chart.

4.3.2 Interviews:

In the structured interview, questions are presented in the same order and with the same wording to all interviewees. The interviewer will have full control on the questionnaire throughout the entire process of the interview (Naoum, 2007).

Interviews provided a medium to discover information first-hand from people involved in engineering offices and consulting firms . In this research, the structured interview included close ended questions.

Each of these interviews lasted from half to an hour, depending on the answers provided and the follow-up questions asked. Personal interviews and speaking to the respondents are considered the success way to gain his or her trust in the interview, and have high response rates. Personal interviews can obtain large amounts of information. The interviewer will explain the nature of the study in general terms. The respondents were asked the questions after a brief explanation for the objectives and contents of the questionnaire. The interviewer assures that the answers will be kept confidential.

The following steps are conducted to the interview success:

1. Private: The first step is, whenever possible, to take the interview without an audience, because if other members of the organization or out of the organization attend the interview , the respondent might give the answers that they would approve, rather than his own attitudes, candor is greatest when interviews are private.
2. Confidential: The interviewer assures the respondent that the answers and documentations will be kept confidential; this makes the respondents answers frankly and comfortably. All interviewees remained anonymous to maintain confidentiality.
3. Asking the questions: The interviewer asks the questions as they have been written and exactly in the same order which they appear in the questionnaire. The questions are sequent; the researcher doesn't interrupt the respondent until completing the answer of the previous question. The interviewer should just ask the questions and shouldn't give their own opinions.
4. Recording the answers: After the interviewer asks the questions, he usually records the respondents' answers exactly, including a correct record of closed ended answers and a verbatim record of open-ended answers. When the longer answer is made by respondent, the researcher summarizes the answer in his mind and records the answer.

4.3.3 Questionnaire Population:

A questionnaire population consists of the totality of the observation with which is concerned. In this research, the population is the total number of 168 engineering offices and consulting firms which approved in the (AEOF). One hundred and sixty eight questionnaires were distributed and seventy two questionnaires were received.

4.3.4 Questionnaire Design and Content:

According to the literature review and after interviewed experts and all the information that could help in achieving the study objectives were collected, reviewed and organized to be suitable for the study survey and after many stages of brain storming, consulting, amending, and reviewing conducted by the researcher with the supervisors, a questionnaire was developed with closed and open-ended questions. The questionnaire was designed in the Arabic language (Appendix 2) to be more understandable to the targeted population. A translated English version of the questionnaire was attached in appendix 1. The questionnaire of 8 pages is provided with cover letter in which explained the purpose of the study, and the confidentiality of the information in order to encourage high response. The questionnaire consists of four sections to accomplish the objectives of the research, as following:

1. Office / company background.
2. The organizational structure of the (AEOF) board.
3. Management effectiveness of the (AEOF).
4. Classification procedures of the (AEOF).

Likert quintuple criterion is used in the research to measure and examine the answers of questionnaire questions. Most of the answers were limited to the following classifications. Questions follows scale as in Table (4-1).

Table (4-1): Likert quintuple criterion used in the research.

Level	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Scale	1	2	3	4	5

4.3.5 Pilot Study:

A pilot study for the questionnaire was conducted before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of question, identifying ambiguous questions, testing the techniques that

used to collect data, and measuring the effectiveness of standard invitation to respondents.

4.4 Validity of the Research:

The validity of an instrument is defined as a determination of the extent to which the instrument actually reflects the abstract construct being examined. "Validity refers to the degree to which an instrument measures what it is supposed to be measuring" (Abu Rass, 2006). High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid; it truly reflects the concept it is supposed to measure. Achieving good validity required the care in the research design and sample selection (Naoum, 2007) . The amended questionnaire was by the supervisors and three experts in the arbitration to evaluate the procedure of questions and the method of analyzing the results. The experts agreed that the questionnaire was valid and suitable enough to measure the purpose that the questionnaire designed for.

4.5 Statistical Validity of the Questionnaire:

To insure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Pearson test) which measure the correlation coefficient between each item in the field and the whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one filed and all the fields of the questionnaire that have the same level of similar scale.

4.5.1 Criterion Related Validity :

a) Internal consistency: Internal consistency of the questionnaire is measured by a surveyed sample, which consisted of thirty questionnaires, through measuring the correlation coefficients between each paragraph in one field and the whole fields. Tables (4-2) and (4-3) below show the correlation coefficient and p-value for each field items. As shown in the table the p- Values are less than 0.05 or 0.01, so the correlation coefficients of this field are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for.

Table (4-2): The correlation coefficient between each paragraph in the field and the whole field.

#	Question	Pearson coefficient	p- value	Sig. level
A	**The structure of the association of offices and engineering firm**			
1	The number of members of the board of directors of the association of offices and engineering firm is Compatible with the association's tasks.	0.873	0.000	**
2	The chairman of the association is committed to effectiveness and high ability in order to perform the required tasks.	0.670	0.000	**
3	The limitation of board of directors of the association by representatives of the association gives independency, power and liberty to the association in making decisions.	0.843	0.000	**
4	Involvement of outside members in board of directors of the association is necessary.	0.589	0.001	**
5	The board of directors of the association develops, form or implement policies related to its formation (size, formation, skills, expertise … etc.).	0.728	0.000	**
6	The used elective system is appropriate and emerge board of director's members with efficiency and ability to perform the tasks.	0.715	0.000	**
7	There are harmony and cooperation between the board of director's members which contribute in progress of the work.	0.688	0.000	**
B	**Management effectiveness of the association of offices and engineering firm to the offices and companies**			
1	The board of directors of the association plays sufficiently the role related to him.	0.819	0.000	**
2	The board of directors of the association uses the authorities granted to him in efficient way within the system.	0.803	0.000	**
3	There are clear priorities at The board of directors of the association concerning the administration of offices file and engineering firms.	0.880	0.000	**
4	Donors are committed to classification of the Association.	0.677	0.000	**
5	The Association supervises and follows engineering offices and consulting firms.	0.867	0.000	**
6	The Association provides continuous technical and administrative support to the engineering offices and consulting firms.	0.825	0.000	**

7	The Association contributes in solving problems that face engineering offices and consulting firms.	0.820	0.000	**
C	**Classification procedures that used in the association of offices and engineering firm for the engineering offices and consulting firms.**			
1	Policies and procedures of the Associations' classification to the offices and firms are clear.	0.874	0.000	**
2	Policies and procedures of the Associations' classification to the offices and firms are fair.	0.636	0.000	**
3	Policies and procedures of the Associations' classification to the offices and firms are clear are continually revised and verified.	0.611	0.000	**
4	Classifications' procedures are easy and easily available, and committed to only provided paper files.	0.436	0.016	*
5	Six months as a classifications' period is sufficient.	0.743	0.000	**
6	The process of classifications' renewal ignores the performance of office and evaluation of its employees during the past period.	0.793	0.000	**
7	Standards of manufacturing are sufficient and comprehensive for evaluating the real abilities of the office.	0.738	0.000	**
8	It is preferred to increase classifications' categories (Engineer office, Engineering office B, Engineering office A, Consulting office).	0.863	0.000	**
9	Confirmation of the classifications' certificate by other sides is necessary.	0.849	0.000	**

* Correlation coefficient is significant at the $\alpha = 0.05$ ** at the $\alpha = 0.01$

4.5.2 Structure Validity of the Questionnaire:

Structure validity is the second statistical test that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole questionnaire. It measures the correlation coefficient between one field and all the fields of the questionnaire that have the same level of likert scale.

As shown in Table (4-3), the significance values are less than 0.05 or 0.01, so the correlation coefficients of all the fields are significant at $\alpha = 0.01$ or $\alpha = 0.05$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim 'of the study.

Table (4-3): Correlation coefficient between each filed and all the fields.

#.	Section	Correlation	p- value
1	The structure of the association of offices and engineering firm.	**0.772	**0.000**
2	Management effectiveness of the association of offices and engineering firm to the offices and	**0.940	**0.000**
3	Classification procedures that used in the association of engineering offices consulting and	**0.903	**0.000**

** Correlation coefficient is significant at the α = 0.01

Results of K-S test as shown in Table (5-1), clarifies that the calculated p-value is greater than the significant level which is equal 0.05 (p-value. > 0.05). This in turn denotes that data follows normal distribution, and so parametric Tests must be used.

4.6 Reliability of the Research:

Reliability of an instrument is the degree of consistency with which it measures the attribute that is supposed to be measured . The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient. For the most purposes reliability coefficient above 0.7 are considered satisfactory. Period of two weeks to a month is recommended between two tests, but it is too difficult to ask the same sample of people to responds to our questionnaire twice within short period. To overcome this problem **Half Split Method and Cronbach Alpha coefficient are used through the SPSS software**.

4.6.1 Half Split Method:

This method depends on finding Pearson correlation coefficient between the means of odd rank questions and even rank questions of each field of the questionnaire. Then, correcting the Pearson correlation coefficients can be done by using Spearman Brown correlation coefficient of correction. The corrected correlation coefficient (consistency coefficient) is computed according to the following equation :

Consistency coefficient = 2r/(r+1), where r is the person correlation coefficient.

The normal range of corrected correlation coefficient 2r/(r+1) is between 0.0 and + 1.0 As shown in Table (4-4), all the corrected correlation coefficients values are between 0.599 and 0.906 and the general reliability for all items equal 0.874, and the significant (α) is less than 0.05 so all the corrected correlation

coefficients are significance at α = 0.05. It can be said that according to the Half Split method, the dispute causes group are reliable.

Table (4-4): Split-Half Coefficient method.

#	Section	person-correlation	Spearman-Brown Coefficient	p- value
1	The structure of the association of offices and engineering firm.	0.573	0.599	**0.000**
2	Management effectiveness of the association of offices and engineering firm to the offices and companies.	0.849	0.881	**0.000**
3	Classification procedures that used in the association of offices and engineering firm.	0.861	0.906	**0.000**
Total		**0.873**	**0.874**	**0.000**

4.6.2 Cronbach's Alpha Coefficient:

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. As shown in Table (4-5) the Cronbach's coefficient alpha was calculated for each field. The results were in the range from 0.857 and 0.922, and the general reliability for all items equal 0.922. This range is considered high; the result ensures the reliability of the questionnaire.

Table (4-5): Cronbach's Alpha for Reliability.

#	Section	Cronbach's Alpha
1	The structure of the association of offices and engineering firm.	**0.745**
2	Management effectiveness of the association of offices and engineering firm to the offices and	**0.857**
3	Classification procedures that used in the association of offices and engineering firm.	**0.858**
Total		**0.922**

4.6.3 One Sample K-S test will be used to identify if the data follows normal distribution or not, this test is considered necessary in the case of testing data using parametric test which stipulates data to be normality distributed and this test used when the size of the sample are greater than 30.

Table (4-6): One Sample K-S.

#	Section	Z	P-Value
1	The structure of the association of offices and engineering firm.	1.206	**0.109**
2	Support and supervising of the association of offices and engineering firm to the offices and companies.	1.227	**0.098**
3	Classification procedures that used in the association of offices and engineering firm.	1.168	**0.131**
Total		**1.191**	**0.117**

4.7 Development of the classification procedures using AHP:

As one of the objectives of the current study is to evaluate the current classification system and to propose the required modification based on assign weights to the main influencing criteria of the classification by using AHP, the final part of the questionnaire was developed to determine the weights of the eight criteria based on AHP by conducting pairwise comparison that based on specific scale adopted by Saaty (1980). This part consists of the factors that influence the classification process as summarized from literature review and the pilot study. The factors were categorized into eight criteria; these criteria are capital office/company, fixed term staff in office/company, reputation of the office(testimony of previous employees), size of implemented projects, size of general tenders (not private), total experience of the office, experience of the offices' staff and logistic equipment for the office. The respondents were asked to provides their opinions on the identification of classification criteria for offices/companies by scores 1 to 8, where "1" represent very high and "8" the very low. Figure (4-2) shows AHP model.

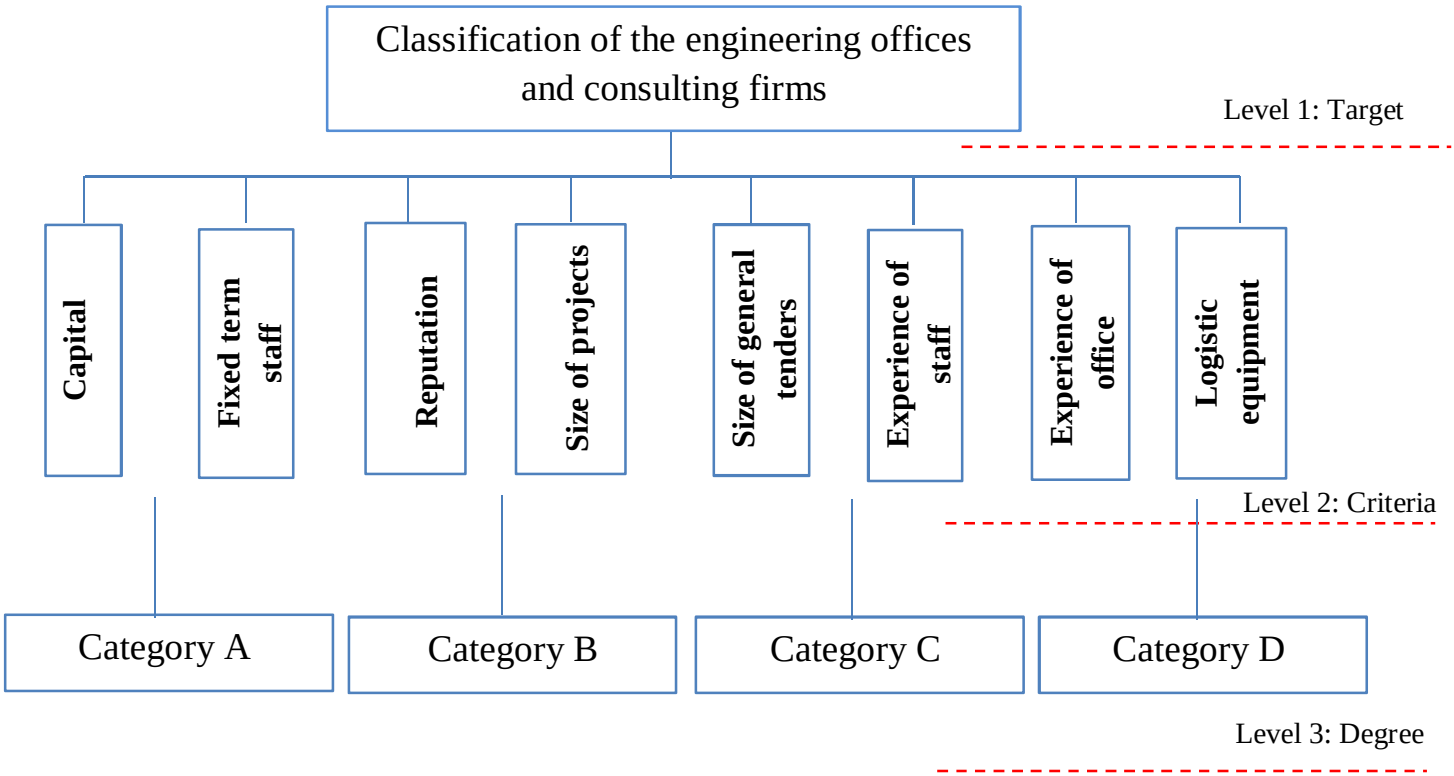


Figure (4-2): AHP model of classification degree.

The main target" classification of the engineering offices and consulting firms" was identified at the top of the hierarchy on level one. In the second level, the main criteria adopted in this research was identified, namely, capital office/company; fixed term staff in office/company; reputation of the office (testimony of previous employees); size of implemented projects; size of general tenders (not private); total experience of the office; experience of the offices' staff and logistic equipment for the office. At level three, the degree representing the office/company to be classified were determined.

The next chapter illustrates and discusses applications of analytical hierarchy process (AHP) in order to establish weights for the proposed classification criteria of the engineering offices and consulting firms in Gaza Strip.

Chapter 5

DATA ANALYSIS AND DISCUSSION

5.1 Introduction:

This chapter describes the results that have been obtained from the questionnaire distributed. For this purpose the statistical package for social sciences (SPSS) was used. The information about the respondents background will be presented.

The survey results, in this chapter, will illustrate the respondents evaluation of classification procedures in the Association Of Offices And Engineering Firms and their opinion about some suggestions for the process of classification and the system of Association Of Offices And Engineering Firms. Classification requirements will be also ranked according to its effect on classification system. Finally, results of interviews with consulting experts will be discussed.

Part 1: Results of Interviews:

Interviews were conducted with 10 experts in consulting firms (an engineer who owned engineering office or consulting firm and with experience not less than 20 years) to collect needed information about classification system that issued by the Association of Engineering Offices And Consulting Firms (AEOF), procedures and needed improvements. The interview form is included in (Appendix 3). Findings from interviews can be summarized as following:

A. <u>The organizational structure of the (AEOF) board:</u>

1. All interviewed experts reviewed the association of offices and engineering firm system because it is available in network and easy to handle with or review.

2. 70% of interviewees haven't nominated themselves for membership of the board of directors of the association of offices and engineering firm because of preoccupation of engineers with work, lack of interest or dissatisfaction with system of election since it is conglomerates. in addition to non-active role of the association's board.

3. Majority of interviewees (80%) recommended to increase the number of members of the board of directors of the association of offices and engineering firm and Involvement of external members in board of directors of the association. Interviewees suggested the necessity of involvement of outside members such as an independent member from the syndicate or an observer member from governmental agencies. Some suggested that members do not necessary to be one of those who own offices or firms, but it is sufficient to be an engineer with a certain expertise.

B. **The classification system:**

1. All interviewees agreed that donors are committed to classification of the Association where all donors demand a valid classification's certificate for all offices that apply to any project.

2. All interviewees agreed that classifications procedures are simple and easily available, and committed to only provided paper files, this term causes annoyance since it is easy for any office to enter competition's arena and renew classification.

3. 90% of interviewees considered that a classifications' period (6 months) is very short.

C. **Management effectiveness of the (AEOF):**

1. All interviewees considered that the support from the association is very limited, since communication with offices does not occur except when classification's renewal is demanded.

2. Interviewees were asked to provide suggestions for the Association :

- The Association of Engineering Offices And Consulting Firms (AEOF) is recommended to establish comprehensive database regarding offices/companies who dealt with them with respect to their financial abilities, experience, performance etc. in order to be the basis of any development of classification process in future.

- The major of interviewees suggested to increase the duration of the classification (6 month) since it is very short.

- Increase the support provided from the association to Engineering Offices And Consulting Firms.

- Developing the website of the (AEOF) and publishing articles about (AEOF) efforts, services and issuing classification magazine periodically.

Part 2: Results of Questionnaires:

5.2.1 General Information:

A. The nature of respondents work in the office / company:

Table (5-1) and Figure (5-1) show that 68.1% of the respondents are owner (office / company) , 26.4% of the respondents are representative (office / company) , 4.2% of the respondents are head of specialization (office / company) and 1.4%

are another job.

Table (5-1): The nature of respondents work

The nature of respondents work	Frequency	Percentages %
Owner (office / company)	49	**68.1**
Representative (office/ company)	19	**26.4**
Head of specialization (office / company)	3	**4.2**
Another job	1	**1.4**
Total	**72**	**100.00**

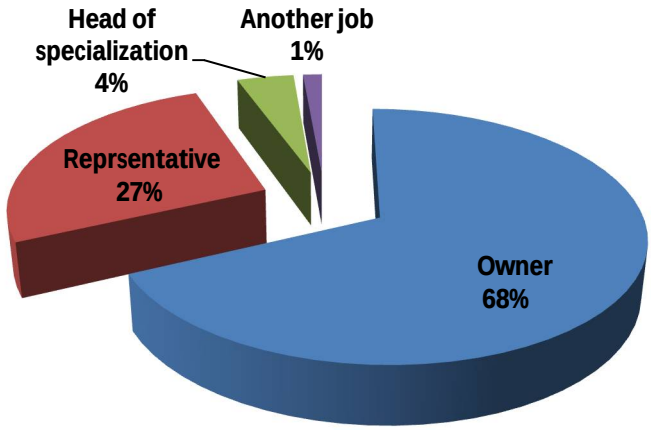


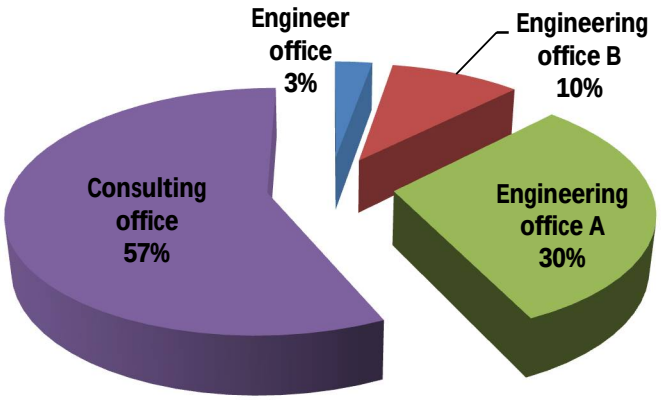
Figure (5-1) : The nature of respondents work in the office / company.

B. The level of the office:

Table (5-2) and Figure (5-2) shows that 2.78% of the respondents are engineer office, 9.72% of the respondents are engineering office B, 30.56% are of the respondents engineering office A and 56.94% are consulting office. Results obviously show that questionnaire was fairly distributed for all offices and firm's categories since the number of respondents was from the general number 50% from engineer office, 32% from engineering office B, 32 % from engineering office A and 64 % was from Consulting office.

Table (5-2): Degree of classification of the office.

The level of the office	Frequency	Percentages
Engineer office	2	**2.78**
Engineering office B	7	**9.72**
Engineering office A	22	**30.56**
Consulting office	41	**56.94**
Total	**72**	**100.00**



Figure(5.2): The level of the office.

C. Specialty of classification of the office:

Table (5-3) shows that more than 44% of the respondents have all specialty of classification, 41.67% of the respondents have (Structural Architectural Electrical Mechanical) specialty of classification, 4.17% of the respondents have (Structural, Architectural, Electrical) specialty of classification, 2.78% of the respondents have (Structural Architectural, Projects administration, Sewage, Roads) specialty of classification and 1.39% of the respondents have Structural specialty of classification.

Table (5-3): Specialty of classification.

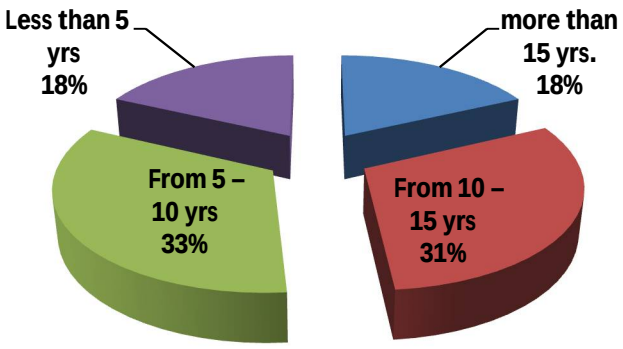
Specialty of classification	Frequency	Percent
Structural	2	2.78
Structural, Projects administration, Sewage, Roads	2	2.78
Structural, Architectural	1	1.39
Structural Architectural, Projects administration, Sewage, Roads	2	2.78
Structural, Architectural, Electrical	3	4.17
Structural Architectural Electrical Mechanical	30	41.67
All of the above	32	44.44
Total	**72**	**100.00**

D. Duration of getting the classification level:

Table (5-4) and Figure (5-3) show that more than 18% of the respondents have duration of getting the classification level less than 5 years, 30.56% of the respondents have duration of getting the classification level from 10 – 15 years and more than 18% of the respondents have duration of getting the classification degree more than 15 years.

Table (5-4): Duration of getting the classification level.

Duration of getting the classification level	Frequency	Percent
more than 15 yrs.	13	18.06
From 10 – 15 yrs.	22	30.56
From 5 – 10 yrs.	24	33.33
Less than 5 yrs.	13	18.06
Total	**72**	**100**



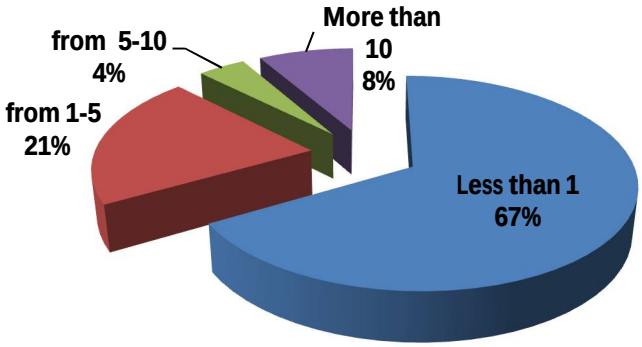
Figure(5.3): Duration of getting the classification level.

E. Amount of designed projects during the past five years (in million dollars):

Table (5-5) and Figure (5-4) show that more than 66% of the respondents have projects that their documentations and design have been prepared during the past five years less than 1 million dollars, 20.83% from 1-5 million dollars, 4.14% from 5-10 million dollars and 8.33% more than 10 million dollars.

Table (5-5): Amount of designed projects during the past five years (in million dollars).

Amount of projects (in million dollars):	Frequency	Percent
Less than 1	48	66.67
from 1-5	15	20.83
from 5-10	3	4.17
More than 10	6	8.33
Total	72	100.00



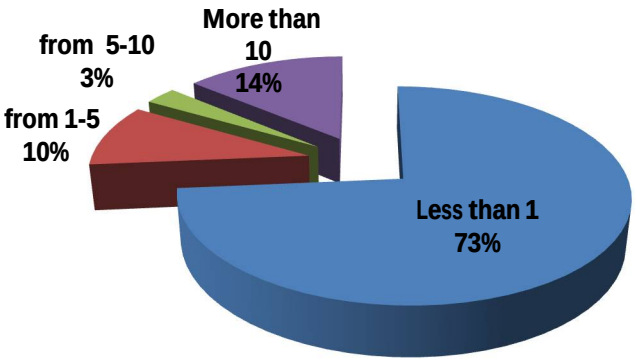
Figure(5-4): Amount of designed projects during the past five years (in million dollars).

F. Amount of projects supervision during the past five years (in million dollars):

Table (5-6) and Figure (5-5) show that more than 73% of the respondents have projects that have been supervised in implementation during the past five years less than 1 million dollars, 9.72% from 1-5 million dollars, 2.78% from 5-10 million dollars and 13.89 more than 10 million dollars.

Table (5-6): Amount of projects supervision during the past five years (in million dollars).

Amount of projects (in million dollars):	Frequency	Percent
Less than 1	53	73.61
from 1-5	7	9.72
from 5-10	2	2.78
More than 10	10	13.89
Total	72	100.00



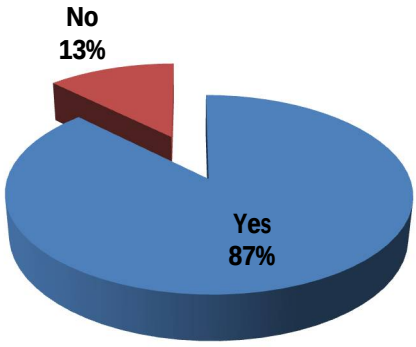
Figure(5-5): Amount of projects supervision during the past five years (in million dollars).

G. Reviewing the system of the (AEOF):

Table (5-7) and Figure (5-6) show that more than 87% of the respondents reviewed the (AEOF) system and 12.5 % of the respondents didn't review. The researcher refers the high ratio of the respondents reviewed association's system because it is available in network and easy to handle with or review.

Table (5-7): Reviewing the system of the (AEOF).

Have you ever reviewed the association of offices and engineering firm system	Frequency	Percent
Yes	63	87.5
No	9	12.5
Total	**72**	**100**



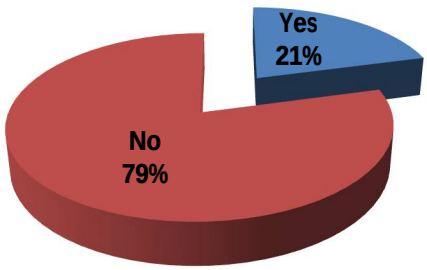
Figure(5-6): Reviewing the system of the (AEOF).

H. The candidate for membership of the board of directors of the (AEOF):

Table (5-8) and Figure (5-7) show that more than 79% of the respondents haven't been candidate for membership of the board of directors of the (AEOF) and 20.83% of the respondents have been candidate. In order to make reasons of non-participation in association's board of directors clear, an open question had been added and the answers concentrated on preoccupation of engineers with work, lack of interest or dissatisfaction with system of election since it is conglomerates. Few answers referred to non-active role of the association's board.

Table (5-8): The candidate for membership of the board of directors of the (AEOF).

Have you ever been a candidate for membership of the board of directors of the association of offices and engineering firm	Frequency	Percent
Yes	15	20.83
No	57	79.17
Total	72	100.00



Figure(5-7): The candidate for membership of the board of directors of the (AEOF).

5.2.2 The structure of the (AEOF):

Table (5-9) shows the opinion of the respondents about the structure of the association of offices and engineering firm and ranked according to Std. Deviation from the most agreeable to the least agreeable from respondents.

Figure (5-8) also shows the percentage of agreement of respondents regarding the structure of the association of offices and engineering firm as will be detailed below.

Table (5-9): Means, std. deviation and the percent weight and rank of each item.

#	Items	Mean	Std. Deviation	T test	p-value	Rank
1	The number of members of the board of directors of the association of offices and engineering firm is Compatible with the association's tasks	2.557	1.555	-2.223	0.030	**2**
2	The chairman of the association is committed to effectiveness and high ability in order to perform the required tasks	1.902	1.091	-7.863	0.000	**4**
3	The limitation of board of directors of the association by representatives of the association gives independency, power and liberty to the association in making decisions	2.197	1.470	-4.268	0.000	**3**
4	Involvement of outside members in board of directors of the association is necessary	4.311	1.205	8.502	0.000	**1**
5	The board of directors of the association develops, form or implement policies related to its formation (size, formation, skills, expertise … etc.)	1.787	0.878	-10.794	0.000	**6**
6	The used elective system is appropriate and emerge board of director's members with efficiency and ability to perform the tasks.	1.754	0.869	-11.197	0.000	**7**

7	There are harmony and cooperation between the board of director's members which contribute in rogress of the work.	1.885	0.950	-9.161	0.000	5

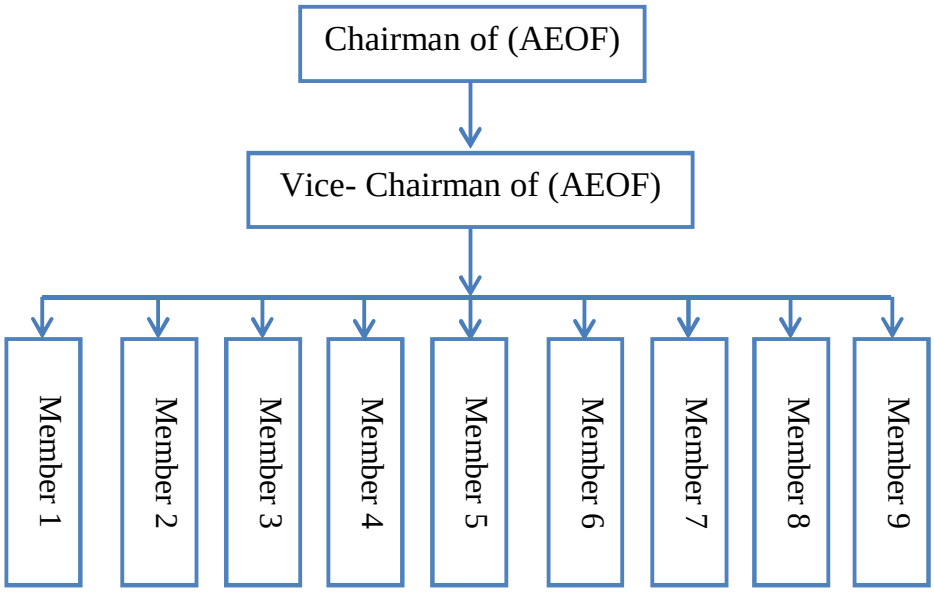
Critical value of t at df "59" and significance level 0.05 equal 2.00
Critical value of t at df "59" and significance level 0.01 equal 2.66

- " Involvement of outside members in board of directors of the association is necessary" that occupied the first rank with percent weight (86.23%).

By reviewing the regulation in Gaza Strip, the board of directors of the association of offices and engineering firm consist of chairman, vice-chairman and nine members as shown in Figure (5-8).

The candidate for the chairman position or vice-chairman shall be a member of engineers syndicate who has been practicing the engineering profession for a period for not less than 11 years.

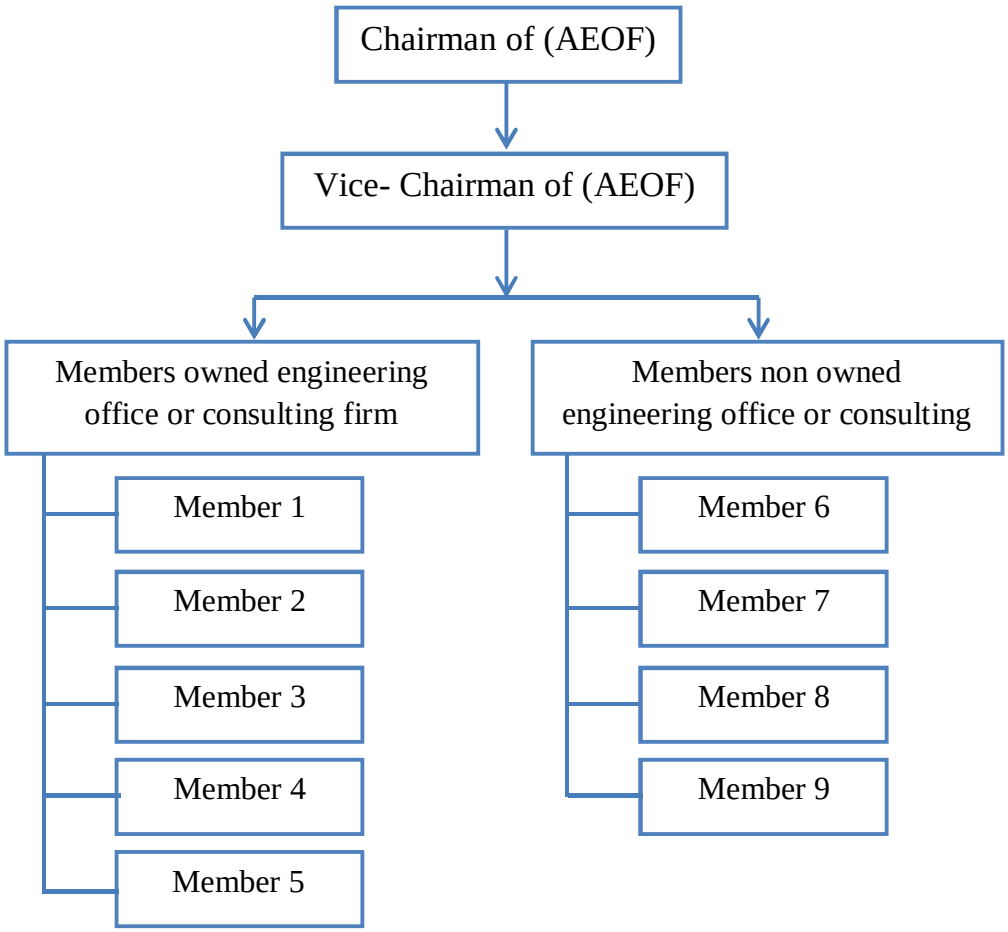
The board members shall be a member of engineers syndicate who has been practicing the engineering profession for a period for not less than 5 years



Figure(5-8): The structure of (AEOF) according to engineers syndicate.

It is noteworthy that the law stipulate that the chairman, his deputy or the board members must be owned engineering office or consulting firm, this article refused by respondents. Through open question respondents suggest the necessity of involvement of outside members such as an independent member from the syndicate or an observer member from governmental agencies. Many suggestions that members do not necessary to be one of those who own offices or firms, but it is sufficient to be an engineer with a certain expertise.

According to interviews and questioners analysis, the researcher suggest some modification on the structure of (AEOF) as shown in Figure (5-9).



Figure(5-9): The suggested structure of (AEOF).

The researcher suggest that the members not owned engineering office or consulting firm as following:

1. A representative of the government institutions
    a. The Ministry of Public Works and Housing or,
    b. Ministry of Local Government or,
    c. Central Tenders Commission.
2. A representative of the non-governmental institutions or municipalities.
3. Independent representative from engineers syndicate (as a monitor).
4. Independent representative (as support member to the firms).

- " The number of members of the board of directors of the association of offices and engineering firm is compatible with the association's tasks" that occupied the second rank with percent weight (51.15%). This percentage emphasizes that number of board's members is high explaining, in experts' point of view, lack of tasks and achievements that association's board achieve.
- " The board of directors of the association develops, form or implement policies related to its formation (size, formation, skills, expertise … etc.)." that occupied the six rank with percent weight (35.74%).
- " The used elective system is appropriate and emerge board of director's members with efficiency and ability to perform the tasks" that occupied the last rank with percent weight (35.08%).

5.2.3 Management effectiveness of the (AEOF):

Table (5-10) shows the opinion of the respondents about support and supervising of the association of offices and engineering firm to the offices and companies and ranked according Std. Deviation from the most agreeable to the least agreeable from respondents. Table (5-10) also shows the percentage of agreement of respondents regarding about support and supervising of the association of offices and engineering firm to the offices and companies as will be detailed below

Table (5-10): Means, std. deviation and the percent weight and rank of each item.

#	Items	Mean	Std. Deviation	T test	p-value	Rank
1	The board of directors of the association plays sufficiently the role related to him	2.115	1.112	-6.217	0.000	**2**
2	The board of directors of the association uses the authorities granted to him in efficient way within the system	2.016	1.190	-6.455	0.000	**4**
3	There are clear priorities at The board of directors of the association concerning the administration of offices file and engineering firms	1.852	1.152	-7.778	0.000	**6**
4	Donors are committed to classification of the Association.	4.098	0.870	9.861	0.000	**1**

5	The Association supervises and follows engineering offices and consulting firms	2.082	1.159	-6.187	0.000	**3**
6	The Association provides continuous technical and administrative support to the engineering offices and consulting firms	1.279	0.733	-18.33	0.000	**7**
7	The Association contributes in solving problems that face engineering offices and consulting firms	1.869	1.162	-7.606	0.000	5

Critical value of t at df "59" and significance level 0.05 equal 2.00
Critical value of t at df "59" and significance level 0.01 equal 2.66

- " Donors are committed to classification of the Association " that occupied the first rank with percent weight (81.97%). The researcher refers the high ratio to that all donors demand a valid classification's certificate for all offices that apply to any project.
- " The board of directors of the association plays sufficiently the role related to him " that occupied the second rank with percent weight (42.30%).
- " There are clear priorities at the board of directors of the association concerning the administration of offices file and engineering firms " that occupied the six rank with percent weight (37.05%)
  " The Association provides continuous technical and administrative support to the engineering offices and consulting firms " that occupied the last rank with percent weight (25.57%). Respondents emphasized that support from the association is trivial, since communication with offices does not occur except when classification's renewal is demanded.

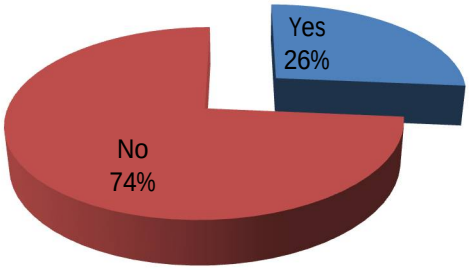
Conflict situation with other sides (owner .. contractors):

The researcher mean of conflict: a disagreement among project parties including disputes relating to the financing behind projects, claims for delay and loss and expense, claims for negligent design and/or workmanship and project overspends (Rajoo, 2008).

Table (5-11) and Figure (5-10) shows that more than 73% of the respondents haven't been in a conflict situation with other sides (owner .. contractors) and 26.39% of the respondents haven been in a conflict situation with other sides (owner .. contractors).

Table (5-11): Conflict situation with other sides (owner .. contractors).

Have your office ever been in a conflict situation with other sides (owner .. contractors)?	Frequency	Percent
Yes	19	26.39
No	53	73.61
Total	72	100.00



Figure(5-10): Conflict situation with other sides (owner .. contractors).

Table (5-12) show that more than 84% of the respondents didn't inform the association, 10.53% of the respondents inform the association but, didn't provide help and 5.62% of the respondents inform the association and it provide help.

Table (5-12): The role that The Association plays in solving this conflict.

If "Yes", what is the role that the association plays in solving this conflict?	Frequency	Percent
The Association did not informed.	16	84.21
The Association informed but, did not provide help.	2	10.53
The Association informed and provide help.	1	5.26
Total	**19**	**100**

Respondents, concerning this term, mentioned that the Association does not intervene in any issue even if they knew about it unless a complaint has been made by one of conflict's parties.

Conflict situation with other firms:

Table (5-13) show that more than 91% of the respondents haven't been in a conflict situation with other firms and 8.33% of the respondents have been in a conflict situation with other firms.

Table (5-13): Conflict situation with other firms.

Have your office ever been in a conflict situation with other firms?	Frequency	Percent
Yes	6	8.33
No	66	91.67
Total	72	100.00

Table (5-14) show that more than 33.33% of the respondents didn't inform the association, 16.67% of the respondents inform the association but, didn't provide help and 50% of the respondents inform the association and it provide help

Table (5-14): The role that The Association plays in solving this conflict.

If "Yes", what is the role that the association plays in solving this conflict?	Frequency	Percent
The Association did not informed.	2	33.33
The Association informed but, did not provide help.	1	16.67
The Association informed and provide help.	3	50.00
Total	**6**	**100.00**

Conflict situation with the association:

Table (5-15) show that more than 95% of the respondents haven't been in a conflict situation with the association and 4.92% of the respondents have been in a conflict situation with the association.

Table (5-15): Conflict situation with other firms.

Have your office ever been in a conflict situation with the association?	Frequency	Percent
Yes	3	4.92
No	69	95.08
Total	**72**	**100.00**

Through open question, respondents who have issues with the association referred their issues to violation of price in one of the projects and the office has been suspended for a while.

5.2.4 Classification procedures in the (AEOF):

Table (5-16) shows the opinion of the respondents about specifications' procedures that used in the association of offices and engineering firm for the engineering offices and consulting firms and ranked according Std. Deviation from the most agreeable to the least agreeable from respondents. Table (5-16) also shows the percentage of agreement of respondents regarding specifications' procedures that used in the (AEOF) for the engineering offices and consulting firms as will be detailed below.

Table (5-16): Means, std. deviation and the percent weight and rank of each item.

#	Items	Mean	Std. Deviation	T test	p-value	Rank
1	Policies and procedures of the Associations' classification to the offices and firms are clear	4.361	0.817	13.005	0.000	**2**
2	Policies and procedures of the Associations' classification to the offices and firms are fair	2.738	1.094	-1.873	0.066	**6**
3	Policies and procedures of the Associations' classification to the offices and firms are clear are continually revised and verified	1.672	0.944	-10.989	0.000	**8**
4	Classifications' procedures are easy and easily available, and committed to only provided paper files.	4.492	0.868	13.417	0.000	**1**
5	Six months as a classifications' period is sufficient	1.672	0.944	-10.989	0.000	**8**
6	The process of classifications' renewal ignores the performance of office and evaluation of its employees during the past period	4.262	0.947	10.411	0.000	**3**
7	Standards of manufacturing are sufficient and comprehensive for evaluating the real abilities of the office.	2.131	1.024	-6.625	0.000	**7**
8	It is preferred to increase classifications' categories (Engineer office, Engineering office B, Engineering office A, Consulting office)	3.541	1.119	3.775	0.000	**5**
9	Confirmation of the classifications' certificate by other sides is necessary	3.689	1.246	4.317	0.000	4

Critical value of t at df "59" and significance level 0.05 equal 2.00
Critical value of t at df "59" and significance level 0.01 equal 2.66

- Number (4) " Classifications procedures are easy and easily available, and committed to only provided paper files " that occupied the first rank with percent weight (89.84%) Based on firms and grand offices, this term causes annoyance since it is easy for any office to enter competition's arena and renew classification.

- " Policies and procedures of the Associations' classification to the offices and firms are clear " that occupied the second rank with percent weight (87.21%). In addition, that what has been explained at the previous term.

- " Policies and procedures of the Associations' classification to the offices and firms are clear are continually revised and verified " that occupied the eight rank with percent weight (33.44%)

- Number (5) " Six months as a classifications' period is sufficient " that occupied the last rank with percent weight (33.44%). Respondents shared their dissatisfaction about the duration of the classification since it is very short. Some of them suggested to increase the duration with more supervising.

5.3 Criteria influencing the classification process:

This part consists of the results and discussion of the factors that influence the classification process as presented in the questionnaire. The factors were categorized into eight criteria; these criteria are capital office/company, fixed term staff in office/company, reputation of the office (testimony of previous employees), size of implemented projects, size of general tenders (not private), total experience of the office, experience of the offices' staff and logistic equipment for the office. To determine the relative importance index (RII) of the criteria, these scores were transformed to importance relative indices based on the formula:

Relative Importance Index (RII) = $\frac{\sum W}{AN} = \frac{\sum_1^5 i\, n}{8\, N}$

Where *w* is the weight given to each factor by the respondent, ranging from 1 to 5, (n1 = number of respondents for Very Important, n2 = number of respondents for Important, …….. n8 = number of respondents for No Importance). A is the highest weight (i.e. 8 in the study) and N is the total number of samples. The RII equals ranges from 0 to 1.

Table (5-18) shows the respondents' opinion regarding the classification criteria for offices/companies. The factors' RII is as the following:

Table (5-17): Rank and RII of the classification criteria.

#	Criteria	RII	Rank
1	Capital office/company **(CA)**	0.75	8
2	Fixed term staff in office/company**(FT)**	0.87	3
3	Reputation of the office **(RO)**	0.80	6
4	Size of implemented projects**(SI)**	0.83	5
5	Size of general tenders **(SG)**	0.84	4
6	Experience of the office **(EX)**	0.90	2
7	Experience of the offices' staff**(ES)**	0.92	1
8	Logistic equipment for the office**(LE)**	0.77	7

The results indicate that the experience of the offices' staff obtained the highest rank that agreed to some extent with previous studies conducted by AL-Shobaki, (2008) and Dadzie et al, (2012). The total experience of the office and fixed term staff in office/company are with rank 2 and 3 respectively, which reflects their importance in the classification process.

The relative importance index of the experience of the offices' staff equals 0.92, which indicates its highest importance. Same thing is valid for the total experience of the office and fixed term staff in office/company.

The factors related the logistic equipment for the office and the capital office/company has low RII compared with the other factors. The researcher refers that to the nature of most companies, which considered relatively small and locally competitive.

5.4 The classification criteria weights:

This part deals with the steps of establishing the model of criteria of the classification of the engineering offices and consulting firms. Accordingly, the classification criteria have been identified based on the statistical analysis results of questionnaire to be the base for establishing the selection model in order to determine its weights based on AHP.

By following AHP steps described in the section 5.6, the hierarchy of the problem can be developed as shown in Figure (4-9). The decision-makers have to indicate preferences or priorities for each decision alternative in terms of how it contributes to each criterion as shown in Table (5-18). The results were obtained by interviewing respondents when filling out the questionnaire and explaining the mechanism of mobilization of this part, it can be considered these results initial to predict the weight of each criterion of classification criteria.

Table (5-18): Pairwise comparison matrix of the classification criteria.

	C.A	F.T	R.O	S.I	S.G	E.X	E.S	L.E
C.A	1.00	0.17	0.33	0.25	0.20	0.14	0.13	0.50
FT	6.00	1.00	4.00	3.00	2.00	0.50	0.33	5.00
R.O	3.00	0.25	1.00	0.50	0.33	0.20	0.17	2.00
S.I	4.00	0.33	2.00	1.00	0.50	0.25	0.20	3.00
S.G	5.00	0.50	3.00	2.00	1.00	0.33	0.25	4.00
T.E	7.00	2.00	5.00	4.00	3.00	1.00	0.50	6.00
E.C	8.00	3.00	6.00	5.00	4.00	2.00	1.00	7.00
L.E	2.00	0.20	0.50	0.33	0.25	0.17	0.14	1.00

The calculations for these items will be explained next for illustration purposes. Synthesizing the pairwise comparison matrix is performed by dividing each element of the matrix by its column total. For example, the value 0.03 in the first row in Table (5-19) is obtained by dividing 1 (from Table 5-17) by the sum of the first column items in Table (5-18) and so forth.

The priority vector in Table (5-19) can be obtained by finding the row averages. For example, the priority vector of the "Capital" in Table (5-19) is calculated by dividing the sum of the first row in Table 5-18 (0.03+0.02+0.02+0.01+0.02+0.03+0.05+0.02)) by the number of criterion (columns), i.e., 8, in order to obtain the value 0.02. The priority vectors for all the nine criteria indicated in Table (5-18), is given below which represent their weights from the decision-makers viewpoint.

Table (5-19): Synthesized matrix of the main criteria.

	C.A	F.T	R.O	S.I	S.G	E.X	E.S	L.E	Priority Vector
C.A	0.03	0.02	0.02	0.02	0.02	0.03	0.05	0.02	0.02
F.T	0.17	0.13	0.18	0.19	0.18	0.11	0.12	0.18	0.16
R.O	0.08	0.03	0.05	0.03	0.03	0.04	0.06	0.07	0.05
S.I	0.11	0.04	0.09	0.06	0.04	0.05	0.07	0.11	0.07
S.G	0.14	0.07	0.14	0.12	0.09	0.07	0.09	0.14	0.11
E.X	0.19	0.27	0.23	0.25	0.27	0.22	0.18	0.21	0.23
E.S	0.22	0.40	0.27	0.31	0.35	0.44	0.37	0.25	0.33
L.E	0.06	0.03	0.02	0.02	0.02	0.04	0.05	0.04	0.03

The next step is to calculate the consistency ratio by multiply Priority Vector by Pairwise comparison matrix as follow:

$$\text{(Weighted sum matrix)} = \begin{vmatrix} 0.19 \\ 1.31 \\ 0.40 \\ 0.60 \\ 0.90 \\ 1.84 \\ 2.60 \\ 0.27 \end{vmatrix}$$

Dividing all the elements of the weighted sum matrices by their respective priority vector element, we obtain:

$$\begin{vmatrix} 0.19 \\ 1.31 \\ 0.40 \\ 0.60 \\ 0.90 \\ 1.84 \\ 2.60 \\ 0.27 \end{vmatrix} \div \begin{vmatrix} 0.02 \\ 0.16 \\ 0.05 \\ 0.07 \\ 0.11 \\ 0.23 \\ 0.33 \\ 0.03 \end{vmatrix} = \begin{vmatrix} 7.79 \\ 8.38 \\ 7.95 \\ 8.18 \\ 8.40 \\ 8.10 \\ 7.96 \\ 7.81 \end{vmatrix}$$

(λ matrix)

Calculating λ max by taking the average of all elements in λ matrix as follows:

$$\lambda \text{ max} = \frac{(7.79+8.38+7.75+8.18+8.4+8.1+7.96+7.81)}{8} = 8.07$$

Now, we find the consistency index, CI, as follows:

$$\text{CI} = \frac{\lambda \text{ max} - n}{n-1} = \frac{8.07-8}{8-1}$$

CI = 0.01

Selecting appropriate value of random consistency ratio, RI, for a matrix size of eight using Table (2-4), we find RI = 1.41. Then the consistency ratio, CR, is calculated as follows:

$$CR = \frac{RI}{CI} = \frac{0.09}{1.41} = 0.07$$

As the value of CR is less than 0.1, the judgments are acceptable. Table (5-18) shows the weights of the main criteria of the classification process of the engineering offices and consulting firms.

The criteria were ranked according to its weight from highest to lowest as the following table:

Table (5-20): Rank of the main criteria.

#	Criteria	%
1	Experience of the offices' staff	33%
2	Total experience of the office	23%
3	Fixed term staff in office/company	16%
4	Size of general tenders (not private)	11%
5	Size of implemented projects	7%
6	Reputation of the office (testimony of previous employees)	5%
7	Logistic equipment for the office	3%
8	Capital	2%

The results indicated that the major decision criteria include Capital office/company ; Fixed term staff in office/company; Reputation of the office (testimony of previous employees); Size of implemented projects; Size of general tenders (not private); Total experience of the office; Experience of the offices' staff and Logistic equipment for the office. Thus, it is concluded that these eight criteria are important and should be applied when classifying of the engineering offices and consulting firms.

5.5 Classification model based on AHP:

Based on the final result obtained above, the researcher suggest the following classification model:

1. Combining similar criteria like logistic equipment and the capital under main criteria (Resource and logistic) with 5%.

2. Integrate similar criteria like total experience of the office, size of general tenders, size of implemented projects, reputation of the office (testimony of previous employees) under main criteria (Previous projects) with 45%.
3. Experience of the offices' staff will be round to be 35%.
4. Fixed term staff in office/company with 15%.

The main criteria and sub criteria and its weight shown in Table (5-21).

Table (5-21): Main criteria and sub criteria and its weight.

Criteria	Sub criteria	Weight
Resource and logistic of the office	Logistic equipment	3%
	Capital	2%
Previous implemented projects of the office	Total experience of the office	20%
	Size of general tenders	10%
	Size of implemented projects	10%
	Testimony of previous employees	5%
Experience of the offices' staff	According to Gaza strip system it is measure by the number of years	35%
Fixed term staff in the office	According to Gaza strip system it is measure by the number of administrators and secretaries	15%

It is obvious from the findings that the total previous implemented projects of the office with weight 45% the highest rank. This is due to the fact that total experience of the office, size of general tenders, size of implemented projects and testimony of previous employees are extremely major and play a major role in the improvement of consultancy practice and success of any project at any stage. This is compatible with many programs for evaluating several institutions such as PECDAR and central classification committee.

Experience of the offices' staff obtained a reasonable weight of 35% that agreed to some extent with previous studies conducted by AL-Shobaki A., (2006) and Dadzie et al., (2012). The researcher refers the relatively high weight of the experience of the staff to the necessity of obtaining the most suitable engineering expertise in order to implement the projects and avoid all kinds of risk, made savings and success at the conceptual and design stages. It is therefore important to select the consultant who will contribute most to the overall success of the project.

Fixed term staff in office/company has a satisfactory weight equals 15%. The low weight of the criteria relevant to fixed term staff (junior staff) was anticipated due to

the Palestinian consultants culture in dealing with the engineers and increase their weight of workload. In most engineering firms in Gaza strip the engineers work as administrators and secretaries.

Resource and logistic of the office obtained a reasonable weight of 5%. The researcher refers this weight of the main criteria capital resource and logistic of the office to the necessity for sound financial consultants in order to implement the projects and avoid all kinds of risk such as insolvency and bankruptcy, which undoubtedly has negative impact on the success of the project.

Chapter 6

CONCLUSION AND RECOMMENDATIO

6.1. Introduction:

This chapter introduces the research conclusions and recommendations for many parties involved in the construction process to improve the local practices in the classification process. Recommendations for further studies are also included.

6.2. Conclusion:

- By reviewing and studying the applied regulation of classifying engineering offices in UAE and in the Gaza strip and comparing the two regulations in some aspects and reviewing points of similarity and difference between the two regulations, the weaknesses of classification system in the Gaza strip where determined.

- From literature review it is found that there are lack in studies which investigate the classification system of engineering consulting firms in Gaza Strip.

- Preoccupation of engineers with work, lack of interest or dissatisfaction with system of election since it is conglomerates and non-active role of the association's board are the main reasons of non-participation in association's board of directors.

- The importance of involvement of outside members such as an Independent member from the syndicate or an observer member from governmental agencies in association's board of directors. Some suggested that members do not necessary to be one of those who own offices or firms, but it is sufficient to be an engineer with a certain expertise.

- Classifications procedures are easy and easily available, and committed to only provided paper files, this term causes annoyance since it is easy for any office to enter competition's arena and renew classification.

- The support from the association is trivial, since communication with offices does not occur except when classification's renewal is demanded and association doesn't intervene in any issue even if they knew about it unless a complaint has been made by one of conflict's parties.

- The factors that influence the classification process were categorized into eight criteria; these criteria were ranked according to its weight from highest to lowest:
    a. Experience of the offices' crew 33%.
    b. Total experience of the office 23%.
    c. Constant crew in office/company 16%.
    d. Size of general tenders (not private) 11%.
    e. Size of implemented projects 7%.
    f. Reputation of the office (testimony of previous employees) 5%.

g. Logistic equipment for the office 3%.
h. Capital 2%.

- Based on the final result obtained above, the researcher suggest the following classification model:

Criteria	Sub criteria	Weight
Resource and logistic of the office	Logistic equipment	3%
	Capital	2%
Previous implemented projects of the office	Total experience of the office	20%
	Size of general tenders	10%
	Size of implemented projects	10%
	Testimony of previous employees	5%
Experience of the offices' staff	According to Gaza strip system it is measure by the number of years	35%
Fixed term staff in the office	According to Gaza strip system it is measure by the number of administrators and secretaries	15%

- The findings have agreed with several local and global previous studies in this field, which enrich and represent a strength point for this research.
- It is obvious from the findings that the total previous implemented projects of the office with weight 45% the highest rank. This is compatible with many programs for evaluating several institutions such as PECDAR and central classification committee.
- Experience of the offices' staff obtained a reasonable weight of 35% that agreed to some extent with previous studies conducted by AL-Shobaki A., (2006) and Dadzie et al, (2012).
- Fixed term staff in office/company has a satisfactory weight equals 15%. The low weight of the criteria relevant to fixed term staff (junior staff) was anticipated due to the Palestinian consultants culture in dealing with the engineers and increase their weight of workload. In most engineering firms in Gaza strip the engineers work as administrators and secretaries.
- Resource and logistic of the office obtained a reasonable weight of 5%. The researcher refers this weight of the main criteria capital resource and logistic of the office to the necessity for sound financial consultants in order to implement the projects and avoid all kinds of risk such as insolvency and bankruptcy, which undoubtedly has negative impact on the success of the project.

6.3. Recommendation:

1. Researcher recommends using the classification criteria of Capital office/company, Constant staff in office/company, Reputation of the office (testimony of previous employees), Size of implemented projects, Size of general tenders (not private), Total experience of the office, Experience of the offices' staff and Logistic equipment for the office in this study as a basis in the classification process of offices/companies in the construction industry in Gaza Strip. Moreover, it is recommended to consider the other criteria of claims and contractual disputes, and current workload in the awarding stage.
2. The Association of Engineering Offices And Consulting Firms (AEOF) is recommended to establish comprehensive and database regarding offices/companies who dealt with them with respect to their financial abilities، experience, performance etc. in order to be the basis of any development of classification process in future. This step will save a lot of time and manage the donors to select the best office/company. Moreover, it will enforce the offices/companies to improve their performance, which in turn will share in improving the construction industry in Gaza Strip.
3. Encouraging the implementing owners/ donors to use AHP in the classification process and helping them to understand and apply AHP approach by initiating training workshops.
4. AHP approach, in addition to its efficiency in classification process, can be developed further to use in the evaluation process in the awarding stage.
5. Researchers are invited to obtain classification sub criteria for each criteria of this research.
6. Study the possibility of using methods other than AHP in the classification process for offices/companies. In addition, study the possibility of merging AHP with other methods in order to obtain improved results.

References

References:

Abu Rass, A. , *"An investigation of dispute resolution in the construction industry: The case of Gaza Strip"*, MSc. Dissertation. Islamic University of Gaza Strip, (2006).

Al-Harbi, K. " Application of the AHP in Project Management", International Journal of Project Management, Vol.19, pp. 19-27, (2001).

Al-Mussallami, A., "Owners Satisfaction With Consultancy Practices In Saudi Arabia", Master Thesis in Engineering and Construction Management, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia, (2000).

AL-Shobaky E., " The local selection methods for consultant selection problems in Gaza Strip, according to decision makers", Thesis Master, The Islamic University-Gaza, Palestine, (2008).

Al Wahaidi s., "An Analytical Hierarchy Process (AHP) Based Prequalification System for Gaza Strip Construction Contractors", MSc. Dissertation. Islamic University of Gaza Strip, (2012).

American Society of Civil Engineers, *"Guidance on Licensing and Ethical Responsibilities for Civil Engineers"*, Edition Developed by National Institute for Engineering Ethics, (2001).

Assaf S., Jannadi O., Siddiqui A. and Al-Besher M., *"A conceptual model for A/E consultant selection in Saudia Arabia"*, College of Environmental Design, King Fahd University of Petroleum & Minerals, Dhahran, (2000).

Bahurmoz, A., " The Analytic Hierarchy Process: A Methodology for Win in Management", JKAU: Econ. & Adm., Vol. 20 no. 1, pp. 3-16, (2006).

Behm M., *"Rapporteur's Report Construction Sector"*, Journal of Safety Research. No. 39, pp.175–178, (2008).

Boroushaki S. and Malczewski J., *" Implementing an Extension of the Analytical Hierarchy Process Using Ordered Weighted Averaging Operators with Fuzzy Quantifiers in Arcgis"*, Computers and Geosciences, Vol. 34, pp. 399–410, (2008).

Buckley J.J., *" Fuzzy Hierarchical Analysis. Fuzzy Sets and Systems"*, Vol. 17 no. 3, pp. 233-247, (1985).

Chan A. and Chan W., *" Developing a benchmark model for project construction time performance in Hong Kong"*, Journal of Building and Environment, Vol. 39, PP. 339-349, (2004).

Cheng, E. and Li, H., *" Contractor Selection Using the Analytic Network Process"*, Construction Management and Economics, Vol. 22, pp. 1021-1032, (2004).

Chow, L. and Ng, S., , *" Delineating the performance standards of engineering consultants at design stage"* , Construction Management and Economics, 28 (1), 3-11, (2010).

Dadzie J., Abdul-Aziz A. and Kwame A., " Performance of consultants on government projects in Ghana ", International Journal of Business and Social Research (IJBSR), Vol. 2, No. 6, (2012).

Douglas P., Mark W. and Matthew J., " state Survey of Firm Licensure Requirements for Architectural and Engineering Firms", 1st Edition – Published January (2015).

Engineering Associate, 2015. About associate. http://www.enggaza.ps/index.php?action=abut#1, accessed on 5 Apr. 2015.

El-Sawalhi, N., Eaton, D. and Rustom, R. "Contractor Pre-Qualification Model: State-of-the-Art.", International Journal of Project Management, Vol. 25 no. 5, pp. 465–474, (2007).

"Engineering Council UK website, FAQ page". Engineering Council UK, accessed on Feb.2015

Enshassi A., Choudhry R, Mayer P. & Shoman Y., *" Safety Performance of Subcontractors in the Palestinian Construction Industry*", Journal of Construction in Developing Countries , Vol.13, No.1, pp.51-62, (2008).

Fayek, A. R. and Marsh, K., "Joint International Conference on Computing and Decision Making in Civil and Building Engineering", Montréal, Canada. pp. 3763- 3772, (2006).

Fong, P.S-W. and Choi, S.K-Y., " *Final Contractor Selection Using the Analytical Hierarchy Process*", Construction Management and Economics, Vol. 18, pp. 547–57, (2000).

Gyadu W., *"Assessing Construction Project Performance in Ghana"*, Unpublished PhD Thesis, Faculty of Built and Natural Environment, Kumasi, Ghana (2009).

Gray, C. and Little, J.,*"A systematic approach to the selection of an appropriate crane for a construction site"*,Construction Management and Economics, Vol. 3, 121–144, (1985).

Gregory M. and Silvia P., *" Mandatory Classification Requirements for Engineers and Contractors in Abu Dhabi"*, Afridi & Angel l law firm, UAE, (2014).

Han W.J. and Tsay W.D., *"Formulation of Quality Strategy Using Analytic Hierarchy Process"*, Twenty Seven Annual Meeting of the Western Decision Science Institute, University of Northern Colorado, USA, pp. 580–583, (1998).

International Federation of Consulting Engineers (FIDIC), "Quality based consulting selection guide", (2011).

Jadid M., " Classification of Engineering Consultancy Firms Using Self-Organizing Maps", International Journal of Civil & Environmental Engineering Vol.13 No.03, (2013).

Kohonen E., (2006), " Self-Organizing Maps ", Springer, Berlin, Publication, (2001).

Malczewski J., *" GIS and Multicriteria Decision Analysis"*, New York: John Willey and Sons, Inc., (1999).

Market Access Program (MAP), *"Survey of the Construction Services Industry"*, Unpublished mission report, West Bank and Gaza, (2002).

Municipal System Portal - Emirate of Abu Dhabi, <https://municipalgateway.com>, accessed on 25 Feb.2015.

Ministry of Municipality & Urban Planning, Engineers & Consulting Offices, Accrediting Committee, In the State of Qatar, http://www.baladiya.gov.qa/, accessed on 2 Feb.2015.

Naoum, S. G., *"Dissertation Research and Writing for Construction Students"*, Reed Educational and Professional Publishing Ltd. Butter worth Heinemann, (2007).

National society of professional engineers (NSPE), http://www.nspe.org/, accessed on Dec.2015.

Ncube, C. and Dean, J.C., *"The Limitations of Current Decision-Making Techniques in the Procurement of COTS Software Components"*, Orlando, FL. pp. 176-187, (2002).

Ogunlana, S. and Olomolaiye. P., *"Factors and procedures used in matching project managers to construction projects in Bangkok"*, International Journal of Project Management, Vol. 20, No. 5, July, PP. 385-400, (2002).

Pakistan Engineering Council (PEC), "Standard Procedure for Pre-Qualification of Consultants" (2009).

Radwan I., *"Afees estimating model for constructing engineering firms in the Gaza Strip"*, Thesis Master, The Islamic University-Gaza, Palestine, (2004).

Raufaste, N., and Callahan, J., *"A Draft Strategic Plan to Improve the Competitiveness of the West Bank and Gaza Strip Construction Sector"*, Market Access Program (MAP), (2002).

Rajoo S., *"Arbitration In The Construction Industry"*, Master Builders. 1 st quarter pp.72-76, (2008).

Saaty, T.L. ," *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World"*, RWS Publication, Pittsburg, PA. (translated into Arabic by Bahurmoz and Hamshary, Institute of Public administration, Riyadh), (2000).

Shoman, Y., *" Measuring the efficiency of construction companies in Gaza Strip"*, MSc. Dissertation. Islamic University of Gaza Strip, (2009).

Statistical Package for the Social Science, (SPSS), Accessed from: www.spss.com/ on Aug. 2015.

Thabet M., "*IT applications in construction industry in Gaza Strip"*, Thesis Master, The Islamic University-Gaza, Palestine, (2006).

The Association of Consulting Engineers of Ireland, *"Guideline for consulting engineering classification"*, (2015).

The Association of Consulting Engineers New Zeilanda, *"Guideline on the briefing & engagement for consulting engineering services"*, 1st edition, (2004).

The Institution of Engineers Sri Lanka (IESL), "*Guideline structure for engineering consultancy fees"*, (2001).

Topcu, Y.I., *" A Decision Model Proposal for Construction Contractor Selection in Turkey"*, Building and Environment, Vol. 39, pp. 469–481, (2004).

United Nation (UN) Committee on Trade and Development, *"Prospect for Sustained Development of the Palestinian Economy in the West Bank and Gaza 1990 to 2010: A Qualitative Framework"*, Geneva, (2010).

World Bank, *"West Bank and Gaza in Brief"*, Washington, USA, (2001).

World Bank, *"Guidelines selection and employment of consultants"*, Washington,USA, Sixth printing, (2002).

Appendix 1

The Islamic University
Faculty of Engineering
Deanery of Graduate Studies

الجامعة الإسلامية – بغزة
كلية الهندسة
عمادة الدارسات العليا

Improving the classification system of consulting firms in the Gaza Strip

Dear sir,

First, I would like to present my pleasure and thanks to you for consuming part of your time and effort in participating to complete this questionnaire.

This questionnaire is prepared to study the classification system of consulting firms in the Gaza Strip. And it is a part of partial of the requirements for degree of master in construction management in Islamic University – Gaza.

All information in the questionnaire will be used for research with complete commitment for absolute confidentiality to your information.

In advance, thank you for your participation.

Sincerely,

Safaa Abu EL-Aish

Section one : General Information:

1- Please, mention the nature of your work in the office / company:
   - O Owner (office / company)
   - O Representative (office / company)
   - O Head of specialization (office / company)
   - O Another job, mention …

2- Degree of classification of the office:
   - O Engineer office
   - O Engineering office B
   - O Engineering office A
   - O Consulting office

3- Specialty of classification (more than choice could be chosen):
   - O Structural
   - O Architectural
   - O Electrical
   - O Mechanical
   - O Projects administration
   - O Sewage
   - O Roads
   - O All of the above

4- Duration of getting the classification degree:
   - O More than 15 yrs.
   - O From 10 – 15 yrs.
   - O From 5 – 10 yrs.
   - O Less than 5 yrs.

5- Amount of projects that their documentations and design have been prepared during the past five years (in million dollars):
   - O Less than 1
   - O From 1-5
   - O From 5-10
   - O More than 10

6- Amount of projects that have been supervised in implementation during the past five years (in million dollars):
   - O Less than 1
   - O From 1-5
   - O From 5-10
   - O More than 1

Section two: The association of offices and engineering firm:

1- Have you ever reviewed the association of offices and engineering firm:

- O Yes
- O No

2- have you ever been a candidate for membership of the board of directors of the association of offices and engineering firm:

- O Yes
- O No

If the answer (No), mention the causes:……
……
……

3- In your point of view, Please tick the appropriate item that you Strongly Agree (SA), Agree (AG), Disagree (DA), Strongly Disagree (SD), Don't Know (DK) the statements as below:

#	Item	SA	AG	DA	SD	DK
1	The number of members of the board of directors of the association of offices and engineering firm is Compatible with the association's tasks					
2	The chairman of the association is committed to effectiveness and high ability in order to perform the required tasks					
3	The limitation of board of directors of the association by representatives of the association gives independency, power and liberty to the association in making decisions					
4	Involvement of outside members in board of directors of the association is necessary.					
5	The board of directors of the association develops, form or implement policies related to its formation (size, formation, skills, expertise … etc.)					
6	The used elective system is appropriate and emerge board of director's members with efficiency and ability to perform the tasks.					
7	There are harmony and cooperation between the board of director's members which contribute in progress of the work.					

4- Do you have comments on the performance of the association which is related to its formation and environment of the work

……
……

5- Do you have suggestions about elective system's development which is followed in the association

……
……
……

Section three: support and supervising of the association of offices and engineering firm to the offices and companies

In your point of view, Please tick the appropriate item that you Strongly Agree (SA), Agree (AG), Disagree (DA), Strongly Disagree (SD), Don't Know (DK) the statements as below: 3.1

#	Item	SA	AG	DA	SD	DK
1	The board of directors of the association plays sufficiently the role related to him					
2	The board of directors of the association uses the authorities granted to him in efficient way within the system					
3	There are clear priorities at The board of directors of the association concerning the administration of offices file and engineering firms					
4	Donors are committed to classification of the Association.					
5	The Association supervises and follows engineering offices and consulting firms					
6	The Association provides continuous technical and administrative support to the engineering offices and consulting firms					
7	The Association contributes in solving problems that face engineering offices and consulting firms					

3.2 Have your office ever been in a conflict situation with other sides (owner .. contractors)?

- O Yes
- O No

If "Yes", what is the role that The Association plays in solving this conflict?

- O The Association did not informed
- O The Association did informed but, did not provide help
- O The Association did informed but and provide help

3.3 Have your office ever been in a conflict situation with offices or other firms?

- O Yes
- O No

If "Yes", What is the role that The Association plays in solving this conflict?

- O The Association did not informed
- O The Association did informed but, did not provide help
- O The Association did informed but and provide help

3.4 Have your office ever been in a conflict situation with the Association?

- O Yes
- O No

If "Yes", explain the conflict and the mechanism of solving the conflict:
……
……..……
…….

3.5 Do you think that there are other tasks and responsibilities should be granted to the Association?

- O Yes
- O No

If "Yes", Explain:
……
……
……

3.6 Do you think that there are other tasks and responsibilities should be deleted from the Association?

- O Yes
- O No

If "Yes", Explain:
……
……
……

Section four: specifications' procedures that used in the association of offices and engineering firm for the engineering offices and consulting firms:

4.1 In your point of view, Please tick the appropriate item that you Strongly Agree (SA), Agree (AG), Disagree (DA), Strongly Disagree (SD), Don't Know (DK) the statements as below:

#	Item	SA	AG	DA	SD	DK
1	Policies and procedures of the Associations' classification to the offices and firms are clear					
2	Policies and procedures of the Associations' classification to the offices and firms are fair					
3	Policies and procedures of the Associations' classification to the offices and firms are clear are continually revised and verified					
4	Classifications' procedures are easy and easily available, and committed to only provided paper files.					
5	Six months as a classifications' period is sufficient					
6	The process of classifications' renewal ignores the performance of office and evaluation of its employees during the past period					
7	Standards of manufacturing are sufficient and comprehensive for evaluating the real abilities of the office.					
8	It is preferred to increase classifications' categories (Engineer office, Engineering office B, Engineering office A, Consulting office)					
9	Confirmation of the classifications' certificate by other sides is necessary explain: ……					

4.2 Identification of weights of the criteria in the prequalification process by using the Analytical Hierarchy Process (AHP):

Please specify the relative importance of each criterion with respect to the other criterion in pairwise comparison to compare all of the criteria to each other, knowing that the relative importance should be based on AHP according to the numerical rating as shown in the table below:

Numerical rating	Verbal judgment of preference
8	preferred Extremely
7	preferred strongly Very
6	Strongly to very strongly
5	preferred Strongly
4	Moderately to strongly
3	preferred Moderately
2	Equally to moderately
1	Equally preferred

Determination of weights of the criteria in the classification of offices and engineering firms by AHP:

	Capital	Constant crew	Reputation of the office	Size of implemented projects	Size of general tenders	Total experience of the office	Experience of the offices' crew	Logistic equipment for the office
Capital								
Constant crew								
Reputation of the office								
Size of implemented projects								
Size of general tenders								
Total experience of the office								
Experience of the offices' crew								
Logistic equipment for the office								

Appendix 2

The Islamic University
Faculty of Engineering
Deanery of Graduate Studies

الجامعة الإسلامية – بغزة
كلية الهندسة
عمادة الدارسات العليا

تطوير نظام تصنيف الشركات الاستشارية و المكاتب الهندسية في قطاع غزة

تحية طيبة وبعد،

نرجو من سيادتكم تعبئة الاستبانة المرفق بالمعلومات المطلوبة والتي تهدف لتحسين نظام تصنيف الشركات الاستشارية في قطاع غزة، علماً بأن هذه الدراسة هي بحث تكميلي لنيل درجة الماجستير في إدارة المشاريع الهندسية للباحثة صفاء أبو العيش و إشراف الدكتور مأمون القدرة والدكتور محمد عرفة.

أثمن لكم جهودكم للإجابة على الأسئلة المطرحة في الاستبانة علما بأنّ جميع المعلومات التي يتم الحصول عليها من سيادتكم سوف تستخدم لغرض الدراسة العلمية البحتة بهدف التطوير مع الالتزام بالسرية التامة.

نشكر سيادتكم على التعاون وتقبلوا فائق الاحترام والتقدير،،

الباحثة
صفاء أبو العيش

القسم الأول: معلومات عامة

1. **الرجاء الإشارة إلى طبيعة عملك في المكتب/الشركة :**

مالك المكتب /الشركة ممثل المكتب /الشركة رئيس اختصاص وظيفة أخرى، اذكرها.....

2. **درجة تصنيف المكتب:**

مكتب مهندس مكتب هندسي ب مكتب هندسي أ مكتب استشاري

3. **تخصصات التصنيف (يمكن اختيار أكثر من بند):**

انشائي عمارة كهرباء ميكانيك ادارة مشاريع صرف صحي طرق كل ما سبق

4. **عدد سنوات الحصول على درجة التصنيف:**

أكثر من 15 سنوات من 10-15 سنة من 5-10 سنوات أقل من 5سنوات

5. **قيمة المشاريع التي تم اعداد وثائقها وتصميمها خلال السنوات الخمس الأخيرة (بالمليون دولار):**

أقل من1 من 1-5 من 5-10 أكثر من 10

6. **قيمة المشاريع التي تم الاشراف على تنفيذها خلال السنوات الخمس الأخيرة (بالمليون دولار):**

أقل من1 من 1-5 من 5-10 أكثر من 10

القسم الثاني: نظام هيئة المكاتب:

1. **هل سبق وأن اطلعتم على نظام مزاولة المهنة في هيئة المكاتب الهندسية**

نعم لا

2. **هل سبق و أن ترشحتم لعضوية مجلس ادارة هيئة المكاتب**

نعم لا

اذا كانت الاجابة (لا) اذكر اسباب:

.....

2.3 برأيك، اختر المناسب

	البند	أعارض بشدة	أعارض	محايد	أوافق	أوافق بشدة
1	عدد أعضاء مجلس ادارة هيئة المكاتب يتناسب مع مهام الهيئة.					
2	يتسم رئيس مجلس ادارة الهيئة بالفعالية والقدرة العالية على أداء المهام المطلوبة.					
3	اقتصار مجلس ادارة هيئة المكاتب على ممثلين عن المكاتب يعطي استقلالية للهيئة ويعطيها قوة وحرية في اتخاذ القرارات.					
4	هناك ضرورة تطعيم مجلس ادارة هيئة المكاتب					

	بعناصر من خارج دائرة المكاتب. وضح.....					
5	يقوم مجلس ادارة الهيئة بتطوير أو صياغة أو تنفيذ سياسات مرتبطة بتشكيله (الحجم، التشكيل، المهارات، الخبرات....)					
6	النظام الانتخابي المعمول به ملائم ويفرز أعضاء مجلس ادارة من ذوي الكفاءات والقدرة على تأدية المهام.					
7	هناك انسجام وتعاون بين أعضاء مجلس الادارة يسهم في الارتقاء في العمل.					

4. هل لديكم ملاحظات على أداء هيئة المكاتب من حيث تشكيلها وبيئة العمل فيها؟

.....

.....

5. هل لديكم اقتراحات لتطوير النظام الانتخابي المتبع في هيئة المكاتب؟

.....

.....

القسم الثالث: دعم ومراقبة هيئة المكاتب الهندسية للمكاتب والشركات:

3.1 برأيك، اختر المناسب

	البند	أعارض بشدة	أعارض	محايد	أوافق	أوافق بشدة
1	يمارس مجلس ادارة الهيئة دوره المنوط به بصورة كافية.					
2	يمارس مجلس ادارة الهيئة السلطات الممنوحة له وفق النظام بصورة عالية.					
3	هناك أولويات واضحة لدى مجلس ادارة الهيئة فيما يتعلق في ادارة ملف المكاتب والشركات الهندسية					
4	تلتزم الجهات المانحة بتصنيف هيئة المكاتب .					
5	تتابع وتراقب الهيئة المكاتب الهندسية والشركات الاستشارية					
6	تقدم هيئة المكاتب دعم فني واداري مستمر للمكاتب الهندسية والشركات الاستشارية.					
7	تسهم هيئة المكاتب في حل الاشكاليات التي تواجه المكاتب الهندسية والشركات الاستشارية.					

3.2 هل سبق وأن حصل خلاف بين مكتبكم وجهات أخرى (مالك...مقاول...)؟

نعم لا

اذا كانت الاجابة (نعم) ما دور هيئة المكاتب في المساعدة في حل هذا الخلاف؟

لم يتم التوجه للهيئة تم اعلامها ولم تقدم أي مساعدة تم اعلامها وقدمت المساعدة

3.3 هل سبق وأن حصل خلاف بين مكتبكم ومكاتب أو شركات أخرى؟

نعم لا

اذا كانت الاجابة (نعم) ما دور هيئة المكاتب في المساعدة في حل هذا الخلاف؟

لم يتم التوجه للهيئة تم اعلامها ولم تقدم أي مساعدة تم اعلامها وقدمت المساعدة

3.4 هل سبق وأن حصل خلاف بين مكتبكم و هيئة المكاتب؟

نعم لا

اذا كانت الاجابة (نعم) وضح الخلاف والية حل هذا الخلاف:

.....

.....

3.5 هل تعتقدون أن هناك مهام أخرى ومسؤوليات يجب أن تمنح لهيئة المكاتب؟

نعم لا

اذا كانت الاجابة (نعم) وضح :

.....

.....

3.6 هل تعتقدون أن هناك مهام أخرى ومسؤوليات يجب أن تسحب من هيئة المكاتب؟

نعم لا

اذا كانت الاجابة (نعم) وضح :

.....

.....

القسم الرابع: اجراءات التصنيف المعمول بها في هيئة المكاتب للمكاتب الهندسية والشركات الاستشارية:

4.1 برأيك، اختر المناسب

	البند	أعارض بشدة	أعارض	محايد	أوافق	أوافق بشدة
1	سياسات واجراءات تصنيف الهيئة للمكاتب والشركات واضحة.					
2	سياسات واجراءات تصنيف الهيئة للمكاتب والشركات عادلة.					
3	تُراجع سياسات واجراءات تصنيف الهيئة للمكاتب والشركات وتدقق باستمرار.					
4	تعتبر اجراءات التصنيف سهلة وميسرة جداً وتخضع للملفات الورقية المقدمة فقط.					
5	تعتبر فترة التصنيف "6 شهور" كافية.					
6	تغفل عملية تجديد التصنيف أداء المكتب وتقييم المشغلين له خلال الدورة السابقة.					
7	تعتبر معايير التصنيع كافية وشاملة لتقييم القدرات الحقيقية للمكتب.					
8	يفضل زيادة فئات التصنيف (مكتب مهندس، هندسي ب، هندسي أ، استشاري) مما يتيح التمايز بين المكاتب.					
9	هناك ضرورة اعتماد شهادة التصنيف من قبل جهات أخرى.وضح:.....					

4.2 **تحديد أوزان المعايير الرئيسية و الفرعية في التأهيل المسبق للمقاولين باستخدام عملية التحليل الهرمي:**

الرجاء تحديد الأهمية النسبية لكل معيار بالنسبة لباقي المعايير في عملية مقارنة زوجية لمقارنة كافة المعايير مع بعضها البعض ، مع العلم بأن هذه الأهمية ستقاس بناء على عملية التحليل الهرمي حسب التصنيف الرقمي للمقارنة الزوجية حسب الجدول التالي:

التصنيف الرقمي	أحكام لفظية للأهمية
8	أهم بدرجة قصوى (preferred Extremely)
7	أهم بدرجة عالية جدا (preferred strongly Very)
6	بين الدرجة العالية و العالية جدا
5	أهم بدرجة عالية (preferred Strongly)
4	بين الدرجة المتوسطة و العالية
3	أهم بدرجة متوسطة (preferred Moderately)
2	بين المتساوية و المتوسطة
1	متساوي في الأهمية (Equally preferred)

برجاء تحديد أوزان المعايير في تصنيف المكاتب والشركات الهندسية باستخدام عملية التحليل الهرمي:

	رأس المال	الطاقم الثابت في المكتب/الشركة	سمعة المكتب (شهادة المشغلين السابقين)	حجم المشارع المنفذة	حجم المناقصات العامة	خبرة المكتب الكلية	خبرة طاقم المكتب	التجهيزات اللوجستية للمكتب
رأس المال								
الطاقم الثابت في المكتب/الشركة								
سمعة المكتب (شهادة المشغلين السابقين)								
حجم المشارع المنفذة								
حجم المناقصات العامة								
خبرة المكتب الكلية								
خبرة طاقم المكتب								
التجهيزات اللوجستية للمكتب								

Appendix 3

اسئلة المقابلة

القسم الأول: هيئة المكاتب والشركات الهندسية:

1. هل سبق وأن اطلعتم على نظام هيئة المكاتب (الانتخابات ...المجلس....الأعضاء)؟
2. هل سبق وأن ترشحتم لعضوية المجلس؟ لماذا...
3. ما رأيكم في مجلس اعضاء الهيئة من ناحية(عدد الأعضاء- رئيس الهيئة- الانتخابات....)؟
4. هل ترى ضرورة وجود أعضاء في مجلس ادارة الهيئة من جهات خارجية؟ وضح...

القسم الثاني: نظام التصنيف في هيئة المكاتب والشركات الهندسية:

1. حسب عملكم في الواقع وتعاملكم مع مختلف الجهات المانحة والمالكين هل تصنيف الهيئة للمكاتب ملزم لدى المانحين والمالكين؟ حدد نسبة الالزامية...
2. هل ترى ضرورة لتبعية الهيئة لجهة أخرى (وزارة الاشغال- الحكم المحلي – البلديات....)؟
3. حسب قانون صادر عن المجلس التشريعي أن تبعية هيئة المكاتب يكون لهيئة التصنيف المركزية، حسب رأيكم ما مدى امكانية تطبيق ذلك؟
4. حسب رأيكم هل من ضرورة توحيد هيئة المكاتب بين الضفة الغربية وقطاع غزة؟

القسم الثالث: الدعم المقدم من قبل هيئة المكاتب والشركات الهندسية:

1. هل هناك مراقبة ومتابعة من قبل الهيئة للمكاتب؟ كيف...
2. حسب رأيكم ما هو مدى فعالية هذه المراقبة والمتابعة؟
3. ما حجم الدعم المقدم من قبل الهيئة لدعم المكاتب؟