MOLDOVA STATE UNIVERSITY

The title of the manuscript

CZU: 005.6:334.75:69(043.3)

ZRIKAT AWNY

THE MODEL OF QUALITY MANAGEMENT SYSTEM IN PUBLIC ORGANIZATIONS OF CONSTRUCTIONS

SPECIALTY: 521.03. ECONOMICS AND MANAGEMENT IN THE FIELD OF ACTIVITY
(IN QUALITY MANAGEMENT)

Thesis PhD in Economics

Scientific coordinator: **JALENCU Marian**
Doctor, Associate Professor

Author: **ZRIKAT Awny**

Chisinau, 2024

UNIVERSITATEA DE STAT DIN MOLDOVA

Cu titlu de manuscris

CZU: 005.6:334.75:69(043.3)

ZRIKAT AWNY

MODELUL SISTEMULUI DE MANAGEMENT AL CALITĂȚII ÎN ORGANIZAȚIILE PUBLICE DE CONSTRUCȚII

SPECIALITATEA: 521.03 ECONOMIE ȘI MANAGEMENT ÎN DOMENIUL DE ACTIVITATE

(în managementul calității)

Teză de doctor în științe economice

Conducător științific: **JALENCU Marian**

Doctor, Associate Professor

Autor: **ZRIKAT Awny**

Chisinau, 2024

TABLE OF CONTENTS

ADNOTARE

la teza de doctor în ştiinţe economice cu tema: MODELUL SISTEMULUI DE MANAGEMENT AL CALITĂŢII ÎN ORGANIZAŢIILE PUBLICE DE CONSTRUCŢIE,

Awny Zrikat, Chișinău, 2024

Specialitatea: 521.03 – Economie și management în domeniul de activitate (în managementul calității)

Structura tezei: introducere, trei capitole, concluzii generale și recomandări, bibliografie (173 surse), 7 anexe, prezentată pe 141 de pagini de text de bază, inclusiv 40 de figuri și 32 de tabele. Rezultatele obţinute au fost publicate în 11 lucrări ştiinţifice.

Cuvinte-cheie: calitate, management al calității, management total al calității, consiliu local, management, ISO-9000:2015, ISO-9001:2015, costul calității, implicarea managementului, indicele de experiență, indicele de motivare.

Domeniul de studiu: managementul calității în organizațiile publice și identificarea factorilor de succes.

Scopul tezei constă în identificarea și dezvoltarea procesului de management al „proiectului de construcție în cadrul organizațiilor publice", pentru a economisi bani, timp și pentru a le realiza la cea mai bună calitate. Cercetarea întreprinsă promovează eficacitatea instrumentelor oferite, precum și nivelul de impact realizat cu ajutorul Ghidului Calității în Organizația Publică.

Obiectivele lucrării: identificarea și descrierea principalelor concepte din domeniul managementului calităţiii și analiza specificului aplicării sistemului de management al calității în organizațiile publice de construcție; îmbunătăţirea sistemului de management al calităţii în normele publice de construcţie pe baza perfecţionării Ghidului calităţii în organizaţiile publice; îmbunătățirea procesului de implementare a proiectelor de inginerie pe baza corelației dintre factorii metrici și factorii de succes; elaborarea unui nou model EMC, bazat pe Ghidul de calitate pentru proiectele de construcții pentru organizațiile publice de construcție.

Noutatea și originalitatea științifică constă în îmbunătățirea procesului de management al proiectelor inginerești pentru autoritățile publice locale. Este studiată problematica calității în autoritățile locale din Israel. Autorul dorește să identifice factorii de succes evidențiați de către inginerii Autorităților Locale pentru a reuși să gestioneze proiectele de inginerie cât mai eficient.

Semnificația teoretică a tezei: a fost analizată, extinsă și precizată esența conceptului de „calitate" ca proces; autorul a luat în considerare o serie de ghiduri de calitate și a marcat clar diferența dintre cele două concepte: ghidurile de calitate și seria de standarde de calitate ISO-9000.

Valoarea aplicativă a tezei. Rezultatele obţinute în urma cercetării a dat posibilitate de a dezvolta o metodologie de abordare a ghidurilor de calitate. Ele pot servi ca elemente conceptuale și metodologice pentru cercetări ulterioare în acest domeniu. În baza cercetării, autorul a elaborat un manual de calitate care servește drept standard pentru toate autoritățile locale. De asemenea, el a propus consiliilor locale linii directoare de calitate.

Rezultatele obținute în urma cercetării științifice: Pentru managementul calității, sistemul cuprinzător de evaluare a personalului elaborat, precum și concluziile și recomandările pot fi utilizate direct de întreprinderile consiliilor locale, indiferent de mărimea și sectoarele acestora. Sistemul propus de evaluare a personalului va permite implementarea unor politici de motivare mai obiective la nivelul consiliilor locale. Factorii de implicare a angajaților, motivele interne și managerul de calitate sunt într-adevăr cei mai semnificativi factori pentru succesul conducerii proiectelor de inginerie în Autoritățile Locale. Rezultatele cercetării autorului au condus la fundamentarea științifică a necesității cooperării și stabilirea relațiilor cu angajații; să fie mereu în contact cu diferitele ierarhii din domeniu; să existe motive interne pentru ca angajații să activeze eficient.

Implementarea rezultatelor științifice: Rezultatele, concluziile și recomandările practice ale tezei, inclusiv implementarea unui ghid de calitate, pot fi utilizate direct de către consiliile locale, rezultatele științifice obținute în urma cerercetării contribuind astfel la dezvoltarea teoriei și practicii managementului calității în organizațiile publice.

ANNOTATION

to the Doctoral Thesis in Economics with the Theme: THE MODEL OF QUALITY MANAGEMENT SYSTEM IN PUBLIC ORGANIZATIONS OF CONSTRUCTIONS

Awny Zrikat, Chisinau, 2024

Specialty: 521.03. Economics and Management in the field of activity

(In Quality Management)

Structure of the thesis: the introduction, three chapters, general conclusions and recommendations, the bibliography (173 sources), 7 appendixes and is presented on 141 pages of main text, including 40 figures and 32 tables. The obtained results were published in 11 scientific works.

Keywords: quality, quality management, total quality management, local council, management, ISO-9000:2015, ISO-9001:2015, cost of the quality, Involvement of management, Index of experience, Index of motives.

Field of study: Quality management in public organizations and identification of success factors.

The aim of the research is to identify and develop the process of management of "the project of construction at the public organizations", to save money, time and to do them in the best quality. The research found promotes the effectiveness of the tools given as well as the level of impact made using the Quality Guide in Public Organization.

The objectives of the paper are: identification and description of the main concepts in the field of quality management and analysis of the specifics of the application of the quality management system in public construction organizations; improving the quality management system in the public construction norms based on the improvement of the Quality Guide in Public Organizations; improving the process of implementing engineering projects based on the correlation between metric factors and success factors; new EMC model proposal based on Quality Guide for construction projects for public construction organizations.

The scientific novelty and originality: consists in improving the engineering project management process for local public authorities. The issue of quality in local authorities in Israel is studied. The author wishes to identify the success factors highlighted by Local Authority engineers in order to manage engineering projects as effectively as possible.

The theoretical significance of the thesis: The essence of the concept of "quality" as a process was analyzed, expanded and specified; the author considered a number of quality guidelines and clearly marked the difference between the two concepts: the quality guidelines and the ISO-9000 series.

The applicative value of the thesis. The obtained results of the research develop methodology for approaches to quality guidelines. They can serve as conceptual and methodological elements for further research in this area. Based on the research, the author has developed a quality manual that serves as a standard for all local authorities. He also proposed quality guidelines to local councils.

The results obtained from the scientific research: For quality management, the developed comprehensive personnel evaluation system, as well as the conclusions and recommendations can be directly used by local council enterprises, regardless of their size and sectors. The proposed personnel evaluation system will allow the implementation of more objective motivation policies at the level of local councils. Employee engagement factors, internal motives and quality manager are indeed the most significant factors for the success of engineering project management in Local Authorities. The results of the author's research led to the scientific substantiation of the need for cooperation and the establishment of relations with employees; to always be in contact with the various hierarchies in the field; to have internal reasons for employees to activate effectively.

Implementation of scientific results: The results, conclusions and practical recommendations of the thesis, including the implementation of a quality guide, can be used directly by local councils, the scientific results obtained from the research thus contributing to the development of the theory and practice of quality management in public organizations.

АННОТАЦИЯ

АУНИ Зрикат „МОДЕЛЬ СИСТЕМЫ УПРАВЛЕНИЯ КАЧЕСТВОМ В ОБЩЕСТВЕННЫХ СТРОИТЕЛЬНЫХ ОРГАНИЗАЦИЯХ", диссертация на соискание ученой степени доктора экономических наук, специальность 521.03 – Экономика и управление в сфере деятельности (в управлении качеством), Кишинев, 2024

Диссертационная работа написана на английским языке и состоит из введения, трёх глав, общих выводов и рекомендаций и списка из 173 цитируемых публикаций и 7 приложений. Работа содержит 141 страниц основного текста, 40 рисунок, 32 таблиц. Полученные результаты опубликованы в 11 научных работах.

Ключевые слова: Качество, управления качеством, системное управление качеством, местный совет, ISO-9000:2015, ISO-9001:2015, цена качества, вовлечение управления, индекс опыта и индекс мотивов.

Область исследования: управление качеством в общественных организациях и выявление факторов успеха.

Цель диссертации: выявить и разработать процесс управления «строительным проектом в общественных организациях», сэкономить средства, время и достичь их с наилучшим качеством. Проведенное исследование способствует повышению эффективности предлагаемых инструментов, а также уровня воздействия, достигнутого с помощью Руководства по качеству в общественной организации.

Задачи работы: определить и описать основные концепции в области управления качеством и проанализировать специфику применения системы менеджмента качества в общественных строительных организациях; совершенствование системы менеджмента качества на основе совершенствования Руководства по качеству в общественных организациях; совершенствование процесса реализации инженерных проектов на основе соотношения метрических факторов и факторов успеха; разработка новой модели EMC на основе Руководства по качеству объектов строительства для государственных строительных организаций.

Научная новизна и оригинальность заключается в совершенствовании процесса управления инженерными проектами для органов местного самоуправления. Изучен вопрос качества в местных органах власти в Израиле. Автор выявил факторы успеха, отмеченные инженерами местных органов власти, чтобы максимально эффективно управлять инженерными проектами.

Теоретическая значимость диссертации: проанализирована, расширена и уточнена сущность понятия «качество» как процесса; автор рассмотрел ряд руководств по качеству и четко обозначил разницу между двумя понятиями: руководствами по качеству и стандарты качества серии ISO-9000.

Прикладное значение диссертации. Результаты, полученные в результате исследования, позволили разработать методологию подходов к рекомендациям по качеству. Они могут служить концептуальными и методологическими элементами для дальнейших исследований в этой области. На основе исследования автором разработано руководство по качеству, которое может служить эталоном для всех органов местного самоуправления. Он также предложил руководящие принципы качества для местных советов.

Результаты, полученные в результате научного исследования: Для управления качеством разработанная комплексная система оценки персонала, а также выводы и рекомендации могут быть непосредственно использованы предприятиями местных советов, независимо от их размера и отрасли. Предлагаемая система оценки персонала позволит реализовать более объективную политику мотивации на уровне местных советов. Факторы вовлеченности сотрудников, внутренние мотивы и менеджер по качеству являются наиболее важными факторами успеха управления инженерными проектами в местных органах власти. Результаты авторского исследования привели к научному обоснованию необходимости сотрудничества и налаживания отношений с работниками; всегда быть в контакте с различными организационными иерархиями; выявить внутренние мотивы для обеспечения эффективной работы сотрудников.

Внедрение научных результатов: результаты, выводы и практические рекомендации диссертации, включая внедрение руководства по качеству, могут быть использованы непосредственно местными советами; научные результаты, полученные в результате исследования, тем самым способствуют развитию теории и практики управление качеством в общественных организациях.

LIST OF TABLES

LIST OF FIGURES

LIST OF TERMS

ISO-	International Organization for Standardization
ISA-	International Federation of the National Standardizing Associations
VE -	Value Engineering
TPQM -	Total Productivity & Quality Management
QC -	Quality Control
QA -	Quality Assurance
TOC -	Theory of Constraints
JIT -	Just in Time
TQM -	Total Quality Management
CEO-	Chief Executive Officer
UNSCC -	United Nations Standards Coordinating Committee
BS -	British Standards Institute
MIT -	Massachusetts Institute of Technology
CEO	Chief executive officer

INTRODUCTION

Actuality of the researched topic and the importance of the addressed issue. Infinite books and numerous articles have been written which attempt to define, explain and illustrate these subjects The Quality. An Israeli CEO of a construction company or a public organization, who is genuinely interested in improving the performance of its company or organization, will often encounter vague wording, unclear and rather general definitions, and examples that are not necessarily similar to what is happening in the respective company or organization. According to Sui Pheng Low & Joy Ong: “Intensifying global competition and increasing demand by clients for better quality have caused more and more companies to realize that they will have to provide quality products and/or services in order to successfully compete in the marketplace”. International Standard ISO-9000 series largely answers these questions in that it lists the minimum requirements necessary to establish a quality system in any organization. This, perhaps, is one reason why the standard ISO-9000 series became the new object of companies and organizations in the Israeli domain of construction interested in improving quality.

The History of Standard ISO-9000, the starting point of ISO-9000, as the starting point of the theory of quality from the school of Juran and Deming, was in the period following World War II - this time, on the other side of the globe. After World War II, NATO was founded. In order to set equal standards for the products arriving from suppliers from NATO countries, a document was made in 1969 detailing the quality requirements. The document is called AQAP. This document was based on a similar document of the U.S. Department of Defense - MIL-Q-9858A. In the nineties, standard ISO-9000 series began to take, quite rightly, the place of TQM as the leading concept in the world of quality. Unlike TQM, which was written in countless books and from different and varied perspectives, Standard ISO-9000 series defines, in one anchored and crisp-clear document, the demands from an organization wanting to establish a quality system. Furthermore, the qualification process for ISO-9000 series is accompanied by a tester who certifies the organization – something that results in motivation for progress and meeting goals. Additionally, the certification for the standard is a certificate, and a proof to whoever requires it, that the organization manages a quality system.

The degree of the scientific problem's elaboration. One can study and see that as quality control and management has evolved over time and continues to grow and expand; thus, the impact of the economic and professional development has rapidly transformed. Various factors and determinants were used during the research and development of the situation which all Local Authorities face in concordance with employees and timelines in the workplace. When the term

management is indicated, it includes activities ranging from controlling, planning and creating a sense of order. Local authorities struggle with meeting deadlines, restraining costs, all while being effective leaders who motivate the employees who are the ones developing the visions.

Over the years, a number of studies have been theoretically studied on the importance of Quality. Research on the studies of Total Quality Management and authors who have raised this topic are: W. A. Shewhart, W. E. Deming, J. M. Juran, Ka. Ishikawa, Dr. G. Taguchi, A. V. Feigenbaum, P. B. Crosby, and others. These authors emphasize the theories behind the Quality Guide and its effectiveness in the Local Authorities. Money, time and loss of quality in the Local Authorities are the issues that the author validated in this thesis.

The aim of the research is to identify and develop the process of management of "the project of construction at the public organizations" - to save money, time and to do them in the best quality. The research found promotes the effectiveness of the tools given as well as the level of impact made using the Quality Guide in Public Organization.

The objectives of the research are:

1. The identification and description, in an evolutionary approach, of the concepts of “quality”, “quality management”, “quality management system”, which will lay the theoretical foundations of this scientific work.
2. Analysis of the specifics of the application of the quality management system in public construction organizations.
3. Development of a methodology for the research of the quality management system in the public construction organizations based on the identification and the hierarchy of the metric factors.
4. Improving the quality management system in the public construction norms based on the improvement of the Quality Guide in Public Organizations.
5. Improving the process of implementing engineering projects based on the correlation between metric factors and success factors.
6. New EMC model proposal based on Quality Guide for construction projects for public construction organizations.

The research hypothesis. The results of construction projects in local authorities are strongly influenced by certain *success factors*, such as employee involvement, internal motivation, guidance of a quality management consultant, experience with quality, instructions and multiple-participant meetings, while other factors have a less significant impact, such as deadline or timetable, involvement and commitment of management.

The research methodology of this thesis contains a comprehensive review of the author's research through which the basis of each company's successes of project management became clear. The metrics that the author uses in his research were studied very closely to optimize the pros and cons for the final results. The author sought to study the reasons and work environment to realize which of the success factors which yield the best work for employees of a company.

- ➢ Index of Success Metrics:
  - ○ Length of implementation, changes in organizational culture, resistance and difficulties in work according to standard, amount and volume of procedures, improvement in performance of the authority, reduction of number of clients' complaints, improvement in project performance, and recommendations and satisfaction.
- ➢ Index of Success Factors:
  - ○ involvement and commitment of management, experience with quality, motives for implementations, involvement of employees, the Impact of the quality manager consultant, deadline or timetable, and instructions and multiple-participant meetings.

The thesis gave a percentage weight for every metric, and gave a grade for every metric for the studies conducted. Also, it checked the Index of Success Factors for each Local Authority. Following this, in addition to achieving it we studied the factors which are connected to the success of the Local Authority. The index of success factors played a major role in the research.

The thesis examined the success factors in every Local Authority and conducted tests. The intervening levels of the higher management was studied in relation to company involvement and success. Following this, the tests were compared with the success factors of each Local Authority. The thesis demands to see if there is a correlation for the rate of success levels, respectively.so it finds the most significant factors that play the strongest role of success.

ISO-9000 series is the model on duty for implementation of a quality system in various industries around the world, but for the Israeli construction branch (in generalization), its implementation is an initial experience in managing quality in a large-scale. Implementation of ISO-9001:2015 in a construction company or public body is, if so, a very contemporary subject, but it is also a meeting of ways between two developed research areas, with a long history, and they are: function in the branch of construction on the one hand, and quality management, on the other. In the survey of literature, an effort is made to explain this meeting in detail and depth, while emphasizing the development of the area of quality management in general, and the

implementation of quality management in the construction branch in particular.

The important scientific problem solved is to demonstrate the necessity of implementation of the Quality Guide in the Local Authorities in order to generate a more effective structure within the Local Authorities through Quality Control, Quality Assurance and Total Quality Management. Thus, several metrics were used and studied.

Scientific novelty and originality of the obtained results consists in improving the engineering project management process for local public authorities. The issue of quality in local authorities in Israel is studied. The author wishes to identify the success factors highlighted by Local Authority engineers in order to manage engineering projects as effectively as possible.

1. Using statistical methods, we recommend that quality management systems in construction organizations be designed based on statistical correlations. Thus, based on the results of the study, we state that it is important to use statistical analysis in other project management systems in the construction industry.

2. The EMC model, developed and proposed by us following the research, is recommended to be used through implementation in other public organizations.

3. By implementing the EMC model proposed by us, the quality management system of the entire public organization can be improved, not only of the engineering department.

4. Our proposed model application results in significant improvement of engineering projects in terms of quality, without delays and with maximum savings.

5. The new EMC model represents an innovative and feasible solution in the management of engineering projects in local authorities.

- Some of the small local authorities are characterized with a process called "outsourcing", i.e. transferring the engineering project management process to an external body which manages the engineering projects instead of the Local Authority. In "big" local authorities, the entire engineering project management process is done within the Local Authority. Here, the function is slightly different from medium-sized and small local authorities since the engineering department is divided into sub-departments: water, electricity, roads, buildings, safety and more. Each sub-department checks the engineering project in all its stages - hence the advantage of a big Local Authority over a small authority.
- Quality Control, and mainly Quality Review, in the local authorities related to engineering project management, is performed, for the most part, by the project managers. The quality control system and quality assurance, intended to be achieved by the quality manager or

the ISO-9000 series, is more detailed, more documented, and mainly more systematic than the traditional quality review used in the engineering departments.

The theoretical value of the thesis is composed of the concept of "quality" as a process which was analyzed, expanded and specified; the study considered a number of quality guidelines and clearly marked the difference between the two concepts: the quality guidelines and the ISO 9000 series it also suggested quality guidelines to the local councils.

The applicative value of the thesis. The obtained results of the research develop methodology for approaches to quality guidelines. They can serve as conceptual and methodological elements for further research in this area. Based on the research, the author has developed a quality manual that serves as a standard for all local authorities. He also proposed quality guidelines to local councils.

The main scientific results submitted for support. For quality management, the developed comprehensive personnel evaluation system, as well as the conclusions and recommendations can be directly used by local council enterprises, regardless of their size and sectors. The proposed personnel evaluation system will allow the implementation of more objective motivation policies at the level of local councils. Employee engagement factors, internal motives and quality manager are indeed the most significant factors for the success of engineering project management in Local Authorities. The results of the author's research led to the scientific substantiation of the need for cooperation and the establishment of relations with employees; to always be in contact with the various hierarchies in the field; to have internal reasons for employees to activate effectively.

The scientific developments which took place in several stages. The testing stage, in conforming with the ISO-9000:2015, aiming for design and quality supervision, and the aim to improve quality and long-term performance through employees and supervisors. The items take place in stages: the Initial Stage, the Quality Control Stage, the Quality Assurance Stage and the Quality Management Stage.

Testing stage: test the suitability of the product in accordance with ISO-9000:2015. The test was visual and done by measuring and observation, and in accordance with the research of Taylor, who strives to improve production output in the factory by separating the defective products from the proper products.

Quality Control Stage, in conformity with ISO-9001:2015, is "a part of quality management that focuses on the requirements of quality". This means planning for testing from the beginning of the production or service, through the use of modern statistical methods for

quality supervision. This contributed to the discovery of errors and defects at an early stage, but it was not possible to prevent the flaw and predict it. The studies and the thesis follow to indicate that all quality control is considered a more developed stage of testing in terms of the complexity of the methods and the development of the procedures used.

Quality Assurance Stage, Quality assurance stage has been defined in accordance with ISO-9001:2015 as a "part of quality management which concentrates on providing security that quality is achievable". This stage focuses on directing all efforts at all management levels to participate in the design and quality supervision, to prevent a defect or error. This stage prevents the defect from happening right from the start, and focuses on the requirements of the customer who became the target of organization and factory occupation, and creates the easement of product definition, and prevention of errors at the initial stage, which increases quality assurance for the customer.

Quality Management Stage, the stage of quality management is an inclusive stage of product manufacturing which includes all employees. Thus, can the organization implement quality management to achieve maximal achievements, and by that, ensuring that customer requirements are implemented. In this method, the organization or company can implement its goals. Parallel to the development of quality control, quality assurance and total quality management, different methods were developed to prevent the wastage of the majority of the benefit from the production process. These methods are: JIT, Value Engineering and Constructability. Some were even developed in the same places and at the same time as the sophisticated approaches to quality management. JIT, for example, was developed in Japan during the same years and in the same factories in which quality circles and the TQM methods were developed.

Implementation of scientific results. The results, conclusions and practical recommendations of the thesis, including the implementation of a quality guide, can be used directly by local councils, the scientific results obtained from the research thus contributing to the development of the theory and practice of quality management in public organizations.

In the process of developing the EMC model, conference interviews were conducted and questions were formulated (in the form of a questionnaire) sent to 40 Local Authority engineers to answer and receive feedback on the results of its implementation. From the responses received, it can be seen that employee involvement factors, internal reasons and quality manager are indeed the most affected factors for the success of engineering project management in Local Authorities. The results of the author's research led to the creation of a new scientific concept

that is based on cooperation between employee relations; to always be in contact with different hierarchies in the field; so that there are internal reasons for employees to work. The quality guide developed by the author as a result of the research is currently applied in 4 Local Authorities in Israel and is in the process of being implemented in 2 other Local Authorities. In parallel, the necessary steps were taken to the Ministry of the Interior for the application of the Quality Guide at the level of the entire country, within all Local Authorities in Israel.

Approval of search results. The main results of this research study were published in 11 scientific works, and one book with a volume of 6.15 c.a.

Dissertation structure. The thesis includes: the annotation (in Romanian, English and Russian), list of terms, introduction, three chapters, general conclusions and recommendations, bibliography (173 sources), 7 appendixes and is written on 141 text pages of main text, including 40 figures and 32 tables.

In the **Introduction,** the thesis presents the relativity, significance and the degree to which the chosen thesis topic investigated. The reasoning and objectives of the research topic are executed and calculated. Following, the author conveys the elements of the thesis in relation to novelty, theoretical significance and the applicative value of the found results implemented in the thesis.

The first chapter entitled "Theoretical approaches to quality management system applicable to public enterprises" puts emphasis on the analysis of the historical aspects of how and where quality began, evolved and came to be used. Total Quality Management (TQM), is a set of management practices throughout the organization, geared to ensure the organization consistently meets or exceeds customer requirements. TQM places strong focus on process measurement and controls as a means of continuous improvement. These aspects include the concluding quality, notion of quality and quality management in the evolution of time as seen throughout history. This conveys that the evolution of quality has shaped the way of organizing unions. This includes the essential sciences which enhances and signifies the structure of business. This procedure yields a decrease in costs by leading this management style and concluding with decreased costs, loyal customers and top-notch performance. The core concepts studies illustrate the core concepts and ideology for creating a successful and efficient environment within the workplace.

Chapter 2 entitled "Quality management systems of local authorities in the State of Israel" the assessment reveals that there is no direct correlation between the size of the local authority and the success metrics. The critical analysis of the ISO-9000 series revealed that many

countries are in dire need for significant improvement for Quality standards. While size does not matter, the metrics of success and the factors of success matter. The indexes of the rate of success of engineering projects were isolated, which are: length of implementation, cultural changes, behavior and difficulties, amount of procedures, improvement in performance of Authority, reduction in number of complaints, improvement in performance of projects as well as recommendations and satisfaction. Additionally, a weight was set for each rate of success between 10 and 20%.

Chapter 3 entitled "A new model of the quality management system for public construction enterprises" identifies employee involvement, internal motives and quality management consulting. The more professional and successful a project, the more Quality factors are utilized. Thus, the most effective factors in the success of the total quality management system were set: involvement of management, employee instruction, internal motives of employees, quality manager, deadline or planning of timetables, and for each factor, a weight is received in implementation of a quality system in Local Authority.

The correlation between factors and the Guide Quality Management implementation success yielded from three factors. Firstly, involvement of employees, secondly, motives for implementations, thirdly, the impact of the deadlines or time tables, and last but not least, the Impact of the quality manager consultant. The involvement of employees was a direct factor to the rate of success in local authorities.

- The level of correlation received was R^2 =0.693, a very high score in comparison to the other factors tested for the implementation of success.
- The second factor which is the motives for implementations, strongly affected the success, which received a score of R^2 =0.536.
- The third strongest factor of deadlines or time tables was R^2 =0.535.
- The fourth strongest factor which also had a remarkable effect on the success rates is the Impact of the quality manager consultant, which received a score of R^2 =0.356.
- The R alone, non-squared, will have a negative effect.

The more combinations the thesis and imprecision's, the more positive of an effect there would be.

The General conclusions and recommendations section conveys the results of the examination indicating a high rate of correlation of employee involvement and of motives and a low level of correlation of experience and instructions and meetings.

There was statistical analysis made, in which a number of factors of success were gathered for getting the most effective cumulative level of correlation. After completion of a statistical analysis, there was an indication in this process which conveyed that the adding of factors of employee involvement, internal motives of employees and quality manager, supply the highest level of correlation R=0.828.

The thesis's opinion on this matter is that if the Local Authorities implemented this research in their jobs, it will save time, money, less problematic issues in the work field, and if there is a change in employees, there will be no delays and problems because everything would be organized and planned to continue without any issues making it easier to take over projects.

Key-words: quality, quality management, total quality management, local council, management, ISO-9000:2015, ISO-9001:2015, cost of the quality, Involvement of management, Index of experience, Index of motives.

1. THEORETICAL APPROACHES TO QUALITY MANAGEMENT SYSTEM APPLICABLE TO PUBLIC ENTERPRISES

1.1. Conceptualization of the notion of quality and quality management in evolutionary approach

Infinite books and numerous articles have been written which attempt to define, explain and illustrate these subjects. An Israeli CEO of a construction company or a public organization, who is genuinely interested in improving the performance of his company or organization, will often encounter vague wording, unclear and rather general definitions, and examples that are not necessarily similar to what is happening in his company or organization. To that, one can add a variety of management methods and concepts linked to the subject of quality. Many of those, as if to plant more confusion and embarrassment, have "bombarding" initials and names [2, p. 8]:

VE - Value Engineering, TPQM - Total Productivity & Quality Management, QC - Quality Control, QA - Quality Assurance, TOC - Theory of Constraints, JIT - Just In Time, TQM - Total Quality Management, Eventually, the CEO will not always find answers to simple questions of a practical man:

* What should I do to establish a quality system?

* Where should I start?

The science of quality is considered, at the present time, one of the essential sciences that improve and promote the building of companies and goal setting, and the foundation for implementing these goals in all that aligns with the strategy of the companies and the direction of their development. Quality is the most important challenge facing companies and organizations of all kinds. It also constitutes one of the indices to evaluate companies by measuring their current situation and their future among other companies. According to Sui Pheng Low & Joy Ong: “Intensifying global competition and increasing demand by clients for better quality have caused more and more companies to realize that they will have to provide quality products and/or services in order to successfully compete in the marketplace” [98, p. 8]. The concept of quality has become the main element in evaluating companies and organizations; therefore, it is very important to implement quality in order to maintain their performance and, of course, for constant improvement of production and performance. Later on, the author will detail the meaning of the concept of quality, the history of the development of this science, and how it became the main element in evaluating companies and organizations [2, p. 9].

The history of quality began in 17th century Europe, when various professionals began organizing unions in Europe, which they called organizations, until the 19th century. Production

in the industrialized world tended to follow this professional model. Factories began focusing on product testing in Great Britain in mid-1750. It then developed until it took shape in the form of the industrial revolution in the early 1800's. Early in the 20th century, craftsmen began establishing a quality process in factories. During the involvement of the United States in World War II, there was a more pronounced need for quality, especially in terms of manufacturing for war purposes: for example, bullets manufactured in the U.S. needed to be suited for guns manufactured in different districts. Thus, began the process of production testing only for the need of simplifying this process regardless of safety. The first version of ISO 9000 family of standards was published in 1987 [161, p. 460].

Following this process, the army began to sample certain products and work on their suitability, until indices and military specifications were announced, thus began the process of perfecting in terms of testing and the manner of sampling, as well as supervision of production. However, upon World War II, a large number of U.S. factories began production for war in order to supply equipment and weapons for war, which affected local civil production till the point of shortage of civilian products such as refrigerators, stoves, etc. The certification to satisfy these needs brought up inflation in certificate variety problems requiring standardization in numerous certification types and procedures in 1987 "ISO 9000 Quality Assurance System" is developed as a model. This system is neither production human resource oriented by process-oriented system [132, p. 321].

After this it caused the factory owners and businessmen to ask workers and engineers to increase production at all costs, even at the expense of product quality. This, of course, led to a significant decrease in the product quality. After the war, Dr. Edward Deming and Joseph Juran wished to focus on quality rather than quantity. They founded groups and published guidelines for improving quality but their requests were not answered. Japan, who was destroyed from the war and whose goal was to restore industrial and economic building and development, invited Edward Deming and the engineer Joseph Juran to give a number of lectures in front of businessmen, industrial personnel, engineers and workers, as well as in Japanese universities. Quality theory echoed and was accepted very well in Japan. The Japanese industry sought to implement this theory in all factories, until its implementation became serious throughout Japan, and all products were required to be subjected to rigorous testing for detecting industrial deficiency during production.

This process resulted in a significant improvement of the Japanese industry and Japanese products on a world-scale. No product was marketed without rigorous testing for product quality.

This caused the Japanese industry and products to be received excellently in the markets, even in the U.S. itself. This industry was favorable in the eyes of consumers - products without defects. Thus the Japanese industry developed and production increased, to a point where Japanese products jumped from 4% to 20% of consumption in the U.S. in just a small number of years, and to a larger percentage in the years that followed. Products in the United States were not marketed and remained in factories without any buyers. During this period, there was no full understanding of what was happening in the U.S. First, they tied this phenomenon to the low prices of Japanese products, and therefore lowered the prices of products at the expense of quality. Japanese products dominated again in the U.S. markets and took over the U.S.

After years of frustration, Americans concluded and began to apply quality theory and to test every product using rigorous testing similar to the ones of Japan, but these tests added additional costs. They got used to production in poor quality, and as a result, several factories crashed again. Then there was a need for a thorough analysis of what happened, and a view of the entire production process, as the situation was intolerable. They concluded that it is necessary to test the product during production and not post-production. Indeed, that was a success, but it was too late; they failed to produce a single product in better quality than the quality of Japan. The Americans found the Japanese secret of the concept of "total quality", which the Japanese developed before them, after the implementation of the quality process (which belonged originally to the Americans). This step handles the product throughout its life at each and every stage, and repairs the defect before proceeding to the next step. In the early seventies, industries in the U.S. developed, especially the industry of vehicles and electronic products, because of Japanese competition of high-quality products, on the basis of Total Quality Management (TQM).

“Management” is concerned with producing order and consistency through actions such as planning, budgeting, organizing and controlling. while leadership is concerned with producing and movement by vision building. motivating, aligning people and communicating. This is not to imply that leadership is “good” and management “bad” to recognize that they serve different purposes and require different skills management serves us well in static situations (one might think of the situation of ford in early 20th century) however, more dynamic situation require leadership [70, p. 826]. Traditional organizations have tended to emphasize control and organization (management) over vision and motivation (leadership). This results in static organizations good at doing what they have always done, and focused on ensuring management instructions are carried out, but poor at responding to changing environments and developing

situations which are increasingly the norm in the modern business environment" [42, p. 11]. In daily usage, quality contracts with luxury, because, in the past, obtaining a product with good features that lasted for a long time involved a high price. The question arises: Is the product cost not part of its features?

The professional definitions of quality are numerous and varied:

- **Feigenbaum:** defines quality as "the total composite product and service characteristics of marketing, engineering, manufacturing and maintenance through which the product and service in use will meet the expectations of the customer" [76, p. 925].
- **Juran:** defines quality as "fitness for use or purpose, regardless of product condition" claiming that in this definition he considers two more definitions of quality, which are "product features" and "freedom from deficiencies" [36, p. 8].
- **Deming:** defines quality as "predictable degree of uniformity and dependability at low cost with a quality suited to the market" [51, p. 27].
- **Low Sui Pheng:** quality is a term difficult to define, judging from the sheer volume of literature attempting to do so [162, p. 51].
- **S. P. Mukherjee:** Quality is not a goal—it is a march forward. Even zero-defect is not the ultimate goal to be achieved. Since we can always have a more stringent definition of defect, scope for improvement always remains—in materials, processes, procedures and systems [163, p. 2].
- **Steve Goodhew:** quality is the main focus of partnering. The team aspect looks to reduce the impact of traditional definitions and roles of the different team members and allow the team to focus on what the client requires, much of which may well coincide with a sustainable building, appropriately constructed and run [164, p. 34].
- **Taguchi:** defines quality by defining its opposite. According to Taguchi, non-quality is "the loss imparted to society from the time the product is shipped" [51, p. 27]. Taguchi is aiming at the costs of non-quality, and what he means is that the more the product is of higher quality, the smaller the loss of society as a result of the costs of non-quality. Taguchi refers to the test of society and not to the test of a company. Later the author will see that this broad reference to the topic of quality is common to all experts on the subject.
- **Carlos J. F.:** defines the "quality" of the strategy content resulting from the process depends also on the cognitive limitations of the participants, their emotional involvement, their fears, their resistance to change, and the time available for decision making and implementation [118, p. 150].

- **The American Federal Quality Institute:** defines as follows: "performing the right job correctly from the first time, relying on assessment learned by knowledge throughout the performance improvement".
- **Armand Feigenbaum's:** definition: "customer satisfaction".
- **Crosby:** (1979) "conformance to requirements. The more compatible product features are to customer requirements, the more this product is of good quality" [119, p. 466].
- **International Standard ISO-9000:2015** "the degree to which a set of inherent characteristics of a product fulfill customer requirements" [63, p. 32].
- **Omer and Sefy Akili:** "the production of a product by an organization, or presenting a service of high quality that can satisfy the needs and requirements of the customers in a manner that aligns with their expectations and gaining their favor and joy, and this is implemented by predetermined measurements in the production process of the product or the service and finding a unique feature" [63, p. 22].
- **John S.:** The accepted and simplest definition of quality is: "satisfying customer needs" or "meeting customer requirements" [51, p. 453].
- **David Hoyle:** "in discussions in which the word quality is used, people will differ in their viewpoint either because the word quality has more than one meaning or that they have different perceptions of what the word quality means or because they are drawing conclusions from different premises or concepts. Some of the people are perhaps thinking that quality means goodness or perfection or that quality means adherence to procedure, following the rules etc. or that fewer defects means higher costs or that quality means high class and is expensive. Others might be thinking that controlling quality means rigid systems, inspectors in white coats or that if they push production, quality suffers, or that quality management is what the quality department does" [4, p. 23].

Based on the professional definitions of quality that are presented above, the author suggests that the definition of Deming is the broadest one. Juran's definition is also so similar to Deming's. The rest of the definitions all agree with these two broad definitions and are elaborated accordingly. Which suggests that most of the experts who worked on the issue of quality adopted Deming's and Juran's view and elaborated their own perspectives accordingly.

Standard ISO-8042 and Israeli Standard 1432 define quality as: "the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs". This definition is used by ISO-9001:2015 [147].

The Quality Triangle, one can express the manner of reference to quality as part of the

forces working to create a product, using the model described in figure 1.1. [10, p. 207]. This model, often called "triangle quality", explains that in addition to the minimum cost and minimum time, the author must strive for maximum quality when manufacturing a product. Also, the model emphasizes that a product cannot be defined in terms of cost and time only and regardless of its quality [50, p. 38].

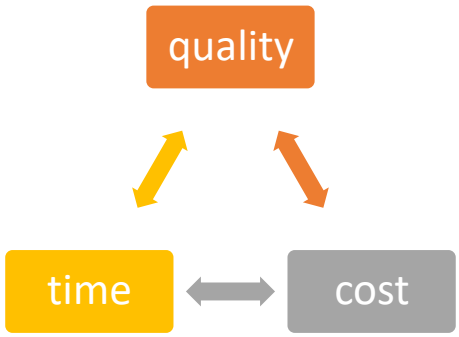


Fig. 1.1. The Force Triangle - Quality, Cost, Time [10, p. 207]

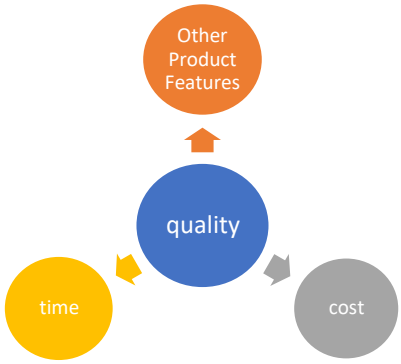


Fig. 1.2. The Quality Triangle [10, p. 207]

Another possible model, which better matches the various definitions of quality, and which explains the role of quality as part of the forces working to create a product is depicted in figure 1.2. This model explains that quality means durability of costs, schedules and fulfillment of all other product features (all according to customer needs) [10, p. 207].

The difference between the two models above also explains, in part, the development of the concept of quality in the different approaches. Quality turns from being another characteristic of the product to the source of its definition [10, p. 207].

The evolution of quality management in the years that followed the Second World War was not significant, but was steady and stable and stood out after a number of studies from the last century. But later on, this science developed in several stages, and each stage has not canceled the one previous to it, but contained it and developed it as explained below:

Testing Stage, in this stage, which was the initial stage, they would test the suitability of the product in accordance with ISO-9000:2015. The test was visual and done by measuring and observation, and in accordance with the research of Taylor, who strives to improve production output in the factory by separating the defective products from the proper products. He found that about 15% of the products were defective, and tried to fix these products and ensure that they would not be marketed with the proper products. The defect had already been made, and the test discovered it. The test did not, however, observe why this had happened.

Quality Control Stage, in conformity with ISO-9000:2015, is "a part of quality management that focuses on the requirements of quality". This means planning for testing from the beginning of the production or service, through the use of modern statistical methods for quality supervision. This contributed to the discovery of errors and defects at an early stage, but it was not possible to prevent the flaw and predict it. The author can say that all quality control is considered a more developed stage of testing in terms of the complexity of the methods and the development of the procedures used.

Quality Assurance Stage, Quality assurance stage has been defined in accordance with ISO-9001:2015 as a "part of quality management which concentrates on providing security that quality is achievable". This stage focuses on directing all efforts at all management levels to participate in the design and quality supervision, to prevent a defect or error. This stage prevents the defect from happening right from the start, and focuses on the requirements of the customer who became the target of organization and factory occupation [119, p. 466] and creates the easement of product definition, and prevention of errors at the initial stage, which increases quality assurance for the customer [14, p. 22].

Quality Management Stage, the stage of quality management is an inclusive stage of product manufacturing which includes all employees and aims to continually improve the quality and long-term performance. Thus can the organization implement quality management to achieve maximal achievements, and by that, ensuring that customer requirements are implemented. In this method, the organization or company can implement its goals [119, p. 466].

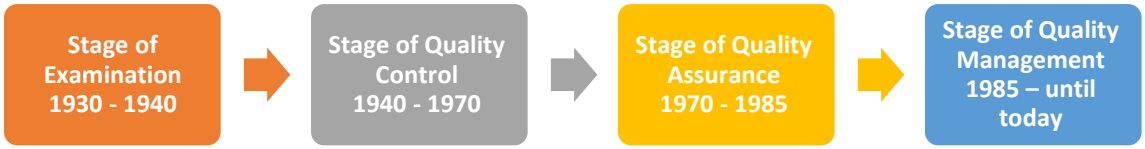


Fig. 1.3. Quality development stages [2, p. 11-15]

Costs of Quality Management: The concept was weaved by Feigenbaum in the 40s. Since then, and to the present day, the components of these costs have not changed, Feigenbaum divides quality costs to "Costs of Quality Control" and "Costs of Quality Control Failure" [76, p. 925], Feigenbaum uses the word "control" in the broadest sense and his intention is actually to all quality activities. When saying "Quality Control", he actually refers to the quality system. Therefore the author shall use the terms "Costs of Quality System" and "Costs of Quality System Failure" instead of "Costs of Quality Control" and "Costs of Quality Control Failure". Some call "Quality Costs" by the name "Costs of Non-Quality", because those are costs which quantify the

non-quality in the system and not the other way around [39, p. 85].

Understanding the criteria that the client will use for tender selection is important. It may be price, duration, quality, safety or a combination of any of these. Knowledge of the construction team and past experience can also be a Factor [165, p. 150].

Costs of a quality system are Prevention Costs and Appraisal Costs of a quality system. Costs of quality system failure are Internal Failure Costs and External Failure Costs.

Prevention costs include the costs of writing, maintaining and updating of specification procedures and standards, the costs of preparing a quality plan, the costs of training and qualification of employees [90, p. 12], the costs of purchase quality, the costs of quality circles and so on. Appraisal costs include the costs of inspection, the costs of entry control, the costs of process inspection and final inspection, the costs of calibration and maintenance of the means of measurement, the costs of external inspection and so on.

Internal failure costs include the costs of disqualification of materials and products, the costs of excess inventory holding, the costs of changing the type of quality [70, p. 828], the costs of rework and repairs, the costs of investigations of mismatches, the costs of change as a result of mismatching and so on. External failure costs include the costs of product revocation, the costs of rework and repairs, handling customer complaints, the costs of rejecting a product or service, the costs of service during warranty, the costs of marketing errors, the costs of damages as a result of suppliers and so on [119, p. 466], [17, p. 63].

In defining costs, Feigenbaum was careful not to include costs that could generate objections from organizations he advised or worked at. Therefore, there are costs that are a waste and not included in the list of Feigenbaum that can certainly be placed under the heading of quality costs. For example, costs due to delays and waiting, costs due to low efficiency, costs due to hasty investments and costs due to rejection of personnel [9, p. 102].

Developments in Regard to Quality Costs: It has been related to quality system costs and failure costs for a long time by finding the balance between both, as shown in figure 1.4. [52, p. 112]. To save costs, according to this approach, one must produce products in such a quality that the total costs of the quality system and quality system failure will be minimal.

In a later period of time, when the standard of living began to improve, it was found that customers were willing to pay more to get higher quality [119, p. 466]. It follows that the quality of the product should be determined according to the maximal financial gain that can be derived from it, that is shown in Figure 1.4.

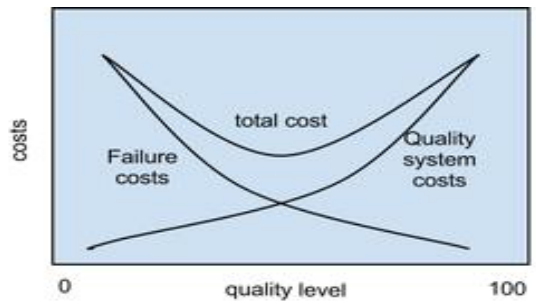


Fig 1.4. Quality Cost - The Maximum Profit approach [52, p. 112]

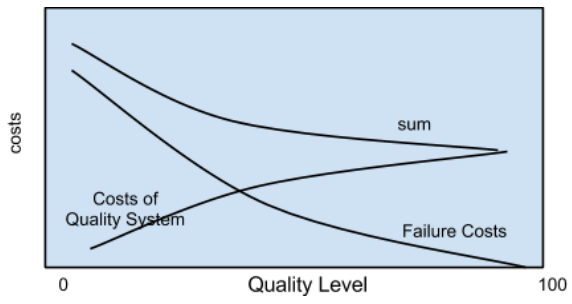


Fig 1.5. Quality Cost - The Maximum Quality approach [8, p. 36]

The significant change in the attitude to the subject of quality occurred when Japanese companies were able to provide a quality equal to the quality of American and European companies, but at a cheaper price. This was especially evident in the automotive and electronics industry. They were basically able to move the graph of quality system costs and cause the preference for their products by customers, as described in figure 1.5. [52, p. 112]. This means that it is preferable to produce products of the highest quality. When the prices of materials, manpower and machinery fall, the marginal cost of producing quality output would be expected to fall [162, p. 79].

In conclusion, the notion of quality has been ever-present since the 17th century. In the author's opinion, quality is important for business, employees, customers, etc. A customer should be able to receive the same quality treatment, goods and service anywhere, anyplace and anytime. Quality is necessary for good customer service. The three interrelated reference points are quality, time and cost which summarize the Quality Triangle. The author is a strong believer of quality and its presence at all times.

1.2. Systemic treatment of quality management: Total Quality Management (TQM)

Total Quality Management (TQM) is a set of management practices throughout the organization, geared to ensure the organization consistently meets or exceeds customer requirements. TQM places strong focus on process measurement and controls as means of continuous improvement [119, p. 466].

James J. O'Brien is quoted as saying about TQM: "is both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. TQM is the application of quantitative methods and human resources to improve the material and services supplied to an organization, all the processes within an organization and the degree to

which the needs of the customer are met, now and in the future" [49, p. 112]. Before reading more about TQM, it might be helpful to quickly review the major forms of quality management in an organization. These are briefly described at the top of the Quality Management topic.

Statistical Tools: Quality management must be based on facts. If the author strives to improve and solve quality problems, The author must rely on information and analyze it using reliable statistical tools.

Statistical tools that the author can use are varied, and statistical analysis can be performed in several forms simultaneously. The process and the various factors in the process should be described in the form of a quality chain of customers and suppliers, to define the input and output of each factor and set the parameters the author wants to measure. You can test the endurance of the chosen parameters and test, for example, whether the different suppliers meet them [119, p. 466]. Such analysis will give a measure of the level of quality, and directions for examination for improvement. Other statistical analysis can be done by a histogram showing the distribution of the factors or distribution of defects. Using a detailed analysis, one can identify the most significant factors or deficiencies and treat them as part of quality circles or by any other corrective action. Another statistical analysis is examining the correlation between two data. Using a scatter diagram, showing the dependence between a certain statistic data and another, it can be known whether there is a correlation between the data. If one of the data is an input of some other date, and there is a high correlation between them, one can strongly control the output data by the input data. If the two data are outputs of various factors then it is necessary to check the common factor influencing them so strongly and resulting in a high correlation between them. Another method for statistical analysis, which is rather complex and not suitable, for many reasons, for the field of construction, is the Taguchi method.

7 Important Principles of Total Quality Management: Total Quality Management (TQM) is an approach that organizations use to improve their internal processes and increase customer satisfaction. When it is properly implemented, this style of management can lead to decreased costs related to corrective or preventive maintenance, better overall performance, and an increased number of happy and loyal customers [119, p. 466].

However, TQM is not something that happens overnight. While there are a number of software solutions that will help organizations quickly start to implement a quality management system, there are some underlying philosophies that the company must integrate throughout every department of the company and at every level of management. Whatever other resources you use, you should adopt these seven important principles of Total Quality Management as a

foundation for all your activities. The 7 Qualities of Brilliant Executive Coaching [3, p. 24].

1. Quality can and must be managed: Many companies have wallowed in a repetitive cycle of chaos and customer complaints. They believe that their operations are simply too large to effectively manage the level of quality. The first step in the TQM process, then, is to realize there is a problem and that it can be controlled.

2. Processes, not people, are the problem: If your process is causing problems, it won't matter how many times you hire new employees or how many training sessions you put them through. Correct the process and then train your people on these new procedures. As said by DR. Carlos that the author must listen to the employees [120, p. 53].

3. Don't treat symptoms, look for the cure: If you just patch over the underlying problems in the process, you will never be able to fully reach your potential. If, for example, your shipping department is falling behind, you may find that it is because of holdups in manufacturing. Go for the source to correct the problem.

4. Every employee is responsible for quality: Everyone in the company, from the workers on the line to the upper management, must realize that they have an important part to play in ensuring high levels of quality in their products and services. Everyone has a customer to delight, and they must all step up and take responsibility for them [119, p. 466].

5. Quality must be measurable: A quality management system is only effective when you can quantify the results. You need to see how the process is implemented and if it is having the desired effect. This will help you set your goals for the future and ensure that every department is working toward the same result.

6. Quality improvements must be continuous: Total Quality Management is not something that can be done once and then forgotten. It's not a management "phase" that will end after a problem has been corrected. Real improvements must occur frequently and continually in order to increase customer satisfaction and loyalty. The author must define a clear service quality strategy [120, p. 53].

7. Quality is a long-term investment: Quality management is not a quick fix. You can purchase QMS software that will help you get things started, but you should understand that real results won't occur immediately. TQM is a long-term investment, and it is designed to help you find long-term success.

In my opinion the 7th principles it's very important to highlight and emphasize on these principles for every quality model.

In Table 1.1. There is a description of the different roles of each factor, and its commitments to achieving continuous improvement of the process, as described by Juran [52, p. 163].

Table 1.1. Continuous Improvement Practices

Responsibility for Quality		
As a customer	**As Process Executive**	**As Supplier**
Define my requirements from the supplier clearly and in a documented manner	Measure the means of quality and measure others	Understand the customer's requirements, document and track the products I provide
Return defective products	Constantly improve my processes, reduce defects and work duration	Reduce defects and variance in my products
Provide feedback for the supplier on the quality of his products	Document and present my method of work, the defects and my plans to improve quality	Measure the quality of the products from the point of view of the customer

Source: [2, p. 16]

Deming describes the process of continuous improvement through a cycle called the "Deming Cycle" [20, p. 88] in which four recurring tasks are described which are required for continuous improvement (figure 1.6.).

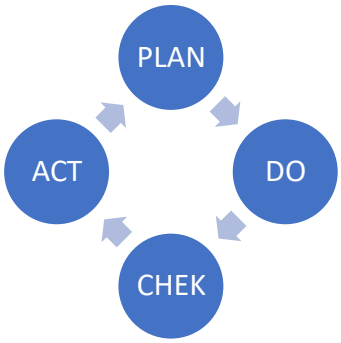


Fig. 1.6. Deming's Continuous Improvement Cycle [2, p. 16]

The Model of the TQM Method: TQM method is described in different ways. One possible model of the theory is the model of Kanji & Asher, 1993. They argue that there are four guiding principles, and 8 core concepts which describe total quality management. The guiding principles and core concepts are described in Table 1.2.

Table 1.2. Principles and Core Concepts of TQM

Principles	Core Concepts
Please the Customer	Customer satisfaction Internal Customers are Real
Management Through Facts	Every Job is a Process Measurement
Management Based on People	Teamwork People Make Quality
Continuous Improvement	Continuous Cycle Prevention

Source: [2, p. 17]

Table 1.2. is a clear and concise chart which illustrates core concepts and ideas for making the workplace successful and efficient. It helps employees understand that people work with people and need to take everyone and everything seriously and positively in a continuous manner.

Tools for Implementing Total Quality Management: The means for establishing the method can be described using the model in figure 1.7. [51, p. 454]. Total Quality Management requires continuous improvement and overlays which are all interconnected for the ultimate success for a work in progress. Carlos J. F.: TQM as the most radical technique and as one of the most difficult to implement [121, p. 1139]. Customer satisfaction for example, would even require people-based management, leadership, teamwork, etc. Essentially, all work is an ongoing process with the fact that people are all involved within each other and within each office, even if they do not realize it. The four bases are people-based management, delight the customer, management by tact and continuous improvement. In order to reach the zenith of the pyramid, employees must involve all factors and adhere to them so maximum quality and success can be attained.

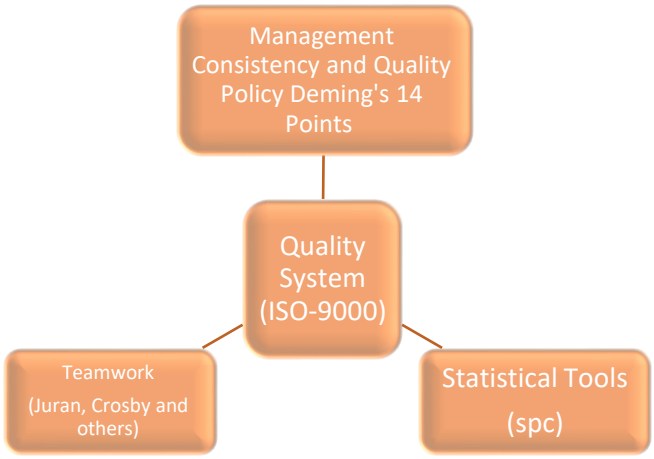


Fig. 1.7. The Implementation TQM Model [51, p. 454]

The Project Management Context - Characteristics of the Project Life Cycle

The project life cycle serves to define the beginning and the end of a project. For example, when an organization identifies an opportunity to which it would like to respond, it will often authorize a needs assessment and/or a feasibility study to decide if it should undertake a project. The project life-cycle definition will determine whether the feasibility study is treated as the first project phase or as a separate, standalone project [2, p. 12]. Reviewing the academic literature, Fernez-Walch and Triomphe highlighted three multi-project management approaches concerning innovation projects in use in a multi-project setting: project portfolio management (PPM), platform-based multi-project management and trajectory-based multi-project management [166, p. 88].

Management Consultancy and Quality Policy: Management constancy and the quality policy of an organization can be defined in many forms. Guidelines can be found in different places. The most common source is Edward Deming. The fourteen points of Deming define the quality policy. Deming's fourteen points convey the ideal ways to have management consistency and quality management. They are considered to be ideal to maintain and achieve success. These policies are the preferred way to incorporate and achieve success.

Consequently, for subchapter 1.2., there should be a never-ending cycle of improvement, planning, achieving and guiding. The author suggested that improving is always attainable and necessary in order to please and satisfy the customer. Simple steps of a cycle are to act, plan, check, do, and continuously improve the cycle to complete tasks, etc. The Total Quality Management model is a clear and simple guide to follow in order to implement a successful outcome. The model has been used by numerous individuals regarding many different fields which have all had a positive outcome. The individuals who want to create a new outlook should create appropriate diagrams and analyze its appropriateness to the respective field, and if it is successful. The individuals need to see how to work with the diagram, how to implement it and how it can work in their favor. This includes noting the correlation between the factors and the results and finding the best outcome for their workplace. Ultimately excellent companies have completely integrated the two complementary systems [167, p. 262].

Quality 2030 consists of five collectively designed themes for future QM research and Practice: the study emphasizes systems perspectives applied, (b) stability in change, (c) models for smart self-organization, (d) integrating sustainable development, and (e) higher purpose as QM booster. The study also identified a positive core of QM (values and aspects that need to be preserved and nurtured), consisting of the following elements: (1) value as a guiding and unifying

WHY for the entire organization; (2) leading with a systems perspective and in collaboration; (3) belief in human potential, aiming to strengthen the system around people, for people; (4) providing systematics and methodologies for inquiring and understanding underlying causes and variation; (5) research that is close to practice, relevant, and interactive; and (6) knowledge on how to develop organizational capacity for learning, change, and adaptation. [171, p. 14]

In addition to the QTM, on the other hand there are three types of QMS use: business management, improvement and compliance-oriented use. The purpose was to explore how these three differing types of uses of QMS correlate with management perceptions of quality management in terms of respect, cost, and strategic importance. Overall, the conclusion is that different ways of working with QMS does not only impact the value of QMS per se, rather it also influences management's respect for and view of quality management.

management. In terms of difference between the three types of QMS usage, there is a correlation between business management- and improvement-oriented uses of QMS with quality management being respected, and viewed as strategic and not cost-driving. Previously the research has suggested a compliance-oriented use of QMS was the reason for many of the negative perceptions of QMS that in turn was suspected to lead to negative views on quality management in general.

On the other hand, the findings of this study are somewhat contradictory to this and provide a more nuanced picture showing that, in general, compliance-oriented views might not drive negative perceptions and that it is useful to operationalize compliance into documentation and standardization. It is suggested that a perception of QMS as having limited value is mainly due to a focus on documentation, whereas work on standardization, which is also part of a compliance-oriented QMS, does not carry similar negative implications. In summary, this study highlights how the perceived strategic value of quality management can be increased through a deliberate design, and choice of an organization's ways of using QMS. [172, p. 11]

1.3. Models of Quality Management System: Content and Scope

Introduction: Parallel to the development of quality control, quality assurance and total quality management, different methods were developed to prevent the wastage of the majority of the benefit from the production process. These methods are: JIT, Value Engineering and Constructability. Some were even developed in the same places and at the same time as the sophisticated approaches to quality management JIT [21, p. 23], for example, was developed in Japan during the same years and in the same factories in which quality circles and the TQM

method were developed [2, p. 71].

Described below are methods developed over the years:

JIT – Just in Time: JIT is a collection of management philosophies developed in Japan. The approach defines the term "waste" as everything from the absolute minimum amount of resources needed to produce goods and services. The approach focuses on immediate improvement in productivity by reducing costs associated with inventory and includes direct costs of purchasing, financing, storage, insurance, security, inventory obsolescence and more.

JIT is, without doubt, a far better-quality management method, in addition to it being a technique for improving productivity that can generate short-term benefit as well. JIT's objective is maximizing the timing of delivery or receiving of inventory of accurate quantities. According to JIT approach, the required inventory is pulled into the work process on a basis of small portions. Materials or labor or inventory in the process are provided only when they are needed by the subsequent workstation. The movement of inventory or labor is done from the supplier to the workstation directly.

The supplier and subcontractor should also be part of the process and act according to the method of JIT themselves. Otherwise, waste costs resulting from excess inventory at the supplier would roll to the prime contractor and then to the customer [119, p. 466]. To have suppliers and subcontractors participate in a "new game", one must establish a relationship of long term cooperation with them. One should avoid common approaches of attachment with suppliers and subcontractors which essentially is multiple suppliers per product and attachments on the basis of price tag alone. The manner of the new attachment should be based on economic interests, as in any business attachment, but on trust and partnership. Each product should have a minimum number of suppliers and the attachment with them should be based on quality and price together. The need for a new type of attachment led to a new concept in the business world which is "Partnering".

Partnering: "Partnering" is a concept developed in recent decades and it means: a (usually) long-term business attachment between parties, with a joint effort based on open communication, mutual trust and cooperation, in order to achieve the objectives of all parties involved. Partnering is supposed to improve efficiency and yield, to encourage innovation and continuous improvement of product and service quality [112, p. 27]. James J. O'Brien is quoted as saying "Partnering refers to long-term agreements between companies to cooperate to an unusually high degree to achieve separate yet complementary objectives" [49, p.100].

Partnering is basically breaking conventions of accepted modes of attachment between

organizations. The new concept is a unified culture and breaking boundaries and barriers between attaching organizations. The goal is to make the most of every participant in the process by removing obstacles of lack-of-trust, fear and lack of cooperation. According to Yomi Babatunde & Sui Pheng Low: “Since China’s economic reforms, its special economic zones have performed successfully as a negotiation strategy in its partnering discussions in the African countries” [115, p. 42].

The connection between quality management and partnering is almost obvious. It can be said, in a simplistic manner, that partnering is implementing Deming's 14 points, not only within the organization, namely: for the contractor or developer and so on, but referring to the project and to all the parties in the project as one organization implementing Deming's 14 points.

Quality Assurance (QA): Quality assurance (QA) refers to the systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled. It is the systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention. This can be contrasted with quality control, which is focused on process outputs. James J. O’Brien was quoted as saying: “Quality assurance is maintained from project conception (and preferably before) through startup. The QA procedures provide the basis for QC planning and implementation” [49, p. 132]. Two principles included in QA are: "Fit for purpose", the product should be suitable for the intended purpose; and "Right first time," mistakes should be eliminated. QA includes management of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.

Suitable quality is determined by product users, clients or customers, not by society in general. It is not related to cost and adjectives or descriptors such as "high" and "poor" are not applicable. For example [119, p. 466], a low-priced product may be viewed as having high quality because it is disposable where another may be viewed as having poor quality because it is not disposable.

Quality Control (QC): Quality control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of quality criteria or meets the requirements of the client or customer. QC is similar to, but not identical with, quality assurance (QA). QA is defined as a procedure or set of procedures intended to ensure that a product or service under development (before work is complete, as opposed to afterwards) meets specified requirements. QA is sometimes expressed together with QC as a single expression, quality assurance and control (QA/QC) [3, p. 46]. James J. O’Brien was

quoted as saying: “Quality assurance is maintained from project conception (and preferably before) through start up. The QA procedures provide the basis for QC planning and implementation” [49, p. 132].

In order to implement an effective QC program, an enterprise must first decide which specific standards the product or service must meet. Then the extent of QC actions should be determined (for example, the percentage of units to be tested from each lot). Next, real-world data should be collected (for example, the percentage of units that fail) and the results reported to management personnel. After this, corrective action has to be decided upon and taken (for example, defective units have to be repaired or rejected and poor service repeated at no charge until the customer is satisfied) [119, p. 466]. If too many unit failures or instances of poor service occur, a plan ought to be devised to improve the production or service process and then that plan must be put into action. Finally, the QC process must be ongoing to ensure that remedial efforts, if required, have produced satisfactory results and to immediately detect recurrences or new instances of trouble [14, p. 93].

Value Engineering (VA): Value engineering is an organized approach for identifying and eliminating unnecessary costs. The purpose of value engineering is to provide the necessary functions required from a product at the lowest price. Value engineering started out in American industry in the 40s. Following the shortage of raw materials, an exploration of options began in order to provide alternative existing components. The development of this way of thinking resulted in many replacements providing equal or better performance at low costs. James J. O’Brien is quoted as saying: “This is also called the design development. After approval of the sketch or schematic phase, the drawings are refined to a degree sufficient to permit the development of dimensioned space layouts, heating and ventilating systems main feeders, and electrical main feeders, as well as definite development of the structural framework. Requirements for utilities are also definitely developed, and specific equipment requirements are determined. The budgetary type cost estimate is revised, and a more firm estimate made. Within QA parameters, value engineering (VE) and constructability reviews are best applied at this stage” [49, p. 8].

On the basis of the results obtained, value engineering was based. In the analysis of unnecessary costs, the following points should be examined:

- **Functions**: functions that do not match the product designation are not necessary.
- **Lifespan**: the lifespan of each component in the product should be balanced with the life of the product.

- **Quality**: cost reduction does not come at the expense of quality.
- **Appearance**: the appearance of the product is, at times, one of the most important components to the customer, and therefore must be considered at the time of cost reduction [119, p. 466].
- **Value engineering:** is performed by a multidisciplinary staff which includes customer representatives, designer, executive, purchasing and marketing people and more. Value engineering is performed in a number of steps:
- **Orientation**: analyzing the product and its components, and defining the functional needs for each component from the perspective of the customer [119, p. 466].
- **Info**: coming up with reliable information about costs, quantities, sketches, specifications and methods of execution. The quality of decisions depends largely on the quality of the information.
- **Creativity**: raising ideas and solutions to problems using the technique of "brainstorming" and then examining them.
- **Analysis and Evaluation**: assessing the monetary value of the ideas and ranking them by the profit inherent in them.
- **Planning**: preparing an execution plan for the various participants in the process: the designer, the executives, purchasing and more.
- **Performing a "Pilot"**: presenting the execution plans for the various participants in the process, performing a "pilot" and further examination.
- **Summary and Conclusions**: summary of results and start of execution.

Constructability: constructability, the ability to construct, is defined as "the optimal way for use of knowledge of construction, planning, purchasing and executive experience, to achieve the project goals". The way in which constructability is performed is by teamwork and improving attachment between the parties involved in the project - developer, architect, designer, various consultants and the executive body [57, p. 45].

Constructability is designed to prevent high costs, which are costs of non-quality, resulting from the detachment between design and execution through the integration between the two as done previously by "Master Builder." The Master Builder was responsible for all project operations - preliminary design, detailed planning, purchasing and organization of execution. During the planning, the Master Builder focused on all aspects of the project and took into account the effect of early decisions on the execution of the construction process [14, p. 12]. Quantitative benefits of application by analysis are [57, p. 10]:

- Reduction of engineering costs resulting from the use of standard components and planned

details.

- Reducing construction costs resulting from the effective use of labor force by early producing, early assembly and modular methods.
- Efficient use of building materials, mechanical equipment and manual tools.
- Shortening the duration of the project.

Quality Procedure System: The heart of this method is the Quality Procedure System, which contains, within itself, procedures, definitions and documentation of the quality subject in a company, and can be used as the major anchor for total quality management of a company. Today the most common model of such a management system is the international standard ISO-9000:2015 or, in its local version, Israeli Standard 9000:2015.

Teamwork- Establishing Teamwork: To develop teamwork, one has to go through the steps described in figure 1.8. [51, p. 36].

Fig. 1.8. The Transaction into Teamwork [2, p. 19]

While establishing teamwork, one has to care for the flow of information and ideas in the organization. Everyone at all levels needs to understand what is happening in the company or organization. Flow of information gives a sense of partnership and a sense of importance to every employee.

Establishing trust is the next step. The worker is not a lazy person who aims to earn a maximum salary with minimal effort, but a person proud of his work. If an employee makes a mistake, it could be for a number of reasons, but it is not because he meant it. Establishing trust in the worker enables him to discover the deficiencies in processes and ways of working. Taking a problem-solving approach rather than blaming the person who discovers the problem will lead to teamwork and improvement.

Free communication in the organization allows employees to reveal the problems without fear of punishment. In a workplace where employees express themselves freely and without fear can establish teamwork. The change needed is in the atmosphere and the attitude, and must be transported from senior management down to all levels. If senior management encourages, consciously, an atmosphere of openness and trust, teamwork and organization will be allowed.

To enable teamwork and to maximize it, it is recommended to establish Quality Circles which have been proven to be most beneficial and effective in construction sites [2, p. 28].

Empowerment: An additional and much broader way, which requires a change in the structure of the organization, is employee empowerment and a transition to self-management teams. In many organizations, the TQM implementation process is accompanied by the transition to management by self-managing teams and employee empowerment. TQM is often associated with this process of "empowerment" more than with any other concept. There is no known attempt in the construction industry for empowerment and a self-management team, and it is possible that these methods are not so suitable for the construction industry, but understanding them can contribute to the understanding of teamwork in its purest way possible [119, p. 470].

Quality Circles: Quality circles are some of the ways to create a team in an organization. Deming and Juran are considered the fathers of Quality Circles. Juran defines them as follows: "a quality circle is a group of employees from the same department, who volunteer to devote time, beyond their normal working hours, to solve problems of their own department" [52, p. 18-19].

Quality Circles began as circles of quality control. Following much success in solving quality problems, they began to naturally deal with other problems related to their work. Techniques developed for tracking and analyzing quality problems were found suitable for other issues as well, and within a few years, the framework of goals for these circles expanded also to production problems, productivity, cost savings, wastage prevention, safety, environmental conditions [2, p. 90]. The typical work process in quality circles is depicted schematically in figure 1.9. [2, p. 20].

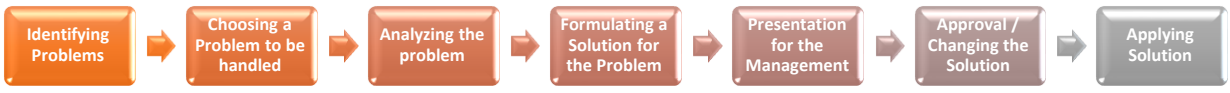


Fig 1.9. The Typical Operation Process of a Quality Circle [2, p. 20]

The basic techniques used by the circle mainly include:

A Brainstorming

B Data Collect Processing

C Pareto Analysis

D Cause & Effect Diagrams

E Management Presentations

Drawing on the employees themselves for tracking and solving the problems stems from

the assumption that people engaged daily in their work know its weak points and problems in particular, and are able to offer practical ways to solve them.

The author has read the opinions and reviews of the Time Quality Management from research conducted and has found that each outlook has offered a solution for each organization involved, including similar organizations. The Time Quality Management has created a new outlook for the author, based on his studies, in order to create a similar diagram for the Local Authorities in Israel. The research and reviews found did not give solutions for how to improve the outcomes at the next level, only for similar organizations with similar issues, at similar places and times. The only aspects the author has seen are for one-time situations. The author has not seen results for future problems organizations might face in the future, such as long-term problems that may occur.

Based on the models presented above, the author believes that the TQM model is the most comprehensive and extensive one which made it last for a long time compared to other models. This is due to the fact that it includes most of the components that are essential to quality which include planning, implementation, delivery to customers and maintenance.

The day-to-day site supervision of all construction activities shall be carried out by the PMC. This includes checking of lines, levels and layouts and on-site checks. Progress monitoring and expediting shall also be carried out by the PMC. The supervisory team of the PMC shall ensure that materials that have been rejected or for which a conformance report has not yet been issued are not used in works.

Construction equipment is a major component of the quality assurance system. The equipment

requirements have been laid out in the Contract documents. It is necessary that the PMC check the adequacy of the equipment used by the contractor for construction as per the prescribed standards and specifications. The equipment used for construction shall be recorded in the daily logs. [151, p. 17]

The literature review highlights the lack of consensus in works related to the impact of certification on performance. Although several studies point to the positive effects of certification, they indicate that certain factors appear necessary for the link to work. This link between certification and the performance can guide decision-makers in their choice to engage in such a process [152, p. 142].

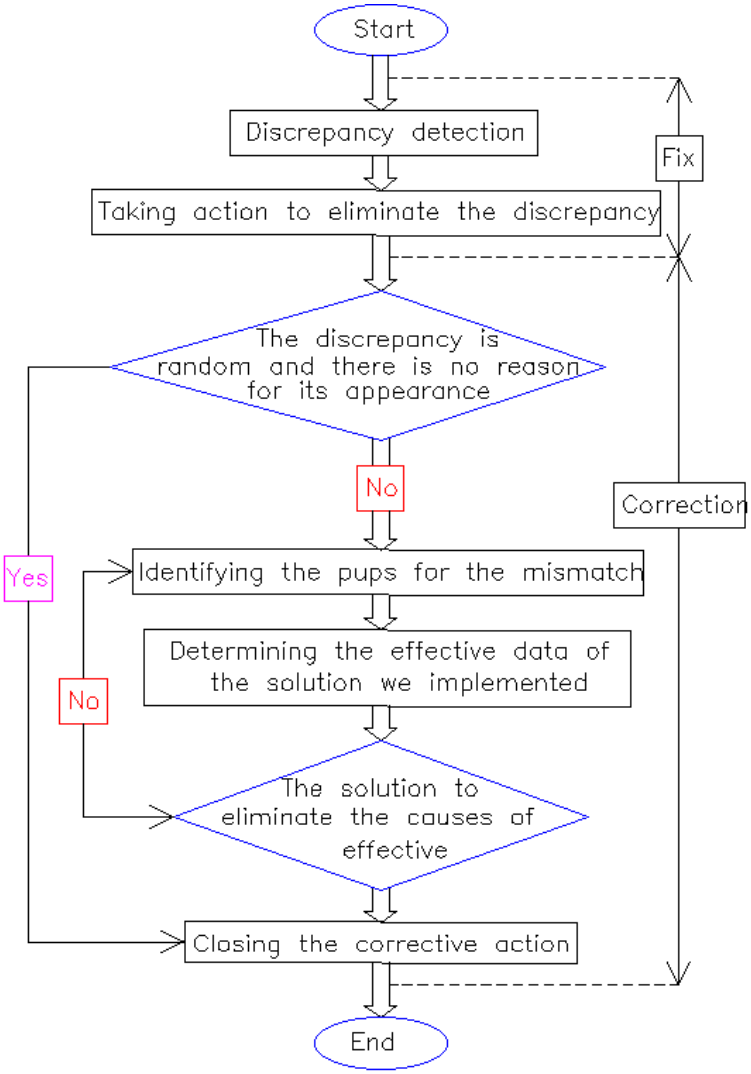


Fig. 1.10. Corrective activity and preventive activity, [173. P. 2]

1.4. The Opportunity of Applying Models of Quality Management System in Public Construction Enterprises

The History of Standard ISO-9000: The starting point of ISO-9000 series, as the starting point of the theory of quality from the school of Juran and Deming, was in the period following World War II - this time, on the other side of the globe. After World War II, NATO was founded. In order to set equal standards for the products arriving from suppliers from NATO countries, a document was made in 1969 detailing the quality requirements. The document is called AQAP. This document was based on a similar document of the U.S. Department of Defense - MIL-Q-9858A [55, p. 17, 37-42].

Transition to the civilian market followed the formulation of a similar document in the UK called Def Stan 05 in 1973, followed, in 1979, by Standard BS-5750 of the British Standards Institute. This standard, unlike its predecessors which focused on a final examination of the

product by inspectors, was designed according to the new wind blowing from the east and gave voice to the principles of modern quality management.

For a long time, standard BS-5750, especially in Europe, was the most accepted quality standard. However, standard BS-5750 was not recognized in all countries, and different countries had their own quality standards, which caused complication and confusion for international companies. In 1987, the ISO – International Standardization Organization – published a series of standards under the name ISO-9000. These standards, which are based on the British Standard BS-5750, constituted the proper international response for the global need of an equable quality standard, at a time when the world had become, more and more, a global village.

In the nineties, standard ISO-9000 series began to take, quite rightly, the place of the TQM as the leading concept in the world of quality. Unlike TQM, which was written in countless books and from different and varied perspectives, Standard ISO-9000 series defines, in one anchored and crisp-clear document, the demands from an organization wanting to establish a quality system. Furthermore, the qualification process for ISO-9000:2015 is accompanied by a tester who certifies the organization– something that results in motivation for progress and meeting goals. Additionally, the certification for the standard is a certificate, and a proof to whoever requires it, that the organization manages a quality system. Schlickman, Jay: "The process used to create an effective QMS based on the ISO 9001:2015 International Standard extends directly to the creation of any QMS based on a standard" [89, p. 11]. "ISO-9000 series family of documents focuses its guidance and requirements on satisfying the customer, and this motif is exemplified in the guidelines by stipulating that the organization's leadership should actually create a customer-oriented organization. Thus, SCHLICKMAN, J. has a clear intention and indication of the concept of a unified business/quality imperative as a prime directive of the highlighted Standard's intent" [89, p. 26].

Another reason for the wide circulation of standard ISO-9000:2015 is the ripple effect it created. More and more governmental, institutional and private bodies began asking for the stamp of approval of ISO-9000:2015 from their suppliers, who later began asking for the stamp of approval from suppliers and so on. Here ISO 9000:2015 appears to operate efficiently in a well-structured bureaucracy by giving additional fight rules resulting in complication and verification in work procedures. In this case the efforts of ISO 9000:2015 procedures over functional structure of organization should be examined carefully to avoid additional flexibility risk [132, p. 322].

Despite the above, ISO-9000:2015 is not TQM, because it does not contain all of its

components, but a skeleton on which to build the TQM method. Standard ISO-9000, in itself, constitutes a framework for a quality assurance system, and the evidence for this is its very definition.

The definition of the Israeli Standard 9001:2015, from the introductory chapter of ISO 9001-9003 (the Israeli equivalent of quality standards ISO 9000-9003): "Quality System - model for quality assurance in production, installation, etc."

The question is: without understanding the underlying philosophy behind quality management (for example: Deming's 14 points), without establishing teamwork and without statistical control methods, is there a possibility, in the long run, to implement ISO-9000:2015 effectively and beneficially?

The Establishment of the ISO Organization: Establishment of the ISO organization was done by combining the International Federation of the National Standardizing Associations (ISA), which was established in 1926, and the United Nations Standards Coordinating Committee (UNSCC), which was established in 1944.

In October, 1946, 65 delegates from 25 countries convened at the London Institute of Civil Engineers, and in this meeting, an international organization was established whose purpose was to "facilitate global adjustment and consolidation of the indices dependent on industry". This organization started out on February 23rd of 1947, and in April of the same year, a meeting was held in Paris where 67 technical committees were established. In the fifties, these committees began spreading the recommendations of national indices.

In the mid-sixties, as a result of the multitude of commercial transport operations between the countries, a need arose for the consolidation of indices between the countries to be agreed on. In 1971, a decision was published stating that the guidelines of the committees are not only recommendations but became binding guidelines between the countries. As a result of this and of the guidelines of the committees, the ISO organization became what the author knows today, the largest organization that handles the publishing of international guidelines and indices. An organization should find the best way of behavior in the situation totally affected by aforementioned parameters. On condition that the organization can function more flexibly, faster to respond and less a massive inertial impediment to accomplishing change it may reduce the effects of unpredictable problems before it is too late. successful competition will be based increasingly on an organization's ability to be more effective on a global scale with its physical resources, competing via aggressive operations and process technology, outstanding quality of human resources, products and making major changes more quickly and easily in products,

facilities, organization and technology [132, p. 323].

The Structure of Standard ISO-9001:2015 is actually a series of standards and not one standard. Standards ISO-9000:2015, ISO-9001:2015 apply to businesses according to the scope of their activities. ISO-9004 and standard series ISO-9001-X are standards that include special guidelines for special industrial implementations, as shown in Appendix 4, ISO-9001:2015 [112, p. 161]. The first version of the standard was published in 1987, since then there have been four updates in the years: 1994, 2000, 2008 and 2015. ISO-9001:2015.

The ISO-9000 series is broken down into different parts, such as ISO-9000, ISO-9001, ISO-9004:2018, etc. as shown in Appendix 4, ANSI/ASQC Standards-Guidelines to implement ISO 9000 series.

Contents of ISO-9000 series: ISO-9001:2015 focus on twenty aspects, elements, of a quality plan, that will be subjected to rigorous audits in the certification process. Each element is in a chapter, while ISO-9000:2015 includes all the chapters, and in ISO-9001:2015, certain clauses are placed according to the designation of the standard, as shown in figure 1.11. [112, p. 161].

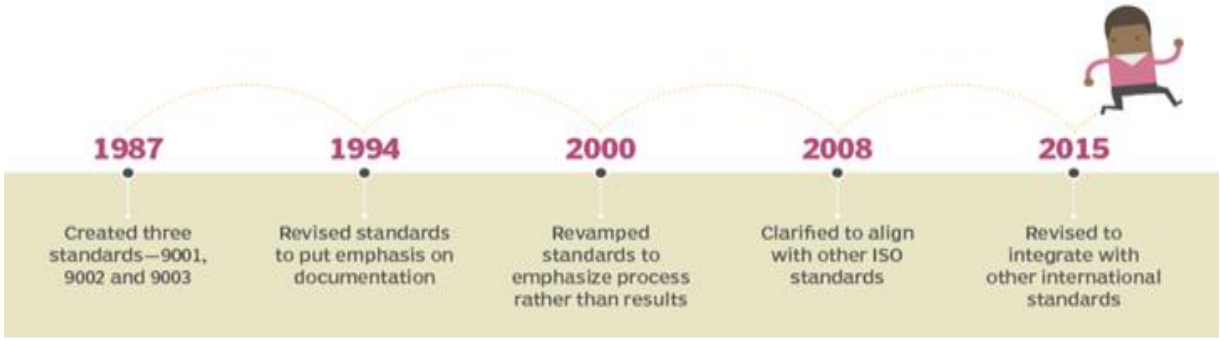


Fig. 1.11. The Timeline of ISO-9001:2015 [112, p. 161]

The different chapters are formulated in a manner appropriate for implementation in different types in an organization. You can classify the chapters in standard ISO-9000:2015 into chapters that require management activities, such as purchasing department, operation department or performance division. You can see the classification of chapters according to this key and their non-validity in the ISO-9000 and ISO-9001 in Appendix 5, Requirements of ISO-9001:2015s [55, p. 17, 37-42]. “The organization must establish, implement, and document a quality management system. In order to do this, the processes of the system must be identified and their sequence and interaction understood. The criteria to effectively manage, operate, monitor, measure, analyze, and control the processes must be determined. Resources must be

made available to operate, monitor, measure where applicable, and improve the processes" [10, p. 24-25].

Procedure Ranking in ISO-9000:2015 System: There are actually 3 layers in a quality system based on ISO-9000:2015, as described in figure 1.11.: (a) general procedures, also called quality procedures, (b) work instructions, also known as work orders, work procedures, performance orders, or internal procedures, (c) forms and reports [55, p. 101].

General procedures are based on the chapters listed in Appendix 5, Requirements of ISO-9001:2015, and their role is to determine the general framework of the quality system, as well as to operate the quality system. An example of defining the framework of a quality system by the general procedures is: determining the duty-holders in the quality system and the responsibility of each duty-holder. Operating the quality system by general procedures is done in two ways: directly and by activating the next layer of procedures, or directly by defining how to perform corrective action, for example. Activating the next layer of procedures can make the definition of how to execute the control in the process and referral to appropriate work instructions.

Work instructions explain how to perform different operations related to the quality system. For example: how to handle supplier invoices or how to check sequence performance. Some of the work instructions require forms or reports that are actually checklists also referred to as testing forms. For example, it is likely to assume that the procedure for testing the manner of performance of a sequence would be accompanied with a checklist of things to test.

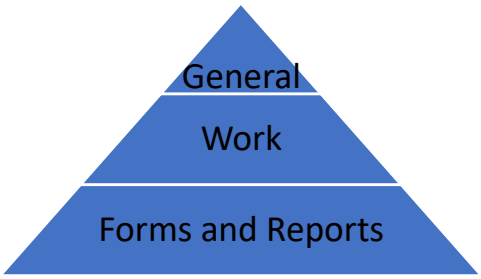


Fig. 1.12. Hierarchy of ISO-9000 series **procedures [42, p. 37]**

This figure illustrates the hierarchy of the ISO-9000 series, with the Forms and Reports being at the basis of the pyramid, followed by Work Instructions and lastly General Procedures.

Distribution of ISO-9000:2015: ISO-9000:2015 has revolutionized the business world. It is still too early to conclusively determine whether the results of the revolution are only a cosmetic change or a real and substantial change in business perception, whether there is a continuous improvement in companies that have implemented ISO-9001:2015, whether the standard creates non-quality cost savings, and whether ultimately the target of quality has been

achieved: "satisfying customer requirements" [119, p. 466].

It can be determined that ISO-9000:2015 caused the most significant exposure to the subject of quality on a world-scale. Before ISO-9000:2015 was created, exposure to quality management and quality assurance was relatively limited, and the subject was common mostly in continental Europe, Japan and the United States, and limited mostly to action.

After the ISO-9000 was created, distribution of quality management and quality assurance grew exponentially and worldwide. The number of companies that are now accredited to ISO-9000, in Israel alone, is 2600. Branches, in which the attitude that there is no need for a quality system was traditionally accepted, implemented and received certification for ISO-9001:2015. The examples are many: hotels and restaurants, financial and other advisers, public institutions, the IDF, education and health institutions and more.

A good example of the penetration of quality assurance to branches that are not concerned with industrial production is the penetration of ISO-9001:2015 to construction branches in Israel. Nowadays, approximately 200 companies in the construction branch in Israel have certification for ISO-9000, and many are in the process of certification.

Guideline Publication: The International Organization for Quality of ISO has published, since its inception in 1947 to date, 1700 guidelines in the following areas: mechanical engineering, basic chemical engineering, non-rigid materials, system management, photography, agriculture, construction, special technology, health, medicine, environment, packaging and distribution. In its publication, two series of guidelines were published, and they are: ISO-9000 and ISO-14000. The first is associated with quality procedures and the second with the environment. Nowadays, more than 51 countries have adopted the quality systems as national guidelines, including the European Union and U.S.

It is important to distinguish between the manufacturer's guidelines, which are pedantic about product features, and the features which were determined by quality procedures that assure the suitability of the product to the quality level set by the company. The manufacturing company can determine the quality level of its product based on market research and customer requirements [119, p. 466]. On the other hand, quality procedures help with correct planning of production and with the assurance of receiving the product in the same quality level that was set.

ISO-9000 series began in professional committee number 8402 in 1986, which goal was to consolidate and define individual concepts in quality procedures, and later issued a series of guidelines:

ISO 9001: 1987 quality assurance in systems of design, development, production and

servicing.

Each system was adapted to its operations. After that, the ISO 9004:2018 system was issued, which was a manual and guidelines for quality procedures, and developed over the years to become the world's most popular guide.

In 1994, the professional committee issued a new family of 9000 quality sets which has an emphasis on quality assurance and preventive actions instead of the final inspection.

The 2000 edition solved problems of 174 common mistakes and gave them a proper solution that ensured the satisfaction of the customer [119, p. 466].

In the 2008 edition, there was a need to clarify a number of requirements. In the end of the process, the edition was published in November 2008 with the clarifications that simplified and rearranged the requirements, such as the measuring of customer satisfaction. Schlickman, Jay: "A Quality Policy Statement Is a Mandatory Document the author recommends that the quality policy statement be placed within the quality manual. This approach considers the need for ease of distribution and overall visibility. However, the quality policy could just as readily be a separate document. In fact, many organizations place the quality policy statement within the quality manual and then extract it for purposes of display and ready availability. Either way, the document is to be controlled, usually by signature and date of the top manager, but it could also be signed off by the entire executive team and/or the entire set of employees. The Quality Policy Statement must contain all of the Standard's requirements" [89, p. 51].

LAWS IN ISRAEL

There are several laws includes construction managements laws and forms such as:

1. The Planning and Construction and regulation laws
2. Law regulation for the sale of apartments
3. The law regulation for the obligation of tenders

STANDARDS INSTITUTE (SII) (Makhon Hatkanem) took regulations from the Country laws to manifest standards to work and manage by and obliged the constructions.

Those tens of standards are formed to reach minimum quality to work from.

ISO 9001:2015 concludes a newest form and this standard is the latest ISO that formulated and so solved different problems, ISO always develops throughout the years and that is beneficial for the whole system, thus it replaced the policy statement with the quality manual, yet we wait the new improved version of the ISO.

ISO is formatted to be general standard in several fields and it can contain planning, management and supervision. The public institutions and entrepreneurs were demanding ISO

9001:2015 in the construction field but in recent years the demand decreased drastically.

Introduction: Research Method

At the beginning of the study, the author reviewed in detail the subject of quality (Chapter 1 - literature review), and that included the development of quality management in the 20th century. The author also compared different approaches and different methods central to quality management nowadays, TQM and ISO-9000.

In the literature review, the author also referred to the methods and techniques accompanying quality management, which constitute as supplements to the main approaches of quality management. These include JIT, Partnering and Value Engineering [15, p. 39].

The literature review presented here is the background and basis for the research work specified henceforth.

Israel has 257 local authorities, two of which are industrial local authorities. Each Local Authority has an Engineering Department (sometimes called the Engineering Division or Engineering Administration). The data was collected using a questionnaire that included 22 essential questions: numerical data on the authority, the department and the quality manual, including frequency of use and update. In addition, a conclusion committee was held, for feedback on the quality guide proposed by the researcher.

Following subchapter 1.4., the author recognized the quality management system in public construction enterprises [153, p. 513-516], especially the Standard ISO-9000:2015, the author believes that the construction branch was one of the last fields to join this change. In the author's opinion, the construction branch should have joined this wave much sooner, especially public organizations because this system allows for clarity in the Local Authority and in the engineering departments [169, p. 110-119].

1.5. Conclusion for Chapter 1

1. In Chapter 1, it was the author's analysis of the historical aspects of how and where quality began, evolved and came to be used. These aspects include the concluding quality, notion of quality and quality management in the evolution of time as seen throughout history. Studies presented in this chapter convey that the evolution of quality has shaped the way of organizing unions. This includes the essential sciences which enhances and signifies the structure of business. This began in 17th century Europe, when various professionals began organizing unions in Europe, which they called organizations, until the 19th century. Production in the industrialized world tended to follow this professional model. Factories began focusing on product testing in Great Britain in mid-1750. It then developed until it took shape in the form of

the industrial revolution in the early 1800's.

Early in the 20th century, craftsmen began establishing a quality process in factories. During the involvement of the United States in World War II, there was a more pronounced need for quality, especially in terms of manufacturing for war purposes: for example, bullets manufactured in the U.S. needed to be suited for guns manufactured in different districts. And here began the process of production testing only for the need of simplifying this process regardless of safety.

Thus, the army began to sample certain products and work on their suitability, until indices and military specifications were announced, thus began the process of perfecting in terms of testing and the manner of sampling, as well as supervision of production. However, upon World War II, a large number of U.S. factories began production for war in order to supply equipment and weapons for war, which affected local civil production till the point of shortage of civilian products such as refrigerators, stoves, etc. I have analyzed that there must be strive for utmost quality when manufacturing a product. This includes the “triangle quality” which maximizes cost and time. In addition, the model emphasizes that a product cannot be defined in terms of cost and time only and regardless of its quality.

2. TQM is a set of management practices throughout the organization, geared to ensure the organization consistently meets or exceeds customer requirements. Before reading more about TQM, it might be helpful to quickly review the major forms of quality management in an organization. These are briefly described at the top of the Quality Management topic. This is an approach that organizations use to improve their internal processes and increase customer satisfaction. It is a guiding foundation for improving an organization. Thus, I have analyzed this procedure which yields a decrease in costs by leading this management style and concluding with decreasing costs, loyal customers and top-notch performance. The core concepts studies illustrate the core concepts and ideology for creating a successful and efficient environment within the workplace.

However, TQM is not something that happens overnight. While there are a number of software solutions that will help organizations quickly start to implement a quality management system, there are some underlying philosophies that the company must integrate throughout every department of the company and at every level of management. Whatever other resources you use, you should adopt these seven important principles of Total Quality Management as a foundation for all your activities.

3. International Standard ISO-9000:2015 largely answers these questions in that it lists the

minimum requirements necessary to establish a quality system in any organization. This, perhaps, is one reason why the standard ISO-9000:2015 became the new object of companies and organizations in the Israeli domain of construction interested in improving quality. The ISO-9000:2015 organizes the quality on a global-level. Since it began, I have studied and seen an improvement in the coordination of delegating work. Thus, the guidelines are applicable in any country and do not need to be modified. It has eased the workplace environment and has created a clear route for each person involved.

It was the author's analysis of Chapter 1, this is a positive detail but also has its negative aspects. Mishaps also become evident in assessing the requirements of a quality system in the form of a standard. The standard defines minimum requirements for implementing a quality system, and thus may limit the motivation to develop the subject of quality in a company or organization to higher levels. In addition, the fact that there is a qualification and certification for the quality system may create the relief that after receiving the stamp of approval, the quality system works properly, and seemingly the job is finished. In the end, the stamp of approval becomes a long-awaited character of its own and may cause companies to want to boast about it more than to improve quality. Schlickman, Jay: "*The Excellent Corporation is committed, at all levels of the company, to total customer satisfaction*". To meet this commitment, The author provides products and services that fulfill customer expectations, and provide quality at levels greater than that available from any of our competitors. Our quality management system is based on the International Standard ISO 9001:2015, and the authors are fully committed to continually improve the effectiveness of our system by means of constant top management review and oversight. This level of attention is complemented by formal management reviews, internal audits, extensive training, and an aggressive corrective and preventive action program that includes cross functional teams for root-cause analysis and problem resolution. To ensure the integrity of our system, quantitative quality objectives which are based on operational metrics are established, monitored, measured, and reviewed by managers who are held accountable for their results. In addition, all of our employees are thoroughly trained in quality management methods and are supplied with the resources required to ensure that such methods are effective. I believe that it is the responsibility of every employee in every company to withhold and abide by the highest quality standards in order to achieve maximum success and in order to have effective results.

2. QUALITY MANAGEMENT SYSTEMS OF LOCAL AUTHORITIES IN THE STATE OF ISRAEL

2.1. Present Situation of Quality Guides in Engineering Departments in Local Authorities in Israel

Hundreds of countries independently run by ISO standards. There is a presence of the standard, ISO-9000 series, such as in Mexico, the United States and Malaysia. Singapore and the United Kingdom are also very adamant about the quality standards. As referenced by Dr. Lawrence D. Eicher, “in Belgium, the public transport authority operating in the Brussels metropolitan area has an ISO 9000:2015-based quality system and the buses, trams and trolleys of the public transport authority of Geneva, where ISO Central Secretariat is based, proudly sport a logo portraying its ISO 9000:2015 certification”.

Associated with this, there is a need to provide information about the standards and strategic issues of ISO's business with a view towards achieving the aim of the organization, which is to promote the development of standardization and related activities in the world, in the Local Authorities, especially in the developing countries such as Jordan and the Palestinian Territories.

The author mentioned the example of local authorities in Canada and Australia. To these, the author can add the United Kingdom, which has had the longest experience of a quality management standard, BS 5750, which predated ISO-9000 series, and it is in this country that there has been the largest take-up so far by public administrations. Dozens of local government departments, with responsibilities ranging from the upkeep of parks, to municipal swimming pools, to road maintenance have implemented ISO 9001:2015 and sought certification of their quality systems. A number of operating units of central government departments, including the Treasury and Inland Revenue, and public utilities, such as a water authority, as well as other public servants, such as the Metropolitan Police, have also instituted ISO 9000:2015 quality systems. In Finland, local municipalities have implemented a project called "Quality and the Community", based on ISO 9000:2015 standards. In Belgium, the public transport authority operating in the Brussels metropolitan area has an ISO 9000:2015-based quality system and the buses, trams and trolleys of the public transport authority of Geneva, where ISO Central Secretariat is based, proudly sport a logo portraying its ISO 9000:2015 certification. In France, one of the first organizations to be certified to the revised ISO 9001:2015 standard was the public works department of Lyon, the country's second city. In fact, you can go around the world and find many other examples of ISO 9000:2015 having been implemented by government

departments, such as in the United States, Mexico and Singapore. Perhaps the most ambitious project of all is in Malaysia, which has decided to implement ISO 9000:2015 across the board in its entire public administration. Why is there this growing interest in quality in the public sector? In the United Kingdom, which has the greatest experience of this phenomenon, the following four influences have been identified. Few cities in Jordan have a standard, and it is still non-evident that they will all be incorporating a standard such as the ISO-9000:2015. In the Palestinian Territories, there are standards in the Local Municipalities of Engineering, especially in the main cities. Within the Palestinian Territories, they are ever improving their quality systems.

Firstly, the introduction of compulsory competitive tendering for procurement contracts has produced a more businesslike approach to services. Secondly, the customers for public services are becoming increasingly demanding and discerning about the quality of these services. Thirdly, the emphasis in public-sector management has shifted from a traditional institution-led approach to an approach focused on the customer. Lastly, the generalized development of quality management in the private manufacturing and service sectors means that public-sector service providers cannot remain outside the quality movement. Quality in public administration must take account of a number of distinctive features. Public administrations, like international not-for-profit organizations, may be accountable to customers, citizens, elected representatives and to government, which creates responsibilities additional to those of private-sector organizations. The range and nature of services in public administration also makes it distinctive as does the diversity between different central and local authorities in terms of functions, population, geographical area, socio-economic factors, and business and community needs.

However, these distinctions do not mean that the essentials of good management practice are not applicable. They just need applying in the knowledge that the ultimate aim for service provision is not profitability, but for added value to the individual, to the administration, to the government or other stakeholders which fund the administration's activities and to society as a whole [148].

At the beginning of the study, the author reviewed in detail the subject of quality (Chapter 1 - literature review), and that included the development of quality management in the 20th century. The author also compared different approaches and different methods central to quality management nowadays, TQM and standard ISO-9000:2015.

In the literature review, the author also referred to the methods and techniques accompanying quality management, which constitute as supplements to the main approaches of

quality management. These include JIT, Partnering and Value Engineering. The literature review presented here is the background and basis for the research work specified henceforth.

Israel has 257 local authorities, two of which are industrial local authorities. Each Local Authority has an Engineering Department (sometimes called the Engineering Division or Engineering Administration). The data was collected using a questionnaire that included 22 essential questions: numerical data on the authority, the department and the quality manual, including frequency of use and update. In addition, a conclusion committee was held, for feedback on the quality guide proposed by the researcher. See figure 2.1. Which summarizes the methodology of the study and data collection [124].

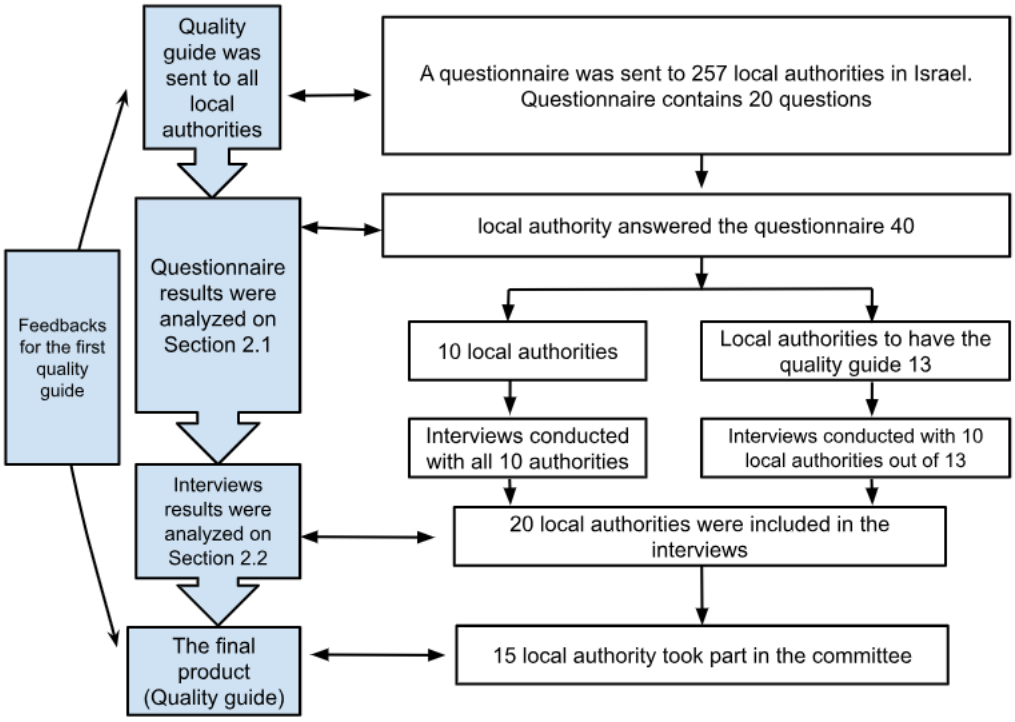


Fig. 2.1. Research Methodology

Source: Author's research specialized for the thesis

In sub-chapter 2.2., and based on the main findings of the interviews and questionnaires, and based on the feedback of the quality manual proposed by the researchers, the main conclusions of the study were formulated, the most central of which was identifying the main factors for success in implementing the ISO-9001:2015 in local authorities. Moreover, a quality guide was formulated (in light of the cumulative experience of the researcher [119, p. 469], as well as the feedback received from the committee, and the e-mail responses of the local

authorities' engineers, in which they asked to change and improve the quality manual sent to them). A proposed model was formulated at the end of the study which is suitable to some extent to the ISO-9000 Israeli standard. This guide is meant to assist local authorities interested in entering the circle of quality and implementing ISO-9001:2015 in the most efficient and beneficial manner.

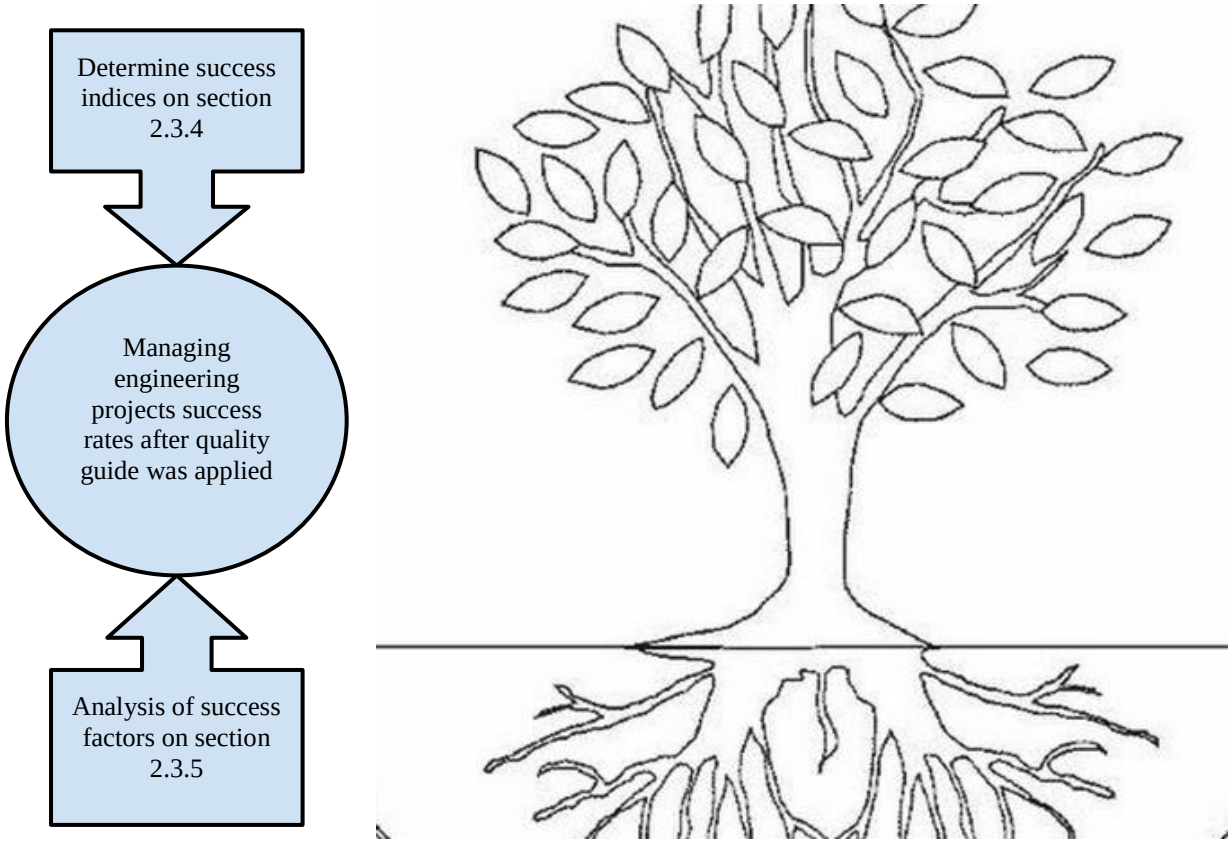


Fig. 2.2. Description of the Research Method in the Sub-chapter 2.3.

Source: Author's research specialized for the thesis

The Current Situation in Local Authorities: The standard organizational structure of local authorities in the country is in the form of a pyramid, though each Local Authority adapts its organizational structure according to the positions manned in the authority. When the head of the authority is at the top of the pyramid, and under who are the various department directors, the Local Authority's engineer, who is the head of the engineering department, is in direct contact with the head of the authority, and under him are 3 levels: the sub-department of licensing, the sub-department of construction, the sub-department of planning. In our research, the author studies the sub-department of construction [92, p. 27]. Below is a schematic diagram illustrating a standard organizational chart of local authorities in the country [86, p. 3-15].

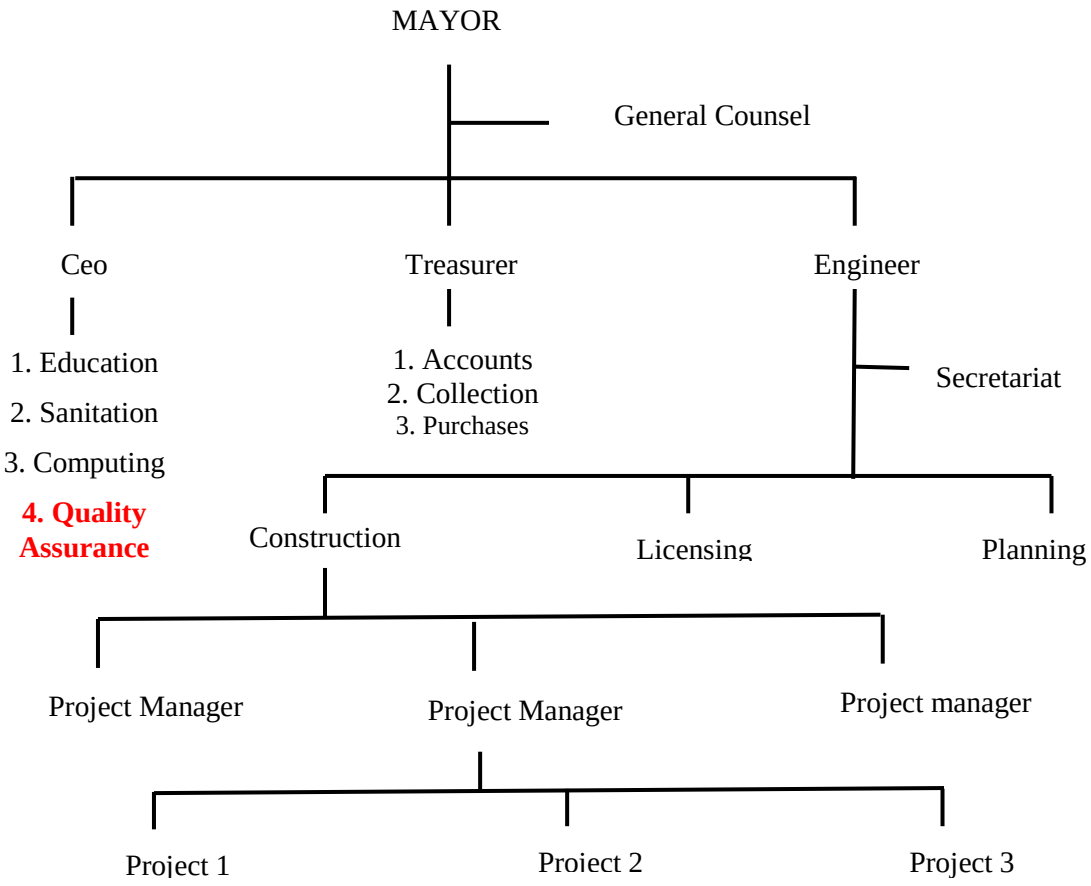


Fig. 2.3. Standard Organizational Chart in Local Authorities in Israel

Source: Author's research specialized for the thesis

Residents' Satisfaction with Local Authorities: The satisfaction of residents with local authorities' officials and departments, taken from the research of Dr. Itay Barry of the University of Haifa, is shown in the following diagrams [8], [92, p. 28].

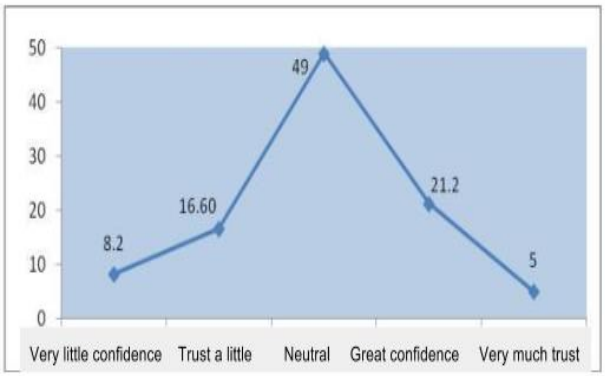


Fig 2.4. Level of satisfaction of the head Authority's office [8, p. 12]

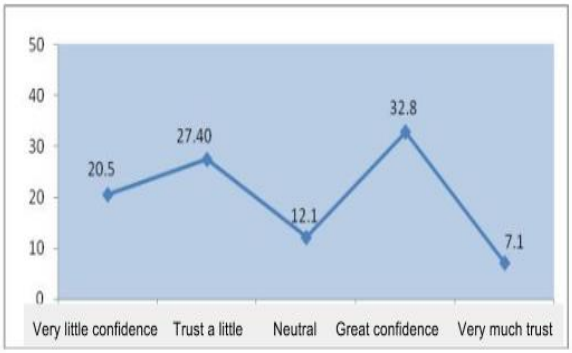


Fig 2.5. Level of satisfaction from the engineering department [8, p. 21]

Based on these graphs the level of satisfaction of the head of Authorities shows that 74% on average are satisfied with the office. The level of satisfaction from the engineering department shows a median of 59% are pleased. The reason could be that the engineering departments have more rules, therefore are not capable of the freedom to freely do as the public wants.

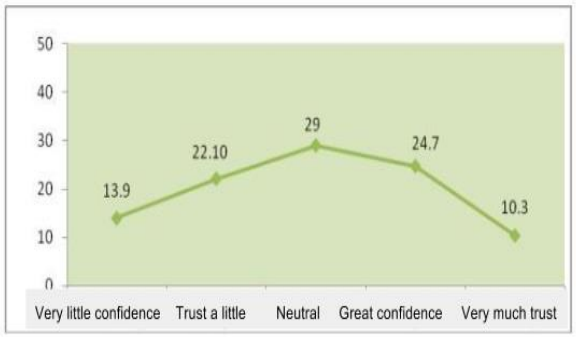


Fig 2.6. Level of confidence in head of Local Authority [8, p. 28]

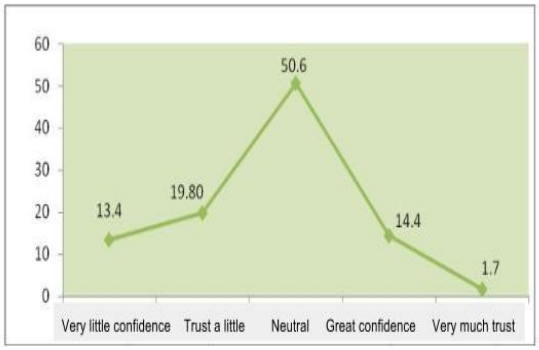


Fig 2.7. Level of confidence in the Local Authority engineer [8, p. 31]

Based on these graphs, the level of confidence of the head of the Local Authority shows that 65%, on average, are confident with the office of the Local Authority. The level of confidence from the Local Authority Engineer shows a median of 83% are confident.

Table 2.1. Level of confidence in the Local Authority

Satisfaction	Great Confidence	Medium Confidence	Normal	Little Confidence	No Confidence
Chairman's Office	5.00%	21.20%	49.00%	16.60%	8.20%
Head of the Local Authority	10.30%	24.70%	29.00%	22.10%	13.90%
Engineering Department	7.10%	32.80%	12.10%	27.40%	20.50%
Authority's Engineer	1.70%	14.40%	50.60%	19.80%	13.40%

Source: [8, p. 17-31]

Table 2.1. above shows:

a. The great confidence in the head of the authority, among the public, is higher than that of the authority's engineer, 10.30% compared to 1.70%. It is possible because the public elects

a head of authority every 5 years while the authority's engineer does not change in the same frequency.

b. If the author looks at the distrust, the author can notice that the two officials (the head of the authority compared to the authority's engineer) have the same percentage.
c. In regard to the Chairman's Office compared with the engineering department, the author sees that the public has greater confidence in the Authority Chairman Office than in the engineering department, which probably stems from the same reason mentioned in clause 1.
d. On the other hand, there is a big gap in the distrust in the engineering department compared to the authority's Chairman Office, 8.2% versus 20.5%.

Certification of Local Authorities and Organizations: Every year there are requests for accreditation for ISO-9001:2015. Although ISO-9001:2015 has been around for over 20 years, only 10 local authorities in Israel are ISO-9001:2015 certified [141]. It is noteworthy that the efforts of organizations to join the list of authorities accredited for this standard are complicated and accompanied with financial and organizational difficulties, in addition to a lack of knowledge of the importance of the matter. The Standards Institution of Israel is the main accreditation body for organizations in Israel for ISO-9001:2015. Other bodies have recently emerged which offer accreditation for ISO-9001:2015. Many organizations are interested in joining the accreditation for various reasons, the primary among which is "reputation".

Data Collection on Local Authorities: There are 257 local authorities in Israel, 2 of which are industrial councils (no residents). The following table summarizes the data on local authorities in the country, taken from the website of the Ministry of Interior [http// www.moin.gov.il.].

Table 2.2. Local Authorities in the Country Broken Down by Sectors and Status

	Jewish Sector	Non-Jewish Sector	Jewish Sector in Judea and Samaria	Total
Municipalities	60	11	4	75
Local Councils	43	70	13	126
Regional Councils	44	4	6	54
Industrial Councils	2	-	-	2
Total	149	85	23	257

Source: Ministry of Interior-Israel

The main data collection was done through questionnaires and structured interviews, in addition to the committee held in Nazareth. The content of the interviews and questionnaires was based on the literature review conducted and in accordance with the purposes set forth in the study. In total, interviews were held with about 20 local authorities. Through face-to-face interviews [120, p. 39]. The duration of each interview was about two hours. Interviews were conducted in various locations, mostly at the premises of local authorities.

At the end of the interviews with the interviewees, they were asked to recommend a suitable candidate for an interview among project managers. This was in order to verify the responses The author received from the first interviewee, and thus the author got a more realistic picture. Most of the interviews were conducted with authorities' engineers, who are basically the higher authority in all that related to managing engineering projects. However, there were interviews with authorities' quality managers, project managers, supervisors and planners who provide design services to local authorities. Moreover, there were interviews with senior employees of engineering departments in local authorities.

Data was also collected using a questionnaire including 20 questions. The questionnaire was sent by email to 313 officials, using a Google Drive questionnaire. This number of sent emails is large and comprehensive. For example, the Nazareth Local Authority was sent 4 questionnaires because it applied to 4 people. The author did not receive feedback from all recipients, of course 40 questionnaires were filled by senior officials in authorities. The questionnaires were based on the acquaintance of senior officials in Local Authority with quality procedures and the degree of their implementation.

Another way to collect data and feedback on the proposed procedures was through an extended conference of the senior forum in engineering departments in local authorities, attended by 15 Local Authority officials. During the conference, a wide and in-depth discussion was held of the procedures suggested by me (the author of this research has been a midsize-authority engineer for the past 22 years). The procedures which include forms were examined, revised and improved. As the author seeks to maximize the benefits of the conference, the author had several phone conversations with the representatives coming to the conference. The author coordinated several different points with them that might waste considerable time at the conference. Thus, the author brought all participants to uniformity in the database.

Receiving the responses to the questionnaires was carried out using Google Drive, and then transferred to an Excel spreadsheet for further analysis. The questionnaire was sent to the contact person using Google Drive, and after receiving the answers, everything was automatically

processed in Google Drive and the author got the results for each answer in percentages and numbers. The responses in my interviews with officials of the local authorities were also transferred to an Excel spreadsheet.

Engineering Project Management in Local Authorities: The engineering project management process in all local authorities is usually the same. Some of the authorities (small local authorities) are characterized with a process called "outsourcing", i.e. transferring the engineering project management process to an external body which manages (to some extent) the engineering projects instead of the Local Authority. According to Nolberto Munier “Project management is a very complex activity involving interacting and dealing with people with diverse skills, interests, and experience, different activities and lines of work, various trades and often working for the same project in different places at the same time” [73, p. 5], [129, p. 5, 57].

In "big" local authorities, the entire engineering project management process is done within the Local Authority. Here, the function is slightly different from medium-sized and small local authorities since the engineering department is divided into sub-departments: water, electricity, roads, buildings, safety and more. Each sub-department checks the engineering project in all its stages - hence the advantage of a big Local Authority over a small authority [10, p. 207].

The Project's Six Stages of Life

The Initiation Stage: This is the stage in which the idea of the project emerges. This stage examines the problem, the need and the motives to initiate the engineering project. In the initiation stage, the main objectives are defined in macro-level, technological objectives, and required schedules that are set with the various stakeholders. This stage tends to be vague but at its end answers are received to questions such as: Who are the users? What is the need? What are the objectives? What is the execution process? What is the solution required? Who are the stakeholders? etc. Helpful information at this stage is historical information, basic assumptions, organizational policies and more. The products of this stage are the decision on the commencement of the project, a document of preliminary project contents (program), and the appointment of a project manager. A mistake in the definition of the project, at this stage, will lead to the likely failure of the project. According to Nolberto Munier “risk management should be considered well in advance of the project, when it still is in the initiation stage” [73, p. 82].

The planning stage is the most significant stage in the project. Successful planning is likely to lead to success in achieving project targets, user satisfaction, meeting deadlines, quality compliance and more. This stage begins during the initiation stage and ends towards the end of the project. One must be sure to complete the required planning and not to rush (skip this stage

will lead to failure in execution). According to Nolberto Munier “the planning stage of the ‘costs to develop a project’, which is an essential step to further prepare and maintain the project budget baseline or ‘Budgeting” [73, p. 173]. This stage includes the forming of many work plans. It is recommended to have plans for the following subjects:

- Planning work content, both high-level planning and detailed planning (low-level) of work packages in the project, dividing responsibility and how to update regarding changes.
- Planning schedules, tasks, order of tasks, time per task, dependents, constraints and a critical path.
- Cost Planning - preparing a budget plan and financial estimates.
- Product / service quality planning and how to ensure the desired quality is received.
- HR staffing plan - building a winning team that will lead the project to its successful conclusion.
- Communication planning - keep in mind that communication is the glue that binds all parties to collaborative work [119, p. 467].
- Risk management - risk identification, risk assessment of total probability and effect, a decision as to what to treat and how.
- Procurement planning - to purchase or to produce? Who will be the contractor? Closing contracts and more.
- Integration planning - how the project will actually be managed and how the parts are connected to each other.
- Appropriate budget raising (usually from various government offices).

The Execution Stage: This is the most expensive stage of the project. It includes the operation of people and different resources according to the set work plans. At this stage, supervision is performed (planning versus actual performance) and, as a result, there may be a request for a change in content, schedules, costs and other factors. In this stage, much communication is distributed between the various parties, contracts and subcontractors are activated in order to achieve the different objectives [158, p. 32-37]. This stage begins around the beginning of planning and ends with the closing stage of the project. At this stage, the project's actual products are delivered [119, p. 467]. According to Nolberto Munier “In general the project manager is responsible for the whole lifecycle of the project, that is from inception to finish, including the warranty period. Normally reporting to him is a construction manager, who is responsible for the construction or execution stage” [73, p. 85].

Monitoring and Controlling Stage: This stage provides feedback to the integration of all parts and testing that the contents have been completed and in the required quality, observation/supervision of the schedule, costs, resource management and personnel, reporting to stakeholders, observation/supervision of contractors and contracts and risk management. The goal is to sample performance at all times and, if there is a deviation, to perform repairs in time. According to Nolberto Munier "Just by planning how to deal with risk is not enough. Naturally, doing a real effort during the risk planning stage will increase the probability of project success, but since risks evolve during the project lifecycle, it is necessary to exert monitoring and control including forecasting risks when the project is underway. However, if these actions are not performed seriously, the project might still fail" [73, p. 85].

Project Closing Stage: This is the last and final stage. It includes the completion of the project and the closure of the relevant legal contracts. The stage ends with a tour of project delivery, with the participation of the users. According to Nolberto Munier "Even when the project is finished, at least physically, its closing is important; everything must be neatly 'tied-up'" [73, p. 243].

Operation and Maintenance Stage: This stage begins from the day the project is transferred from the contractor to the Local Authority and to the users. At this stage, the engineering project is activated, defects are located and fixed. According to Nolberto Munier "Establish a company at a destination for import, packing, distribution and hiring employees. Find out about regulations regarding minimum wages and salaries, as well as taxes withheld" [73, p. 63].

In section 2.3, the indexes of rate of success of engineering projects were isolated, which are: length of implementation, cultural changes, behavior and difficulties, amount of procedures, improvement in performance of Authority, reduction in number of complaints, improvement in performance of projects as well as recommendations and satisfaction. Additionally, a weight was set for each rate of success between 10 and 20%.

As found, the most effective factors in success of total quality management system were set: involvement of management, employee instruction, internal motives of employees, quality manager, deadline or planning of timetables, and for each factor, a weight is received in implementation of a quality system in Local Authority [78, p. 5].

Definitions and differences between construction inspector/supervisor and the project manager: The role of the construction supervisor is to check that the suitability of the construction to the plans, to confirm the quality of the work performance, the use materials in

accordance to the construction plan, and to make sure the construction is according to standards and laws. Another role of the inspector is to ensure that the interest of the client is strictly preserved and that problems arising are resolved in a professional manner appropriate to his client. In summary, the main services of the construction supervisor are:

- Accurate examination of estimating material quantities, for price quotes.
- Supervising the selection of contractors and professionals.
- Close supervision of construction works and construction materials.

The project manager, the one with the professional knowledge as a construction person, is responsible for managing schedules, mediation and coordination between the different contractors, the developer and planning and construction authorities. He is the central axis through which arising problems and various data are transferred. His role is to make decisions that would bring the project to a close on time and according to budget plans.

Some of the roles of a construction project manager [116, p. 3]:

- Construction project management from planning to completion.
- Being the link between the planners/designers and the various professionals and contractors.
- Assistance in the negotiations with contractors.
- Close monitoring of all the construction work.
- Setting priorities for the execution of the work.
- Coordination of schedules among the many bodies involved in construction: different professionals, contractors, construction material suppliers, etc.
- Examination of the construction site organization.
- Documentation and photographing of activities conducted on the site.

In the author's opinion, countries of the world have begun to develop changes in the standard and quality of ISO-9000 series, especially countries in Europe, whereas Middle Eastern countries are in need of incorporating this. Although many countries have yet to incorporate these standards into their workplace environments, the countries who have this as part of their lifestyle are successful in this manner. The author is a strong believer that in time, all the countries of the world will have the high quality which is present in the ISO-9000 series and that there should be an increased number of local authorities and municipalities who have high standard qualities. Israel considers itself advanced, such as the demeanor of a European nation, however there is much room for advancement necessary.

2.2. The summarization and analyzation of the Questionnaires, Interviews and Conference

Schlickman, Jay: “As a result, the author requires an increased level of complexity beyond what the author would normally consider. In fact, this book’s longest text concerns the design of the manual. Such complexity requires increased employee training in documentation structure and usage. The author will assume that the organization is committed to this relatively high level of employee training and has either already mastered or plans to master this art. Unfortunately, the manual’s dominant position in the QMS structure has not been supplemented by explanations that permit the rapid development of effective manuals. It is important that the author first deal with the quality manual controversy as a way to understand how to resolve the issue [89, p. 50].

In this chapter 2.2., the results of the questionnaires and interviews are presented, and at the end of the chapter results and analysis of the extent of success in managing engineering projects in local authorities.

Results of Interviews, Questionnaires and the Workshop: Here The author needs to analyze how the author got to the Quality Guide. First The author needs to explain what the procedures give us; so how did the author get to the procedures?

Findings of the Interviews and Questionnaires and their Analysis: 40 senior officials in engineering departments responded to our questionnaire, which as noted earlier was emailed via Google Drive. These included 15 senior officials from large local authorities whose residents numbered over 25,000, and 25 senior officials from local authorities each with a number of residents less than that. Please refer to the summary table for local authorities which took part in the poll.

Number of Workers in Engineering Departments in Local Authorities: Table 2.3. below summarize the responses of the senior officials in the local authorities who participated in the questionnaire, along with the number of workers in the engineering departments – question number 2 (Appendix 3.1.).

Table 2.3. Characteristics of Local Authorities in the Study

Description	Number	Workers in Engineering Department
Large – more than 25,000 residents	15	1 Local Authority: 1 to 3 workers 3 local authorities: 4 to 10 workers 6 local authorities: more than 10 workers
Medium – between 10,000 and 25,000 residents	15	4 local authorities: 1 worker 7 local authorities: 2 to 3 workers 3 local authorities: 4 to 10 workers 1 Local Authority: more than 10 workers
Small – between 5,000 and 10,000 residents	9	2 local authorities: 1 worker 6 local authorities: 2 to 3 workers 1 Local Authority: 3 to 10 workers
Very small – less than 5,000 residents	1	1 Local Authority: 1 worker

Source: Author's research specialized for the thesis

The above table clearly shows that there is a correlation between the number of workers in the engineering departments and the number of residents in each Local Authority. The bigger the number of residents in a Local Authority, the more workers it employs. This phenomenon is determined by the Ministry of the Interior, which authorizes the necessary jobs in accordance with the size of the Local Authority. Human resources management has been defined as "the science and the practice that deals with the nature of the employment relationship and all of the decisions, actions and issues that relate to that relationship" [95, web set].

Benefits of the Correlation between Number of Residents and Authority Size

The workers will have experience managing engineering projects, and the ability to cope with any problem in the future. The worker gains experience and is able to contribute to the system. Further, the Head of the authority has the capacity to attract "loyal" workers down the road, which loyalty, from my personal experience, is able to move issues inside the authority during the tenure of the current head of the authority [119, p. 469].

Drawbacks of the Correlation between Number of Residents and Authority Size

For workers, with time, there will develop a tendency for boredom, and with no incentives, the workers will be involved in the day-to-day activities that they perform.

The Engineering Project: An engineering project is defined as "transforming the environment for the good and the benefit of man" into which many diverse resources are invested. The number of engineering projects which each authority carries out in a year changes. The local authorities perform engineering projects in the construction field: schools, clubs,

auditoriums and the like. The authorities perform infrastructure projects such as: roads, water and sewer lines, drainage, open spaces and others.

Question number 3 in the questionnaire asked how many engineering projects the authority performed in a year, and here are the results (Appendix 3.1.):

Table 2.4. Projects in a year in Local Authority

Description	Engineering Projects in a Year
Large – more than 25,000 residents	1 Local Authority: up to 10 projects 3 local authorities: 21 to 35 projects 11 local authorities: more than 35 projects
Medium – between 10,000 and 25,000 residents	2 local authorities: up to 10 projects 6 local authorities: 11 to 20 projects 5 local authorities: 21 to 35 projects 1 Local Authority: more than 35 projects
Small – between 5,000 and 10,000 residents	1 Local Authority: up to 10 projects 3 local authorities: 11 to 20 projects 3 local authorities: 21 to 35 projects 1 Local Authority: more than 35 projects
Very small – less than 5,000 residents	1 Local Authority: up to 10 projects

Source: Author's research specialized for the thesis

A quick examination of the above-noted table, it is possible to see that, here too, there is a correlation between the population size and the number of projects each authority carries out annually.

In explanation of the significant deviation in the first line, whereby the large Local Authority performs up to 10 engineering projects per year, the interviewees clarified that the Local Authority engaged a financial company to perform engineering projects on its behalf, and therefore it rarely managed such projects. In addition, some local authorities outsource their projects to external suppliers and project managers. Other local authorities manage the engineering projects through the engineering department workers only. In the large local authorities, there exists a large mechanism that includes, within the engineering departments, sub-departments as noted in Section 2.

In every Local Authority, there is one authority engineer who has the supreme engineering authority, in accordance with the Local Authority Law. To quote from the Authority Engineer Law [36, p. 3]:

- Each authority must have an engineer.
- The authority engineer is the professional authority in his field.

Status of Quality Management in the Local Authorities in the Research: Quality Control, and mainly Quality Review, in the local authorities related to engineering project management, is performed, for the most part, by the project managers. A small part (in small local authorities) is performed by the Authority Engineer. In a few cases, the project inspector performs the quality control function. Quality Control is divided into 3 categories: financial, schedule, and quality management. The quality control system and quality assurance, intended to in conforming with the ISO ISO-9001:2015, is more detailed, more documented, and mainly more systematic than the traditional quality review used in the engineering departments. *Graham Donaldson:* "The Standards in Scotland's Schools etc. Act 2000 provides a framework for improvement planning that requires education authorities to set out and report on improvement objectives related to national priorities and associated measures of performance. Continuous improvement in education services is central to the work of education authorities. There is a clear expectation by Scottish Ministers that national priorities will be addressed through agreed local educational improvement objectives and related targets. To achieve these goals, it is essential for authorities, educational psychology services, community services and establishments to work together to achieve these objectives and to raise standards of attainment and achievement within an innovative culture of support and challenge" [24, p. 5-4].

A question needed to be asked. Did local authorities which took part in the research have work procedures and checklists which they used for process control and management control of the engineering project?

It appeared that most local authorities somehow used internal procedures without any checklists. But to summarize, it can be said that in the local authorities participating in the research, there was use of various types of procedures and forms. Before establishing any procedures or an ISO-9001:2015, local authorities cannot produce a quality control system, and obviously not a quality assurance system, organized, documented and systematic.

Since 40 local authorities participated in the research, and considering the fact that in most local authorities there is not a Quality Guide or certification to ISO-9001:2015, and since these 40 authorities do have a Quality Guide or ISO-9000:2015 certification, it can be assumed that this research represents most local authorities that function under a Quality Guide or have ISO-9000:2015 certification.

Incentives to Establish a Quality Guide: The Standards Institution of Israel occasionally issues publications that encourage local authorities (and various organizations) in general to join

it and obtain certification to the ISO-9001:2015, following which a number of local authorities were indeed certified to the standard.

Surprisingly however, until today only 10 engineering departments in local authorities in Israel received certification out of the total 257 potential local authorities. The question that needs to be asked is why local authorities are not enthusiastic to install and operate a Quality Management System. Is it budgetary concerns about the money they must invest, or the uncertainty about the applicability of this standard?

When asking local authorities about what motivates them to join a quality management system, these were the answers received:

a. Recognition that the standard will be obligatory sometime in the future,
b. Cost reduction as a result of improving processes,
c. Improved quality management of engineering projects,
d. Reputation and image only, and
e. Order, organization, method institutionalization, etc.

The following table summarizes the motives received.

Table 2.5. Motivations for Implementation of ISO-9001:2015 Quality Guide

No.	Motivation	Primary Motivation	One of the Motivations
1	The standard will be obligatory in the future	30%	30%
2	Cost reduction as a result of improving processes	45%	85%
3	Improved quality management of engineering projects	10%	75%
4	Reputation and image only	5%	20%
5	Order, organization, method institutionalization etc.	10%	25%

Source: Author's research specialized for the thesis

As the table shows, the motivation which received the highest responses from interviewees as the Primary Motivation (about 45%) was "cost reduction as a result of improving processes". In addition, it can be seen that about 30% of interviewees indicated that "recognition that the standard will be obligatory sometime in the future" received higher priority than the other motivations: improved quality management of engineering projects; reputation and image only; and order, organization, method institutionalization etc.

Summary: It can be said that there are motivations amongst the local authorities to implement the ISO-9001:2015, or some other quality management guide, combined with other motivations stemming from a will to improve management quality, which leads to the following question. With all the aforementioned motivations for local authorities to implement a quality guide, does the type of the motivation affect the success of implementing the ISO-9001:2015?

Examining Alternatives to Quality Systems in Local Authorities: Examining serious alternatives to quality systems was not done by most local authorities. A small number of local authorities promoted, initiated and improved some quality management systems. Only 10 were certified, and most local authorities still operate an independent quality management system which gets improved from time to time. Most local authorities did not examine additional alternatives, but chose to regard the procedures they had prepared as the only alternative to the implementation of a quality system in their localities. The author can consider three parameters in the design of individual positions in the organization: the specialization of the job, the formalization of behavior in carrying it out, and the training and indoctrination it requires [69, p. 69].

Having noted that, local authorities are correct in that the quality procedures they have prepared and have been working with for a long time, were formulated and integrated in the best possible way. Local authorities are not willing to give up what they have already prepared and for which they have already received relevant approvals, mostly from their legal advisors and their treasury departments. These procedures served them well and with success in previous projects.

Still, this attitude points to the lack of scrutiny by those involved in the quality issue, and to external incentives for implementing a quality guide whatsoever. When Local Authority engineers were asked if they thought there was another way to introduce a quality system to their respective authorities, only two engineers answered positively.

Duration of Implementing a Quality Guide: The duration of implementing a quality guide carried significant importance. Authority engineers need to know how long this process will take. Uncertainty about this matter could alarm engineers about introducing such a process. Since this in particular involves expenditures and the time of various elements, it is worthwhile to be ready in advance. It is difficult to definitively determine the duration of the process as it is an ongoing process: in every new project, the process has to be implemented anew, endless changes must be made to procedures and checklists, training needs to be provided every time and much more.

Despite this, it is possible to define two main periods in this process, which are: the implementation process from the decision point to the certification, and the ongoing operation of the quality guide from the moment of receiving the certification. During the first period, more resources are invested and the main effort is spent [119, p. 470]. Whereas after the certification, the resources are reduced to only those needed for the ongoing operation.

Table 2.6. Duration of ISO-9001:2015 Implementation from Decision until Certification

Average	Up to 6 months	Between 7 and 12 months	More than 12 months
9 months	4 local authorities	8 local authorities	3 Local Authority

Source: Author's research specialized for the thesis

The average duration of the implementation process is 9 months, from the decision moment until receiving certification, as can be seen from the table, with 4 local authorities receiving certification in 6 months. These authorities were ones with existing experience with local (own) processes which they prepared before the certification process [119, p. 469].

In order to check what the actual desired length of time is to implement the ISO-9001:2015, it was requested that quality managers provide their opinion about the length of the process in their local authorities from the decision point until implementation, and on to certification. Most quality managers believed that the implementation time was reasonable in their respective authorities. Regarding explaining why the implementation process took too long, there were varied responses: the quality manager was replaced, the head of the Local Authority did not agree to some decisions, and other responses related to resources, such as time and budget.

Summary: 1. The duration of the implantation process is not the most important component. There is a need to ensure that the quality guide and the standard are appropriate and address the Local Authority's needs. Shortening the implementation time does not necessarily produce successful results. **2**. About 50% of the local authorities set a duration target of 8 months, and it was as such; they stuck to their target and actually achieved it.

Parties Involved in the Implementation: Quality Manager: The quality manager is the axis around which moves the entire implementation process, and as noted in Part 1, section 1.1., in the Quality Management Stage. Many authorities were delayed in the implementation process as a result of the quality manager's lack of time. In general, local authorities do not have quality managers, as the research revealed. When they do exist, these managers undertake many additional roles.

Table 2.7. Quality Managers (QM) in Local Authorities

Number of Local Authorities	Position Type	Local Authorities with QM
25	Full-time	15
35	Part-time	8
180	None	0

Source: Author's research specialized for the thesis

It should be noted that, in most cases, the quality manager holds an engineering degree or is the authority's engineer, which indicates that the quality issue is closely-related to the management process of the engineering project. It is also possible to note that whenever the quality manager is an engineer, the implementation process moves faster and its target is met quicker.

External Parties: Most local authorities are assisted in performing their services by external consultants. The specialization of such consulting outfits encouraged a number of local authorities to enter this process. This however, does not necessarily accelerate the certification process or guarantee its success.

At the 10 local authorities with certification, the external consultants continued to partner with (accompany) the Local Authority, even after achieving certification. In this capacity, the consultant had the responsibility to assist with, maintain, and inspect the quality system. This is manifested in writing new procedures and updating existing ones, and in reviews and more. The consultant functions as a subcontractor to the Local Authority, which arrangement is necessitated by the unavailability of the quality manager or the authority engineer, owing to lack of time.

Internal Parties Involved in the Implementation Process: The ongoing operation of the quality assurance system requires the involvement of many parties within the authority. However, the process of writing procedures required very little involvement from internal parties. The quality manager, as stated, leads the process in the Local Authority, but the initiative for that comes generally from the authority's management: the head, the treasurer and the general manager of the authority.

Table 2.8. Involvement (%) of Internal Parties in the Implementation Process

	Head	Treasurer	General Manager / Secretary	Engineer
Local Authorities with Full Certification (10)	25%	5%	20%	50%
Local Authorities with Partial Procedures (8)	15%	5%	30%	60%

Source: Author's research specialized for the thesis

Writing procedures are performed, in general, by the quality manager along with the external consultant, and of course the authority's engineer, in addition to the project managers and senior officials in the Local Authority.

Summary: To summarize, it can be said that procedure writing is done by the quality manager and sometimes in cooperation with the authority's engineer. In most cases where there is not a steering committee, the quality manager leads the process.

Preparation of the procedures, which is a significant part in designing the quality system, involved the quality manager, authority engineer and project managers. The head of the authority is content with providing feedback and approval. Feedback from additional officials is provided in many cases after the fact, in other words, after the procedures and checklists are written – in the implementation stage. the cost paid by the project owner for the pre-construction, construction, maintenance, operation and end of life. The cost of pre-construction includes survey, planning and designing [159, p. 155].

Difficulties in the Implementation Process

Major Difficulties in the Implementation Process: The implementation of a quality guide is often accompanied by difficulties and resistance from many parties. Quality managers responded that, for the most part, it was a request from upper management that resulted in these procedures. Others indicated that it was good that there was debate about every procedure and section. A large number of the changes involved some procedures that were canceled and replaced out of concern they would create problems in the long run. Some managers started small with minimum inspections and reviews, and with time, expanded these inspections and reviews. Other managers indicated that the standard is not suitable for engineering departments in local authorities, and that it was difficult to apply it for managing engineering projects. Another problem was the existing procedures themselves. Some partners in the engineering projects have already prepared procedures and forms, and have an interest in applying the

material they prepared in the Local Authority, thus the problem of coordination between various procedures.

Resistance to Implementing a Quality Guide: Employers, which are providers of work, are usually differentiated in industrial relations systems depending upon whether they are in the private or the public sector. Historically, trade unionism and collective bargaining developed first in the private sector, but in recent years these phenomena have spread to many public sector settings as well [95, p. 1], [45, p. 6]. One of the most problematic issues in organizational changes is resistance to change. This issue was widely reviewed in the research literature. Humans by their nature need a sense of security. Stability and maintaining the status quo contribute, often in a misleading manner, to such a sense. Therefore, organizational changes create resistance, which finds expression in active ways, in protest and direct confrontation, and/or in lack of cooperation.

Implementing a quality guide in the engineering departments also produces resistance. In the research, an attempt was made to map the major objectors, the level of objection, the major reasons for the objection and ways to deal with them.

The Various Forms of Resistance: Resistance to establishing a quality guide of any type is expressed through protest or non-performance of procedures. Almost all quality managers indicated that the resistance issue was the main difficulty to establishing a quality guide, with resistance taking the following forms, as the managers noted:

- There was no reporting on incompatibility issues,
- Service suppliers did not collaborate [120, p. 51],
- There was a conceptual difficulty to always go from the office to the site with checklist paperwork,
- Process control was not performed as required,
- Forms were filled out in a retroactive manner,
- There was a problem of not completing forms,
- Workers and officers claimed the system was not applicable and not suitable for the engineering branch,
- Project managers and supervisors requested instructions.

Main Opponents to Change: Table 2.9. Presents the distribution of resistance by group. The questionnaire had a question about who in the engineering department objected to quality procedures. The responses revealed a number of opponents as shown in the table below.

Table 2.9. Distribution of Resistance by Group in Engineering Departments

Opposing Group	Workers	Inspectors / Planners	Project Managers	Consultants & Other
% in Authorities	40%	20%	30%	10%

Source: Author's research. [169, p. 113]

Resistance from engineering department workers is almost self-explanatory. This owes to the fact that these department workers are the primary bearers of the workload related to implementation. Inspectors and project planners come next in this regard as they are the secondary bearers of the workload. In a conversation, one authority engineer noted that one planner quit the project upon knowing that the quality guide would obligate him to meet the authority's schedules. Further, a number of planners requested that the quality procedures of the authority matched the planner's quality procedures.

Looking into the objectors' experience, it became clear that it carries significant weight, as demonstrated in the pursuant table showing breakdown in percentages of the resistance component by experience in the authority [119, p. 469].

Table 2.10. Distribution of Resistance by Group in Engineering Departments

Resistance Group	**Yes**	**No**
Resistance percentage of workers / managers **with** experience	77%	23%
Resistance percentage of workers / managers **without** experience	54%	46%

Source: Author's research. [169, p. 113]

From the table, it can be seen that the resistance of experienced workers or managers is much higher than that of inexperienced workers or managers. The reason for this is clear; experienced workers or managers have the power to object. Inexperienced workers or managers simply want to integrate and perform what is required from them, as they are interested in satisfying their supervisors else they get fired [119, p. 469].

Resistance to procedures becomes evident in non-cooperation, which is their main form of objection to the implementation of a quality guide. The various suppliers object to the quality procedures, as stated earlier, since they have their own internal procedures, and the quality procedures of the authority impose an additional burden on the supplier.

Reasons for the Resistance of Using the New Quality Management System and Ways to Deal with Them

In interviews with authority engineers, and in response to an open question, they provided the following as reasons for resistance, along with ways to deal with these reasons.

First the reasons:

- Non-involvement in writing procedures results in more objection,
- A conceptual difficulty in making the documentation turnaround,
- Laziness,
- Old habits,
- Fear of bureaucracy, and
- Change itself produces objection.

Now the ways to deal with them:

- Much more involvement in procedure writing by those in the project management process,
- Pressure and enforcement by the management,
- Creating a healthy competitive atmosphere,
- Changing and canceling procedures accordance to the requirements and feedback from the site,
- Clear definition in contracts that the various contractors must have accreditation, and
- Writing concise procedures that are easy to apply.

Two tables follow, one providing a summary of the reasons for resistance and the other of ways to deal with them.

Table 2.11. Reasons for Resistance

Item	Reason	Workers	Managers	Inspectors / Suppliers	Planners
a.	Status and power	20%	35%	10%	30%
b.	Ideology, do not believe in change	35%	33%	25%	31%
c.	Not understanding the process and its results	55%	72%	66%	15%
d.	Fear of not being up to the task	56%	26%	44%	65%
e.	Other	10%	15%	22%	20%

Source: Author's research. [169, p. 114]

It is discernible from examining the above table for resistance reasons that "not understanding the process and its results" is the central component for objection. Workers, project managers and also planners indicated this in high numbers. In addition, the "fear of not being up to the task" and the pursuant reviews was another motivation for resistance. Planners fear they will not receive additional work, while workers and project managers fear they will be reprimanded.

The "status and power" component received low results, which in the author's opinion, is not accurate. It is possible that they did not emphasize this so that it does not appear as "capitulation" on their part [12, p. 153].

Table 2.12. Ways to Deal with Resistance

Item	Way	Workers	Managers	Inspectors / Suppliers	Planners
a.	Guidance and explanation	90%	85%	80%	60%
b.	Participation and involvement	80%	70%	80%	65%
c.	Providing support and assistance	65%	45%	25%	27%
d.	Pressure and enforcement	40%	20%	46%	40%
e.	Other	5%	14%	25%	22%

Source: Author's research. [169, p. 114]

It is evident that dealing with resistance through "guidance and explanation" greatly softens the resistance. Authority engineers and quality managers responded in high percentages that guidance and explanation resolves a large portion of the resistance, and that is what they plan to do. In second place came "participation and involvement". The workers screamed "give us pride", and rightfully so, after all, as noted in the literature survey, the involvement of the workers in procedure preparation has significant weight. Here too, "pressure and enforcement" were not a solution to soften resistance, but in fact led to implementation failure of the quality guide at the local authorities. In another research by Donaldson Gay [24, p. 35]: "Staff are highly motivated, meaningfully involved in the development of the service and enjoy a high level of professional satisfaction. Staff are well prepared for future leadership responsibilities through their involvement in secondments, projects and programmers. They have good opportunities for

career development and access to a clearly understood continuing professional development (CPD) programmer. They consider that the opportunities for development support their performance effectively and contribute to developing their professional competence. Staff report positively about the quality of support provided by central services and external agencies. Staff are confident in their ability to carry out their duties and engage in effective teamwork at all levels. They are deployed appropriately and feel engaged and valued within the authority".

Summary: The above two tables show that non-involvement of the workers and managers in the implementation process brings about resistance to working under the guide. It was preferred to involve them in the guide preparation and of course in the guide implementation. Guidance and involvement are the solution to softening resistance to the quality guide [119, p. 470].

Main Difficulties in Working to a Quality Guide: A quality guide is based on procedures, and work according to procedures requires a change in working patterns and expertise in a new area. Interviewees were asked if there were difficulties in working to procedures and if so, what they were [107, p. 47].

Another question was who, outside of engineering department workers and managers, resisted procedures. Interviews aimed to answer who these were and why they resisted.

Most local authorities indicated that it was indeed difficult to work according to procedures, the main claim being time consumption and difficulty handling paperwork. In other words, the essence of working with procedures and the essence of working with a quality guide are onerous. The quality system includes about 50 primary forms, and about another 20 secondary forms. As well, there are about 30 internal procedures and on average another 15 procedures for projects. Further, there are checklists and inspection forms, which add significant work for the staff. The table below details the number of authorities which pointed out difficulties whatsoever in working with a quality guide.

Table 2.13. Authorities and Difficulties Working with a Quality System

	Minor Difficulties	Partial Difficulties	Many Difficulties	Too Difficult
Local Authorities with Full Certification (10)	2	3	7	3
Local Authorities with Partial Procedures (8)	4	2	2	0

Source: Author's research. [169, p. 115]

According to the table, most authorities have difficulty working with a quality guide. Although only 3 authorities noted the difficulties as minor, checking another response about the extent of using the quality guide, it was revealed that 2 local authorities used the procedures very little. Therefore, these local authorities either chose to use those procedures applicable to them, leaving the ones not applicable, or they used the procedures whenever it suited them.

Table 2.14. Combination of Difficulties Working with a Quality System with Frequency of Use

	Minor Difficulties	**Partial Difficulties**	**Many Difficulties**	**Too Difficult**
Difficulty Working with Procedures	3	6	8	6
Frequency of Using Procedures	Daily	Weekly	Monthly	Individual projects

Source: Author's research. [169, p. 115]

The distribution of responses is particularly interesting. When the frequency of using procedures increased, the degree of difficulty grew. It can be summarized that working with a quality guide in local authorities is particularly difficult.

Who Generally Resists Working to a Quality Guide in Local Authorities: Questions 16 and 19, which have been formulated after discussion with colleagues at local authorities, Questions (16), "*Who interferes in the quality management model and can influence and change it?*" and question (19) "Who are the o*nes who object to applying the quality management model?*" to senior officers.

Table 2.15. Who Resists Working with a Quality System

Answers to Question 19	Department Managers (2)	Authority Workers (8)	Consultants (4)	-	-
Answers to Question 16	Authority Heads (4)	Elected Officials (2)	Suppliers (2)	Treasury (8)	Department Managers (4)

Source: Author's research. [169, p. 116]

Analyzing this table, it is clear that there is resistance to work to a quality guide among the workers of the local authorities. Among the lower ranks, 8 authority workers (in various departments) answered that Local Authority workers resisted the quality guide of the engineering

department, while 4 answered that it was actually the consultants of the authorities who resisted the Local Authority's quality guide. However, in the second row, it is revealed that there is resistance even among the senior ranks to the quality guide of the engineering department. 8 interviewees indicated that it was the treasury department that was the worst offender with respect to the quality guide of the engineering department, while 4 indicated that actually it was the head of the authority who resisted. It is not clear why the authority's treasury would resist and attempt to interfere with the engineering department doing its job as this department requires it to work. Is there something not clear to the engineering department, possibly budget approvals and reporting to the various government offices providing funding? In Depth clarifications during interviews show that there indeed is something to say about the treasury department, and every time it is something new. Once they claimed that a project needed to be done this way and not like the previous project. They attribute the answers and connect the new requirements to an external policy, which is not related to the authority itself but to the body to which the reports will eventually be submitted [68, p.1].

In addition to this, elected officials and the authority head intervene in the work of the engineering department, and here too, there was an explanation for why they do. The answer was "politics", as elected officials and the authority head want to please their voters and associates – a purely political commitment that has no place in quality procedures.

Summary: To summarize this section, there is no lack of problems to implement quality guides in local governments, both internal (engineering department disgruntled workers because of the extra work) and external (elected officials, treasury department for various reasons).

Main Problems in Working to a Quality Guide: In addition to basic difficulties stemming from changes to the work schedule brought about by the activation of the quality management system, there are also problems, part of them specific to the quality guide itself, and part likely applicable to any quality management system [28, p. 14].

In 10 local authorities, interviewees claimed that it was "difficult to work by dictation from above". Project managers and field staff are used to independence in their work, and to relative freedom in their considerations and resultant decisions. Work procedures dictate a manner of operation for different activities, which naturally varies from project to project. For the sake of quality and also uniformity, quality procedures mandate uniform work for all projects. Furthermore, the management team has to perform activities that it did not before, also by dictation from above. The claim of "dictation from above" can be overcome through involving the management staff in procedure writing [62, p. 49].

Another claim that came up in interviewee responses was it was difficult to implement the quality guide to a project in its startup stages. In most cases, the quality guide is implemented in its advanced stages, at which time the problem arises in applying the quality guide to the phases already performed. A decision must be made which parts of the guide to apply retroactively and which to apply from this phase onward.

The concepts of the quality guide are taken from the quality terminology, and many times these concepts are not understood. At times, a word has one meaning with respect to quality and another with respect to management of construction projects. For example, the word "exceptions" in connection to quality means deficiencies and performance discrepancies, while in construction project management it means extra work that was included in the original contract. In order to solve this problem, if only partially, and if interested, is to assign to one concept two names: one name according to the quality terminology and another name in brackets that applies to the terminology of construction project management [3, p. 39].

Yet another problem, probably the most difficult, is the lack of perseverance. Implementing a quality guide must become a thing of habit. Many local authorities prepare quality guides and some of them receive certification with relative ease after that. When lack of implementing the guide is encountered during simple reviews, authorities noted that they (meaning other local authorities of course) perform only the necessary minimum to maintain certification.

Change in the Client's' Positions (Users of the Engineering Project): The wide public, referred to below as clients, is the user of the engineering projects. These are the principals, teachers and students in the case of a school construction project, youth in the case of a youth club, seniors in the case of day centers for seniors, and so on, for whom the engineering project is carried out. Local authorities that applied the quality guide significantly improved the connection with the clients, who were invited to meetings and turnover tours. They were pleased and offered words of compliment and support upon first use. This successful result followed the improving of quality in all that is related to managing the quality management system [134, p. 11], [133, web set].

The number of complaints was relatively small, and when they occurred, they were in non-material issues. A large part of complaints was resolved during the implementation process, without waiting for construction completion and the beginning of use. Clients were involved in the management process [119, p. 470], Planning and even construction. They were able to

complain in real time, since they were involved all the way, and participated in meetings both in the authority's offices and on the site itself.

In one case, a kindergarten teacher noted during performance the lack of a water tap in the playground, and requested its inclusion. During the turn-over tour, the water tap was found to be ready for use. Consider what would have been required to do had the teacher not noted the missing water tap. Interlocking stones would have had to be dismantled, the wall chiseled, and a water tap installed. This would have cost much money, required performing work in an occupied building, and of course the wall and stone finishing would not have been clean and uniform.

In another case, the manager of a seniors' day center requested, during the planning phase, the installation of low water taps with a drainage network and seating chairs. The request was made because Muslims needed to wash their faces, hands and feet before prayer. In this case too, the request was handled in real time during planning.

Main Shortcomings of Quality Guides: For the sake of balance, and to complete the picture, interviewed quality managers and authority engineers were asked what the quality guide lacked and what harm it caused to the engineering department. Most quality managers and authority engineers replied that there was no harm from the implementation of the quality guide. The answers are summarized in the table below.

Table 2.16. Opinions of Quality Managers and Authority Engineers on Shortcomings

	No Harm	**Time Consuming**	**Small Problems**
Number of Quality Managers and Local Authority Engineers	28	8	4

Source: Author's research specialized for the thesis

As can be seen from the table, the majority of Local Authority engineers and quality managers responded that the quality guide was not harmful, and that they thought it would do them good. Only 8 responded that the quality guide was time-consuming, and that it obligated them to spend one hour more on project management than they would have with the quality guide. Four (4) responded that the quality guide was liable to produce a situation of "small heads", meaning people will do what the guide and procedures require without engaging their minds (heads) about the intentions within both.

When project managers, inspectors and planners were asked about the shortcomings of the quality guide, the answers were different from those of quality managers and authority engineers. Their answers are in the next table.

Table 2.17. Responses of Project Managers, Inspectors & Planners on Shortcomings

	No Harm	Extra Paperwork or Time Consuming	Confusing	Adds Unwarranted Layer
Second Line Interviewees	22	10	2	2

Source: Author's research specialized for the thesis

Although most interviewees responded that there was no harm from the implementation of a quality guide, others noted that there was harm. 10 answered that the quality guide added extra paperwork or was time consuming 2 claimed that this created mind confusion, and 2 indicated that the guide added an unwarranted layer, which was similar to the "small head" claim by 4 quality managers and authority engineers.

Additional Claims: Additional claims and other answers were isolated. Someone indicated that the guide was not applicable to the construction industry, another noted that the guides neutralized independent thought, and yet another indicated that the guide helped little as it was implemented by additional sources in the sector. Lastly, someone indicated that he did not believe in the guide or in the ISO-9000 series, claiming that the standard was too general and generic, and that everyone could do with it as he/she pleased. The standard was not similar for example to Standard 466 – Constitution of Concrete in any shape or form.

Benefits of Implementing a Quality Guide

Expected Benefits: The table below summarizes the answers regarding the main expected benefit from applying quality guides in the local authorities.

Table 2.18. Main Expected Benefits from Quality Guides

Question	Benefit	Maximum Benefit	Partial Benefit	Little Benefit	Almost no Benefit
11	General benefit	22	13	3	1
12	Saving time	21	14	3	1
13	Saving public money	23	14	2	1
12 + 13	Saving time & public money	43	28	5	2

Source: Author's research specialized for the thesis

Interviewees were asked, through questions 11 to 13 in the questionnaire, what were, in their opinion, the main expected benefit from quality guides for local authorities. Those answering the question could only choose one answer for every question. The summary of answers in Table 2.18. show that interviewees pointed out that saving public money (23 out of 40) was at the top of the list, and that money saving was the most important issue for working with a quality guide. In second place (21 out of 40), they put the issue of saving time in project management. To conclude regarding the desired benefit in a quality management system, the two responses lead to a clear and unequivocal answer that 72 out of 80 respondents expect savings in time and public money. Fewer respondents thought that quality guides brought no benefit to the authority.

It is interesting to find out that the interviewees believe in that, and this is good for the quality management system. This authenticates the theories which **Deming** and Juran, quality experts, put forth.

Other Benefits of Quality Guides: There is a special chapter in the ISO-9001:2015 devoted to "Statistical Techniques", which requires the establishment and maintenance of procedures documenting the implementation and control of statistical techniques, to control and verify the product characteristics and fitness of the procedures. Despite this, only a small part of local authorities that participated in the study performed statistical analysis geared to improve various indices, following the implementation of the standard or quality guide. Many authorities claimed that they still did not have data, since they only recently started learning the process and data collection. In their opinion, this chapter in the standard was simply unnecessary. Local authorities that perform statistical analysis document data on the complaints and opinions of the various project managers, after the completion of any project. "In these days of rapid development and globalization, projects are being built, handled and executed at a rapid pace. These projects employ a large workforce and deal with huge amounts of raw material and money. Maintaining a proper structure and discipline in the management of the project takes a toll on anyone and it requires professional training [115, p. 42].

Problems, for example, included lack of forms, procedures not matching for all projects and more. After collecting data, a histogram was created and a Pareto analysis was performed according to the number and costs of complaints, after which conclusions are drawn. Based on the conclusions, it was decided, for example, to enable project managers to suggest a pre-delivery form, and not to work with the final delivery form. As referenced in Part One, in Procedure Ranking ISO-9000. These forms, or reports are often used as checklists, and can be

called testing forms. These forms are key for avoiding problems throughout. figure 1.14 is a clear guide to the importance of forms.

Obviously most local authorities do not function like this, and the acceptable way in most of them to prevent future complaints is through corrective action. In almost all projects, handling exceptions is done through corrective actions, only if the complaints are significant or recurrent. In general, a complaint is resolved through the project management itself.

In spite of this, interviewees were asked to express their opinions about whether the ISO-9000 series reduces complaints in the project management process. In order to focus the question, the interviewees were asked, at the end of managing every engineering project, if in their opinion the quality management was successful in reducing the number of complaints. And also, what the impact was of the quality guide on the successful management of the engineering project about 38% answered that the engineering project success stemmed from managing a system for quality management, and 43% answered that the success stemmed from the fact that a quality management system was activated. Local authority engineers and quality managers answered this question (Number 8), and their responses are found in the following table.

Table 2.19. Impact of Activating a Quality Guides on Engineering Project Management Success

Percent success of engineering project	75%	50%	25%	5%
Number of interviewees Impact of quality management system activation on the success of engineering project management in local authorities	14	16	7	0

Source: Author's research specialized for the thesis

There is no doubt that the interviewees were convinced one way or the other that managing a quality system brings about success in managing engineering projects in the local authorities. 14 out of 40 interviewees responded that the success of engineering projects resulted from activating a quality system, and that the quality guide contributed about 75% to this success. 16 out of the 40 interviewees thought that activating a quality system contributed about 50% to the success of engineering projects. Only 7 out of 40 thought that activating a quality system contributed only 25% to the success, and that there existed other systems which contributed to the success of engineering projects.

As well, the number of complaints decreased, and if any, they were simply complaints that were easily resolved, unlike previous complaints which had no solutions or were particularly difficult to resolve.

Among the second line interviewees, the project managers, inspectors and planners, there was greater uncertainty than that among the quality managers or authority engineers. Only 50% believed that a quality guide decreased costs, and many of them, it actually increased costs. To explain this justified phenomenon, project managers, inspectors and planners noted that a quality management system required additional financial and time resources, especially during the initial stage of establishing the quality management system. They are aware of high expenditures which are not always obvious to them. It is also possible that project managers, inspectors and planners refer to the status of their own projects and not to the status of the Local Authority as a whole.

Local authorities indicated that there was a rise in engineering project management costs, which varied among authorities. In 3 authorities, the implementation was still "limping", without success, at least in the meanwhile, to extract the inherent potential in the quality system. On top of this, in these authorities, many procedures are mainly not properly activated in projects. Another authority had a documented, methodical and efficient quality control system which caused additional expenses for a consultant and the Standards Institute. However, in another authority, the number of complaints significantly decreased, but the dedicated time resources, by management staff in weekly meetings, during the establishment of the quality system and procedure writing, in addition to the time regularly invested by project managers, were so high that they tilted the balance against rather than for the costs.

Quality managers and interviewees, in local authorities with accreditation and in those with an almost-complete quality guide, were asked about improvement in various indices, following the implementation of a quality guide or ISO-9001:2015. A summary of their responses is in the following table.

Table 2.20. Improvement in Indices after Implementing ISO-9001:2015

	Improving Schedule Compliance	**Improving Budget Compliance**	**Improving Customer Satisfaction**	**Improving Project Quality Management**
Quality Managers	27%	22%	40%	-
Project Managers and others	25%	17%	33%	66%

Source: Author's research specialized for the thesis

It can be seen that quality managers think that there was no improvement in meeting budgets or improvement in time tables. It is worth mentioning that about 50% of quality managers are new and it can be assumed that their position is caused by inner feelings and not based on facts. About 50% of the veteran quality managers think that there is a change in meeting time tables and budgets. Those quality managers have more reliable information. Meeting time tables exist more in those Local Authorities that operate some sort of a quality management system. Another component that characterizes the period of current study is the recession that takes place these days, and it is possible that improvement in meeting time tables was achieved due to the fact that there is no pressure of managing projects in this period. Naturally, all that with the addition of application of a real quality system [53, p. 14].

On the other hand, the improvement in executing and managing the engineering projects receives a high significance for interviewees; about 66% of them think that there is improvement following an implementation of a quality guide. On the other hand, the interviewed managers think that improvement in meeting the budgets (17%), stems from the fact that they don't have the data and that data regarding meeting budgets lies with Authorities' engineers. Same goes regarding meeting time tables. In another Case in Spanish local authorities: “This study analyzes efficiency levels in Spanish local governments and their determining factors through the application of DEA (Data Envelopment Analysis) methodology. It aims to find out to what extent inefficiency arises from external factors beyond the control of the entity, or on the other hand, how much it is due to inadequate management of productive resources. The results show that on the whole, there is still a wide margin within which managers could increase local government efficiency levels, although it is revealed that a great deal of inefficiency is due to exogenous factors. It is specifically found that the size of the entity, per capita tax revenue, the per capita grants or the amount of commercial activity are some of the factors determining local government inefficiency” [126, web set].

Summary: It can be summed up that managing a quality system does bring a general improvement in managing engineering projects, especially during the time of delivering the projects to clients. The complaints are reduced significantly. In addition to a limited improvement in time tables and in meeting budgets that can be right for some projects and not for others, because in addition to the many problems that accompany an engineering project, they do not necessarily come from managing the project itself, but rather, from external matters over which quality managers or project managers do not have control over. For example, objections of some of the neighbors close to the project or not getting a construction permit, relating to

planning and construction committees, extends the total duration of a project. In one of the projects there was no proof of ownership of the ground, and in another there was a resistance by Keren Kayemet Le'Israel since there were trees on the ground, and the time moved the trees took about 4 months until it was possible to begin execution. As the process of elaboration continues, the organization turns increasingly to standardization as a means of coordinating the work of its operators. The responsibility for much of this standardization falls on a third group, composed of analysts. Some, such as work study analysts and industrial engineers, concern themselves with the standardization of work processes; others, such as quality control engineers [69, p. 18].

In two authorities, it was customary to reward project managers for meeting time tables, and in saving expenses of a project, which encouraged them to meet the time table and to save expenses of the project. This usually succeeds in most cases as witnessed.

Quoting from words of interviewees who answered that there is benefit from implementing a quality guide:

- Brings order, helps to manage efficiently, daily planning of tasks.
- Puts order to things, sets priorities for different subjects, follow-up on tests, follow-up on programs.
- Helps to control the papers of the project, organized consultant files.
- Organized correspondence assists the convenience of project managers.
- Organizes the system.
- Follow-up on what is done in the field, documenting the works, follow-up on papers, completely more organized, a more logical management.
- Better follow-up on accounts, the management level has risen, there is uniformity and it can be replaced, programs of the project are better as there is a review on them.
- Better order and control, useful to us in planning the stages.
- Order and organizing the test – quality saves time, the follow-up and documentation assist the work when people are inaccessible, missing, replacing and so forth, orders more organized, improvement in the communication level.
- Uniform work system to all project managers, uniformity in the systems, possibility for better communication between different projects.
- Focuses order and uniformity in the form of inspection, uniformity during the project and cross-sectional, improves ability to withstand complaints, not knowing how to work before.
- Assists fine, the change in quality control is not significant, there is more uniformity.
- Uniformity in registering, in reporting, in accounts, deals with subjects that were not handled

before like: submitting bills, follow-up on tasks, accepting programs.

2.3. The Success Metrics and the Success Factors

Reducing Costs and Complaints and Improving the Product: 9 Authorities' engineers indicated that the subject of reducing the number of defects and the reduction of costs as a benefit of implementing a quality management system, 11 Authorities' engineers out of the 20 interviewees claim that these subjects were only slightly improved but they think that it will happen later.

Is Implementation of a Quality Guide Suitable for Managing an Engineering Project? 5 Authorities' engineers claimed that implementation of a quality guide is not effective in managing a construction project. 8 Authorities' engineers said that efficiency in the field is not felt, maybe efficiency in papers and in the office is more effective and efficient especially as the system watches over the Authority. 7 Authorities' engineers claimed that the best efficiency is reducing complaints of users. This engineer prior to the implementation of the guide used forms that he took from a friend, therefore, possibly, a change in work patterns in managing engineering projects is not felt to a large degree.

Reputation: Four Authorities' engineers think that the main benefit from implementing a quality guide is the reputation of the Authority, that it does indeed manage a quality guide. They take pride in the fact that the authority is implementing a quality guide in every encounter with a person in charge. Those two engineers force the contractors and their project managers to work according to quality regulations of the Authority. One is signing the suppliers on maintaining quality regulations of the Authority, including future regulations and forms that will exist in the future figure 2.3. shows 12 Local Authorities' engineers publish that they work with a quality guide, one even asks others to publish warm greetings regarding receiving the qualification and working with a quality guide. 4 Local Authorities' engineers claim that there is no connection between reputation and success of quality guide in Local Authorities [111, p. 60].

Change in Work Pattern Following Implementation of a Quality Guide: As mentioned above, most of the interviewees indicated organization, control, uniformity, supervision and open communication as main benefits from implementation of a quality guide. To clarify the practical meaning of the statement, some examples and clarifications to the subject will be given henceforth [119, p. 467].

There are three levels of regulations: quality regulations – that are sometimes called general regulations, execution orders – sometimes called inner regulations, and tagging lists –

called check forms or "checklists". This level of regulations exists in Local Authorities as well, while occasionally there is an inner division of managing orders to various departments of the Authority.

One of the changes in working style according to the guide is availability of multiple forms, not just examination forms, to the managing team of a project. In 3 Authorities a booklet was prepared which gathered all the forms that had to be used. And each time there is a need for a form, the project manager or the Authority's engineer copies it from the booklet and uses it.

Using the tagging list following implementation of the quality guide is obvious, as quality control is a main part of the implementation, but other forms are used as well, such as a programs follow-up form. Program follow-up creates a situation of organizing and order in programs. The tagging lists put things in order, which is not an optical illusion.

Another example of organization and control that a quality guide creates is a form called "task list", which is employed in managing building projects. There is a list of tasks that need to be executed in a project, responsibility, activity and a deadline of each stage.

One of the complicated actions in building projects is dealing with clients' complaints including describing the defect, the request, date of request and time of its ending. Using an organized form can be of great benefit in dealing with this action. This reduces malfunctions significantly.

There is another example present in a number of Local Authorities. A quality manager prepares a quality program, which he submits to the Authority engineer who uses it in his current work. In the quality program there is description of the project, of management hierarchy in the project, detailing of external elements to work with, detailing of steps to be taken, detailing of the points to examine, and more. This program is of benefit to the Authority engineer as well, by summarizing important data for him.

Another example that demonstrates the long term benefit from implementation of a quality guide is management review meetings which take place once in every three or six months, in the engineering departments in Local Authorities. In management reviews there is an opportunity to examine recurring malfunctions and to deal with them. In one of the examples, a number of malfunctions were examined and delineated in the test year as well as a summary of costs discovered during that year. When management discusses and finds the cost of complaints to be high, they enforce an immediate handling, and if complaints are compartmented it also knows where to concentrate effort, and that might be the most important real contribution of the guide.

Costs Involved in Implementation of a Quality Guide: Quality costs in Local

Authorities is a complicated subject that fits a separate study. In the current study different data were gathered which can explain what are the different components of maintaining a quality system based on ISO-9000 series. It is hard to quantify exactly the total costs of maintaining a quality system, since it is changing from one Authorities to another, and due to lack of data, however order of magnitude and estimations can be given regarding this section [70, p. 828].

Costs of Establishing a Quality System Until Qualification: The qualifying factor, Institute of Standards the other authorizing bodies, collects money for the services it renders. The cost of initial qualification is estimated between 3,620 and 8,597€.

External Advisor: Every Local Authority that participated in the study was assisted by an external advisor. The cost of an external advisor changes between one Authority to another, in accordance with the size of the Authority. The cost of an advisor for establishment of a quality system only is estimated between 6,335 and 22,625€.

Quality Manager: In big Local Authorities there is full-time quality manager, however in small Local Authorities the person serving in this position has one additional person in this position. It is impossible to receive accurate data regarding the time dedicated to the position. One quality manager claimed that he dedicated about two hours every day to writing regulations, and once a week met with the advisor. Another manager claimed that he serves a half-time position in the job and he also dedicates two hours. The current project managers continued their ongoing work during establishment of the quality system. It can be estimated, therefore, that the time a quality manager dedicates is 12 months on average. The cost of work hours of a quality manager is between 19.91 and 40.72€ per hour, depending on his position in the Authority.
The total cost of a quality manager until qualification is estimated between 18,100 and 45,250€.

Steering Team Meetings: Steering team meetings in Local Authorities include, usually, only the quality manager and the advisor, and costs of their work is to be considered. In big Local Authorities in addition to those two position holders, usually, project managers, secretaries and some of the planners or supervisors participate in the steering committee. It is not possible to supply a specified average number of participants in steering teams, since it varies largely in Local Authorities. In total, there were 4 Local Authorities with extended steering teams, and the number of participants in them, in addition to an advisor and a quality manager, was about 7 people. The frequency of meetings of the steering team is between once a month to once in every 3 months. The number of hours dedicated to each meeting was about two. Assuming that only 1/2 of them are getting paid, and assuming that the cost of a working hour is about 40.72€ per hour, and assuming that the average length of qualification is about one year, the cost of an

extended steering team is then about 3,620€.

Other Involved Parties in the Implementation Process: Other factors involved in the implementation process are the Authority engineer and Authority CEO in municipalities, or the Authority secretary in Local Authorities, usually in supplying feedback and authorization to procedures [119, p. 470]. Management of the Authority is involved in assisting in formulating procedures and in supplying feedback; usually, they were not involved in formulating procedures and in the preparatory stage. There is no data regarding the number of hours of position holders in the Authority dedicated to establishing a quality system; therefore, it cannot be quantified.

Instructions: The instructions are for all project managers, supervisors, engineering department employees that work according to a quality guide and go through training on the subject. On average, there are about 20 employees/engineers that participate in the training.
In total, on average it is about 28 hours of training at the most, and if participants are divided into two groups, and according to an average cost of 40.72€per hour the cost is about 2,262€.

Office expenses: Implementation of a quality guide includes also office expenses, involved in working hours invested in printing procedures, paper, copying expenses, etc. This cost can be estimated between 905 and 4,525€.

At the end of the next chapter, there is a concentration table for costs of a quality guide until qualification.

Costs of Operating a Quality System after Qualification: The components of cost of operating a quality system are similar to the components of cost of establishing a quality system.

Quality manager: The quality manager does not end his work upon accepting qualification for ISO-9000 series. Many activities and a lot of responsibility continue to lie on his shoulders. He must continue with instructions, and to implement the quality guide while managing execution of projects. He must also hold internal examinations, maintain regulations, participate in conferences, participate in board meetings, process data accumulated and more. The cost of a quality manager after receiving qualification does not change significantly as compared to the time of establishment of a quality system.

External Advisor: It is worth mentioning that in 4 Local Authorities, the external advisor continued to accompany the Local Authority, simultaneously to the quality manager of the Authority, who holding also a different position, dedicates lesser time to the project. According to a statement of one of the quality managers, the cost of an external advisor in this case is about a quarter-time position and it can be assumed that the quality manager dedicates extra time for it, and the total costs do not reach a half-time position at a job.

External Examinations: An ISO-9000 series association stamp makes obligatory six-monthly examinations of the qualifying factor. Those examinations take place in two places, in the Local Authority offices – in the engineering department and in the construction sites or in the offices of one of the supervisors, project managers. And sometimes there is a need to repeat examinations. The cost of such an examination is estimated by quality managers at about 1,086€, not including the Authority's internal expenses. It would be reasonable that the total cost is double at least, even when the cost of the quality manager is deducted.

Internal Examinations: The quality manager performs internal examinations. The author couldn't verify the quantity of internal examinations that Local Authorities perform; therefore, the author does not have accurate information on their cost. In one Local Authority, internal examinations exist once in every 6 months, and in another authority once in every 3 months. The duration of each exam and the factors that participate in it are also unknown, but it does not last for more than one day.

Instructions: The amount of instructions change from one Authorities to another, in some authorities every employee receives some sort of a training once in every quarter, in other Authorities instructions take place once a month and each time there are different participants, and there are Local Authorities where instructions are irregular. The instructions are estimated at 452€ a month.

Board Meetings: The staff of management of the Authority should have board review meetings usually once in a quarter, but it is likely to assume that in some Local Authorities additional meetings take place.

Operating the System by Employees: Big and significant portion of costs of operating a quality system is the time resource invested by employees in the engineering departments in Local Authorities, in order to work according to a new instruction, according to the tagging list, and mainly to deal continuously with the quality control of the product. Most quality managers that were requested to estimate what is the duration of the time an average worker dedicates to it, could not quantify it or claimed there is no time added, since employees don't remain longer in the office and don't receive extra pay.

Office Expenses: The quality system continues to consume lots of paper, and have various office expenses after qualification is received as well. The expenses are estimated at 452€.

Summary: The costs of establishing a quality system changes drastically from one Authorities to another, the cost depends upon the investment of time of different factors in the Authority. It can be said that a datum with the biggest variance is the cost of a quality manager.

From analysis of the findings thus far, and from analysis of findings in forward contact, it is revealed that the amount of time a quality manager dedicates and his status realty affect efficiency and duration of the establishment process and the success from implementing the standard. Therefore, it is not worthwhile saving on this component of cost.

The cost of a qualifying factor, advisor and a quality manager, in minimal values, are at about 27,150€ in the smallest Local Authorities, and there are many additional costs. Local Authorities should think carefully whether to implement the ISO-9000 series for status improvement and to be proud of the implementation of a quality guide, which may create a situation of unnecessary overload in paperwork and of consuming a lot of time of current work, without any real benefit in quality.

As a result, many employees may be frustrated, and after a while, stop operating the standard almost completely, and eventually, all this may bring about a revocation of the qualification.

Table 2.21. Initial Implementation Cost of ISO-9000 (Minimal Estimate)

Type of expense	Estimation of expense in €
Cost of qualifying factor	6,335€
Cost of external advisor	15,385€
Cost of quality manager	40,725€
Cost of steering team	3,620€
Cost of instruction	2,262€
Office expenses	3,620€
Total initial cost with minimal estimate	71,495€

Source: Author's research specialized for the thesis

Table 2.22. The Monthly Cost of ISO-9000 (Minimal Estimate)

Type of expense	Monthly costs estimate in €
Cost of qualifying factor	1,086€
Cost of external advisor	In case he is not Authority employee, 905€
Cost of external advisor	905€
External tests	1,086€
Cost of steering team	No estimate

Cost of instruction	452€
Office expenses	452€
Total initial cost with minimal estimate	4,706€

Source: Author's research specialized for the thesis

Saving Money in Operating the Quality System: In fact, calculation of money saving upon operating a quality guide was the most difficult part. On one hand, the author investigates the process of managing an engineering project, and the author does not have clear measures that can be quantified and evaluate financial savings. Nevertheless, the researcher attempted to think about what happens when a quality guide is activated in Local Authorities, what are the benefits, and what is the financial saving between what was done prior to operation of the quality guide and what is done after operation of the quality guide. The researcher concentrated on two examples of work that employees in the engineering department Local Authority perform, the researcher asked his interviewees 5 questions in order to estimate saving of time and from that the savings after activating a management quality system:

1. What is the average amount of time (in minutes) until finding a certain project file?
2. What is the average amount of time (in minutes) until you prepare an order to start working?
3. The researcher also checked the time that passes from acceptance of a new employee until learning the system of managing engineering projects without operating the quality guide and after operating the quality guide.
4. The researcher also asked how many visits a project manager had to make to the field before activation of the managing quality system and after that. In addition the researcher asked how issuing of a work order or a request for a certain task was understood by the department employees or by a provider before activating the managing quality system and after that.

From the first two questions, the result is that there is an average saving of 5.75 minutes between what engineering department employees used to perform and what they do perform, since they perform those actions on number of projects, (by estimation and agreed by most of the interviewees, they do it 4 times a day, for two employees) and in total, there is a saving of 46 minutes.

Multiplying those minutes by 5 days a week and by 52 weeks in a year The author gets a total of 11,960 minutes which are about 200 hours and the financial cost of those hours reaches a

total of 10,000 €.

In addition, according to an average time saving in instructing a new employee and his acceptance to work, is 34.75 days. This is justified because a new employee has all the written procedures and forms, and he can read and work, as opposed to an employee that does not have written material.

Calculating the instruction hours gives about 20% saving in instruction hours (8 hours a day) which are 55.6 hours for each employee. And in multiplying the total saving in absorption of a new employee is about 3,200 €.

In addition, the interviewees were asked about frequency of visits to engineering projects, and they replied that there is a change and a reduction in visits after activation of the management quality system, indeed there are not many changes but the result is that there is a saving of 0.65 times of visits to the field.

Table 2.23. Data Concentration

Description of action	Cost
Annual saving in case of operating a quality guide	9,320 €
Saving in absorbing a new employee	2,590 €
Saving in visits to the field for each engineering project	0.65 times

Source: Author's research specialized for the thesis

Other Benefits: In addition to the above, two more parameters that could bring about a financial saving were examined, which are:

1. The average difference between understanding of employees and providers for certain regulations with no mistakes, before and after activating a quality guide, is 11%.
2. The average difference between satisfaction of various project managers (clients), before and after activating a quality guide is 12%.

See appendices at the end of the study.

Consequently following subchapter 2.3, the author's opinion is evident by the research conducted. The author discussed the successes of the questionnaires, interviews and conferences, showing that the large Local Authorities, meanwhile the smaller Authorities suffer from the lack of employees of Local Authority of Engineers, etc. There is also a large resistance for the implementation of the ISO-9000, especially with employees who have been in the field for a long time. Thus, the author strongly believes that the involvement of employees is vital for the growth and expansion and acceptance of incorporating this quality standard.

Constructing a Metric of Success: As part of the interviews and questionnaires, many questions were asked and much data was accumulated about the implementation process of ISO-9000 series and its success. In order to examine the correlation between success and various factors, an index of success was constructed and later, the level of correlation between the success of different Local Authorities and the activities performed by them was examined [119, p. 470].

In order to compare between various Local Authorities an index of success is to be established that is based on an identical foundation of data, therefore the index of success will be set only for those Local Authorities in which an interview for the quality manager has been held and at least for interviewees in the field. In total there are only 23 such Local Authorities. While in one Local Authority the interviews were done in more than one construction project, the index considered for this Authority is an average between the indexes of various projects.

The index of success has been done on just 20 Authorities out of the 23 qualified Local Authorities, or those having a nearly complete quality guide, in 3 Local Authorities no interviews could be held and data taken out from them due to their internal reasons.

Various Components of the Index of Success: The building blocks of the index of success are the answers to questions given in the interviews and the questionnaires. Occasionally, a particular question was repeated several times: once it was asked in the questionnaire and then again in an interview, once a quality manager was asked on it and in another time the interviewees were project managers. In order to increase reliability level, all the answers to identical questions will appear. In total, answers to 70 questions were weighted in the index of success. The answers were weighted quite arbitrarily, but in a way that each answer will have more or less equal weight in the final index [73, p. 47].

The index of success is, thus, a cumulative index of points, meaning that each answer to a question that indicates success adds points, and occasionally, answers that indicate lack of success subtract points. The final index of Authority is not a score from 1 to 10 but rather is an index relative to other Authorities. If some Authority has an index of 30 points, it does not mean anything unless the situation in other Authorities is examined as well. The number of complaints in delivery, number of months of delay of project completion, etc. For the purpose of correlation with various factors, this index surely fits. Description of the index of success for 20 different cases appears in the following figure.

Table 2.24. Concentration of index of Success in Engineering Projects of Local Authorities

Number of Authority	Index of success of the Authority, %	Number of Authority	Index of success of the Authority, %	Number of Authority	Index of success of the Authority, %	Number of Authority	Index of success of the Authority, %
21	49.5%	26	54.3%	31	58.3%	36	66.5%
22	63.8%	27	70.0%	32	63.0%	37	69.3%
23	63.8%	28	39.5%	33	42.5%	38	70.5%
24	49.3%	29	48.0%	34	50.8%	39	57.8%
25	78.3%	30	70.5%	35	76.0%	40	32.0%

Source: Author's research. [150, p. 196]

The chart above shows the Local Authority with its respective percentage of success. The chart below is respective to the scores of each Local Authority illustrated above as a graph.

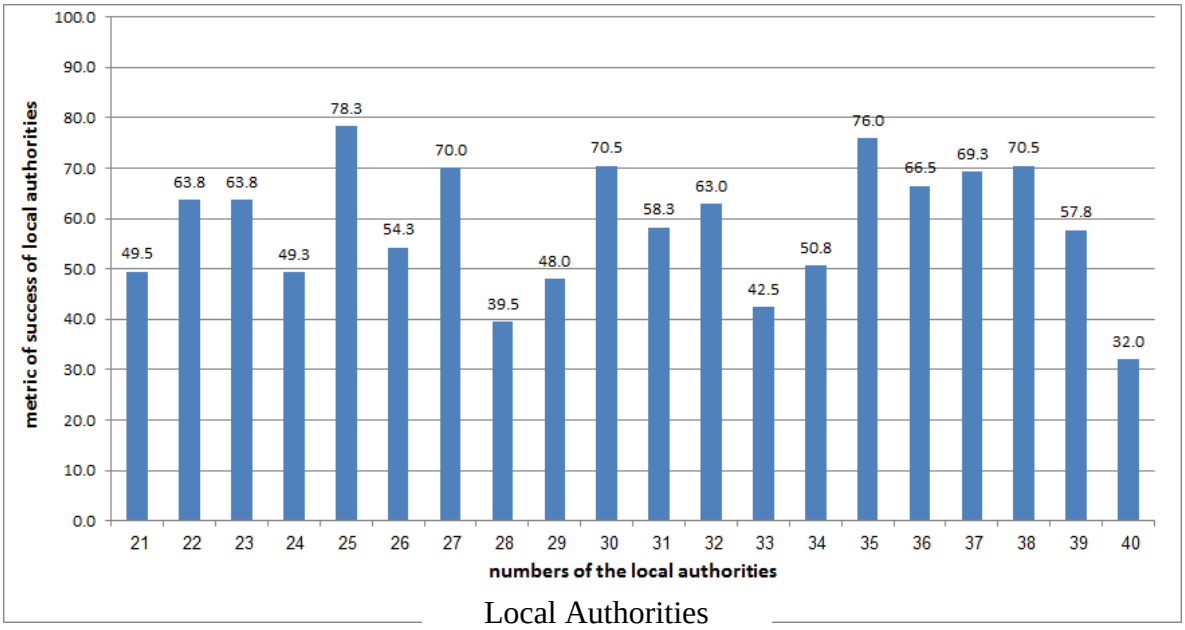


Fig 2.8. Relative Success of ISO-9000 Implementation within Different Locals Authorities

Source: Author's research. [150, p. 196]

Components of index of success in division by subjects are the following:

Length of Implementation: Theoretically, it would have been desired that the length of implementation of Israeli standard of ISO-9001:2015 would be as short as possible, as then, the resources allocated for it would be reduced and the overall cost would have been low. Therefore, a negative score is given for length of implementation the longer it takes. Additionally, should the implementation delay for some reason, a negative score is then given [89, p. 105].

Changes in Organizational Culture and Work Patterns: Positive organizational changes following the implementation of ISO-9001:2015 definitely indicate its success. These changes can be: feedback system from clients, feedback system from employees, giving rewards to employees, a system of handling complaints of clients, and more. Additionally, changes that indicate use and operating the system testify to its success. These changes are: a current change of examination forms, professional instructions for employees, and more.

Objection and Difficulties at Work According to Standard: Organizational changes lead to objections, but managers of the implementation process have great impact and in their actions they enhance or weaken the level of objection; therefore, the lower is the level of objection, the higher is success. Another subject that was examined is the amount of difficulty at work according to procedures [119, p. 470]. A successful implementation process leads eventually to convenience at work and a minimal difficulty. Additionally, improvement in satisfaction of employees testifies to success of the process of implementation and some level of mitigation in the level of resistance.

Amount and Volume of Procedures: ISO-9001:2015 might encumber upon work and might consume too much time. It is clear that if procedures and instructions of work will be more concise and effective, they will cause less difficulties. Therefore, theoretically speaking, it would be desired that there are minimal procedures that bring about maximal results. As results are examined in other components of the index, negative scores can be given as volume of procedures rises.

Improvement in Performance of the Authority: An Authority that implements ISO-9000 series is interested in seeing actual results from it. The interviewees in various Local Authorities were asked to respond whether according to their estimation there has been improvement in various indexes, following implementation of the standard. For example, is there a decrease in costs of projects? Has it met the timetable and budgets, which indicates a good evaluation of the Authority? Can improvement be felt in management of projects in Local Authority? [3, p. 39].

Reduction of Number of Complaints: The central role of ISO-9001:2015 a quality standard is to reduce the number of complaints of clients. The lower is the number of complaints and the more significant is the reduction in number of complaints, the greater is its success [89, p. 27].

Improvement in Performance of Projects: Quality managers and interviewees were asked many questions which purpose is to examine the improvement in project management. The

questions addressed the following subjects: meeting time tables and budgets, rate of progress of projects, time of delivering the programs, amount of corrections in procedures, order of work, etc.

Recommendations and Satisfaction: Quality managers and interviewees were asked to respond to questions that testify to their satisfaction with the standard, such as: is the implementation beneficial to the Authority, would they recommend implementing it, does it prove beneficial, and more. A high level of satisfaction testifies, as well, to success in implementation. See below in the appendix 3 analyze of the metrics of success.

Assigning indexes to Assumed Metrics of Success

Way of Quantifying Metrics of Success: In order to examine the level of correlation between estimated factors of success and between success, the metrics of success are to be quantified as well, and to create an index of the extent of enhancement of each factor. The way in which a weight (score) is given to different factors of success is detailed in the following table.

The metrics have been decided on after the discussion and agreement between the researcher and the council's engineers.

Table 2.25. Way of Quantifying Metrics of Success According to the Researcher and the Council's Engineers Participating in the Research

Weight in percentage	Metrics
10%	Length of implementation
10%	Changes in organizational culture
10%	Resistance and difficulties in work according to standard
10%	Amount and volume of procedures
15%	Improvement in performance of the Authority
20%	Reduction of number of clients' complaints
10%	Improvement in project performance
15%	Recommendations and satisfaction
100%	Total

Source: Author's research [150, p. 197]

In order to simplify the explanation regarding the metrics of success, here is an example: the extent of commitment and involvement of top management was different from one Authorities to another. Similarly to a technique that served for determining an index of success

that was given to each Authority on the extent of commitment of management, according to the answers to questions asked in the interviews. After the score was set for each company on this subject, the rate of correlation between success in implementation and between involvement and commitment of management can be examined. If the rate of correlation is high, then the higher is involvement and commitment of management, the higher is the success of the Authority and if the rate of correlation is low, then involvement and commitment of management are not a factor that has much effect upon success in implementation of ISO-9001:2015.

Estimated Factors of Success: Following the literature review, interviews and questionnaires, a long list of factors appeared, that it was warranted to clarify whether they indeed affect the success of implementation of the quality system. This list, along with an explanation on the components served for the quantification thereof, is hereby presented:

1. Commitment and Involvement of Top Management: Commitment and involvement of top management in implementation of ISO-9001:2015 reviewed in the literature review, is probably one of the primary factors of its success. In order to quantify the extent of commitment and involvement of top management, the data and answers to following questions were used:

- Who has taught the subject first?
- What is the extent of involvement of the Mayor of the Authority?
- What is the extent of involvement of top management in the Authority?
- Were there announcements of the Mayor of the Authority or his deputy in the beginning of the process and at its end?
- Was there a ceremony with multiple participants at the time of getting the qualification?

2. Experience with a Quality System: It can be assumed that the longer a quality system exists, the more change it creates, and thus the greater is success. The quantifying of experience with the quality system served as data and answers to questions for the time elapsed since qualification of the standard, for the level of quality management according to ISO-9000 series (in terms of use in procedures and tagging forms), for the experience accumulated in implementation of the standard in previous project, etc. [119, p. 469].

3. Motives: A whole system of motives drives the various Local Authorities towards implementation of ISO-9000 series at their disposal. Part of them are motives for the sake of quality and part are external motives and others. In the present chapter of the study, it will be clarified, amongst other things, as to whether this system of considerations has a significant impact on success of implementation. In other words: does someone who intends to improve

quality get to do so? James J. O'Brien is quoted as saying: "Tendency towards dispute. A typical construction project attempts to do something never done before with a team that has never worked together. The members of each team commonly mistrust each other and possess preconceived notions regarding capability and integrity and little, if any, understanding of the motives and goals of their counterparts" [49, p. 103].

4. Extent of Employee Involvement: In previous chapters, it was said that the extent of involvement of position holders in sites affected the satisfaction of those position holders, but the question remained open as to whether a high involvement of engineers and project managers in the preparation of procedures affects positively on additional indexes of rate of general success from implementation, as well. As expressed in Part 1, in section 1.2., all employees, whether they are upper management or entry level workers, all have an important role to play with high level quality. In Part 1, section 1.1., the significance of all parties involved as a whole leads to the result of the correlation between the quality and result. According to J. F. Carlos, the "quality" of participants' emotional involvement or even their fears, all play a role. The involvement of employees served for this index is: employee involvement in the steering team, extent of involvement of position holders in formulation of procedures, etc. As said by Dr. Carlos, The author must listen to the employees [58, p. 53]. Listening to the employees also requires that there be an involvement of employees from each department who will partake in the discussion as well as brainstorming ways to improve the overall quality for everyone. This is also expressed in Section 1, figure 1.3., of which Joseph M. Juran deems that a quality circle is stemmed from volunteer employees who seek out, within themselves, ways to better their working environment in their department.

5. Impact of Quality Manager: Quality manager is, as stated in section 2.2., is a significant factor, and could be the most significant one, for the success of implementation of ISO-9000 series. In this section, the extent of impact of quality managers status in the Authority hierarchy will be examined. Although it is costly to have a quality manager, as stated in Part 1, section 1.1The author believes that a quality manager is vital for the growth and continuation of a successful business. It is necessary for the growth and continuation for success

6. Effect of Time Table Planning: In section 2.2. "Total length of implementation", it was found that there is a correlation between the existence of deadlines and setting a timetable with road blocks for the continuation of the implementation process. In this section, it will be examined whether the existence of these and of set weekly meetings affected the overall success of implementation [119, p. 470]. "The delivery mode of TA services is often specified in a

superficial manner, without adequate consideration of alternatives.

7. Training and discussions multiplayer: is sometimes expected to occur automatically as a byproduct of other activities, and scarce high-level national staff may be assigned as "counterparts" to merely observe expatriate experts in their work. Also, the expected output or benefits of the services (as noted earlier, these are not always tangible or easily measurable) may not be sufficiently specified [106, p. 3].

Reservations Regarding the Correlative Data Analysis

Data analysis that appears in section 2.3. suffers from several methodological defects, as the fact of using quantitative techniques for analysis of data that are not quantitative is problematic. Following are the primary problem in a correlative data analysis:

Reliability of Interviewees: Reliability of interviewees is doubtful to some degree, as they are not objective and as part of them have an incentive to present their Authority in a positive light. On the other hand, as stated in section 2.2., this incentive is not as comprehensive as can be thought, and in addition the manipulative ability of interviewees is limited due to various reasons. First, the quality managers cannot refer the researcher only to projects in which there are only happy managers, as they usually implement the standard in few projects, and second, the number of questions asked is so big that it is difficult to create a wrong impression without actually lying.

Time Period of Data: Even if it is assumed that the interviewees were completely honest in their answers, there is a question whether or not the data in their hands are valid? The answer is based mainly on estimations and includes some objective and quantitative data. It might be that these estimations are mistaken to a small or large degree. The experience and professionalism of interviewees are in their favor, and they decide positively or negatively on the period of evaluation [119, p. 469].

Setting Indexes for Success and Factors of Success: Setting the index for success and for factors of success was done according to discretion of the researcher and it is likely to assume that should the researcher be another person, the weighting and quantifying of answers in the interviews was different. Nevertheless, the final result shows a very high level of correlation between the factors of success and success, and it is hard to believe that it was affected by the hand of fate. It can be assumed that if the weighting was slightly different, still a relatively high level of correlation would have been received, and the analysis would have led to similar results.

Limited Number of Cases: Although this is a relatively small number of cases for examining correlation, the very high level of correlation indicates the fact that the results

accepted can be used. Additionally, in the statistical analysis there is representation for various diverse cases from sample population, and it is likely to assume that should there be more cases, the level of correlation would not change much. In addition, 15 cases constitute about 43% of the possible sample population, it is likely to assume that there is a good enough representation of all possible cases. In order to overcome this disadvantage, the study had to have much more consideration, and it is not clear whether the benefit from it would justify the additional investment. Additionally, the time that will pass until the realization of such study would present the utilization of its results by many Authorities interested in implementing ISO-9001:2015 soon [47, p. 61].

Analysis of 20 Authorities out of 23 Possible Ones: In addition, in the current study only 20 Authorities were analyzed instead of 23 possible Local Authorities, it could be that the results can vary, even if not by high percentage. Upon conclusion of current study, the researcher wishes to summarize the important issues of the study and following ways for improvement:

1. Research benefits
2. Suggestions for future improvement

In closing, the researcher thinks that the procedures and forms are to be improved in accordance with the improvement and updating of various laws of the state.

Therefore it is proposed as follows: To appoint a committee for updating procedures composed of a number of members from Local Authorities' engineers, that would convene once in every 6 months, to examine the procedures that are still effective and also to improve them during the next 6 months.

In addition, the researcher proposes to prepare Internet software on the basis of which the Local Authorities' engineers will manage the engineering projects for the entire period.

In the inception of the study (chapter 1– literature review), the researcher reviewed in detail the subject of quality, and this included the development of quality management in the 20th century, and compared between the various approaches and various key methods in TQM in present time and the ISO-9000 series.

In the literature review, the methods and techniques that accompany quality management were addressed as well, which constitute and complement development for the central approaches in quality management: JIT, Partnering, Value Engineering.

The literature review presented constitutes a background and a basis for the research study to be detailed in the following.

In Israel, there are 257 Local Authorities, 2 of which are industrial Local Authorities. In

each, there is a department of engineering (which occasionally is called the engineering department, or engineering manager, according to its size).

Collection of data on the engineering department and the various projects was done by a questionnaire that included 22 essential questions: numerical data on the Authority, the department, and the quality instructor including frequency of use and updating. In addition, interviews were held with 20 interviewees, and a summarizing committee was held for receiving feedback to a quality instructor proposed by the researcher.

In section 2.2. and based on primary findings received in the questionnaires and the interviews, and based on feedback for the quality instructor proposed by the researcher, primary conclusion of the study was formulated, the main part of which was an identification of the primary factors for success in implementation of ISO-9001:2015 in Local Authorities. Additionally, a uniform quality guide was formulated for all Local Authorities in Israel. This guide is supposed to assist the Local Authorities that are interested in improving the design of its engineering projects management, by an effective, uniform and verified format. And as well, in terms of theories of international experts such as ISO-9000 series on one hand, and in terms of an official qualifying institution in Israel such as the Israeli Institute of Standards, on the other hand. An engineering project is defined as “changing the face of the environment for the benefit and welfare of people”; multiple, diverse resources are invested in engineering projects [70, p. 828].

As a general rule, the process of engineering project management in Local Authorities is identical. However, what characterizes part of the Authorities (small Local Authorities) there is a process called “outsourcing”, which means, forwarding the management of an engineering project to an outside factor who (to some degree) manages the engineering projects in the place of Local Authority.

Quality control, and particularly quality inspection in Local Authorities in management of engineering projects, is usually performed by project managers, and some part (in small Authorities) by the engineer of the Authority. In a few cases, a project supervisor is the one to perform quality control. Quality control is divided into 3 categories: financial, time tables and quality of management.

It turns out that most Local Authorities have used, in some way, internal procedures with no tagging lists. But in summary, it can be said that in those Local Authorities that participated in the study, even if various types of procedures and forms were in use, prior to the implementation of any procedures or the ISO-9000 series, are not enough to create a quality control system, and naturally neither a quality assurance system, that is orderly, documented and systematic.

Examining serious alternatives to quality instructors, has not been made by most Local Authorities. A small number of Local Authorities have promoted, initiated and improved some quality management systems. 10 Local Authorities only, have been qualified, most are still operating an independent quality management system that is improved occasionally. Most Local Authorities did not examine additional alternatives, they have chosen to address the procedures they prepared as the only alternative for implementation of a quality system in their disposal.

The process of involvement of employees in preparation of quality guides in Local Authorities is very limited; it can be learned that non-involvement of employees and executives in the implementation process brings about an objection to working in accordance with it [119, p. 470]. It would have been better if they were involved in preparation of the guide and obviously in implementation of the guide. Instruction and involvement are the solution to mitigating objections according to the quality guide.

In addition, the researcher wishes to clarify that there is no shortage of problems in implementing quality guides in Local Authorities, both internally, on the part of disaffected employees of the engineering department from extra work and externally, elected officials and treasury department due to various reasons.

Expected Benefits from the Quality Guide: It can be summed-up that quality system management indeed brings about a general improvement in managing of engineering projects, particularly during the submission of projects to clients. The complaints are reduced significantly, in addition to limited improvement in schedules and in meeting budgets. The multiple problems accompanying the engineering project do not necessarily stem from managing the project, but rather from external subjects over which quality managers or project managers have no control.

Costs Involved in Implementation of a Quality Guide:

a. Total initial cost by minimal estimate – 71,495€.
b. Total current cost in minimal monthly estimate – 4,706€.

Analysis of Primary Factors for Success in Implementation of ISO-9000 Quality Standard

One of the stated purposes of the study was: proposing an effective model for implementation of quality management that supplies the greatest benefit.

All correlation levels between rest of the assumed factors and between the extent of success were examined, from a summary of this analysis can be seen that those factors with highest impact on the extent of success of quality management system in managing engineering projects are: involvement of top management, motives for implementation, involvement of

employees, involvement of quality manager, deadline or timetable. Additionally, it turns out that there is no effect of work experience factors, on the extent of success of a quality management system in engineering projects management, in factors of experience with quality and instruction and multiple-participant meetings [119, p. 469].

Table 2.26. Correlation Between Factors and ISO-9000 Implementation Success

Number	The factor	R^2	r
1	Involvement and commitment of management	0.303	0.551
2	Experience with quality	0.001	0.038
3	Motives for implementations	0.536	0.732
4	Involvement of employees	0.693	0.833
5	Impact of the quality manager consultant consultants	0.356	0.597
6	Deadline or timetable	0.535	0.732
7	Instructions and multiple-participant meetings	0.0219	-0.114

Source: Author's research specialized for the thesis

In grouping of several factors of success, and examination of levels of correlation between the sum-total of all the factors and the extent of success, the way of performing this stage is starting with adding factors with a high level of correlation and then the gradual adding of factors with lower levels of correlation, until the finding of the highest collective level of correlation, and this was done in current study.

In an examination of several levels of collective correlation [122, p. 11], it appears that the highest level of correlation is the adding of levels of correlation: motives for implementation, involvement of employees and the impact of a quality manager that gets the level of correlation to R=0.828.

2.4. Conclusion of Chapter 2

After analyzing success indicators with success factors the author found three salient success factors:

1. Multi-participant Instructions and Discussions: It is clear that prior to the implementation of ISO-9000 series in various projects, individual instruction to employees, engineers and project managers were held. What distinguishes between the various Local

Authorities is the existence or absence of multiple-participant instructions in the beginning of the way and prior to receiving the qualification, and the existence of multiple-participant meetings. As referred in Part 1, section 1.1., the multiple participant meetings of employees were conveyed. The impact of these on the success of the implementation will be examined. Sui Pheng Low & Joy Ong "*To ensure that trainees will use their newly acquired skills, program designers should make certain that managers participate in the training in some way, perhaps by attending the beginning and closing training sessions or special seminars or workshops for them technical assistance staff can reinforce the training by following up on the activities of ex-trainees and by assembling training materials in procedures manuals*" [33, p. 10].

See below in the appendix 3 the analysis of the metric of success factors.

- In the author's opinion, there is no correlation between the size of the Local Authority and the metrics of success. If one has a Local Authority with a much larger number of employees than that of another for example, it does not indicate that the respective Local Authority is more successful. There is a large range between the number of the rate of success and Local Authority.
- In conclusion for chapter 2, the research conducted regarding the ISO-9000 series shows that many countries need improvement for the local quality standard. In Israel, there exists in general a good level of Local Authority of Engineering, while the smaller authorities need improvement for such standards. The thesis is perplexed as to how not all employees are open to this standard improvement for quality change. The results indicate all countries and all municipalities, large or small, to follow the standard quality of the ISO-9000 series. The study the author conducted regarding the Local Authority municipalities in Israel shows that there is a large difference in the metric of success of local authorities, and there should be no reason for this, however the difference is between the small local authorities and the larger ones.

2. Constructing a Metric of Success: As part of the interviews and questionnaires, many questions were asked and much data was accumulated about the implementation process of ISO-9000 series and its success. The success metrics are;

2.1. Length of implementation

2.2. Changes in organizational culture

2.3. Resistance and difficulties in work according to standard

2.4. Amount and volume of procedures

2.5. Improvement in performance of the Authority

2.6. Reduction of number of clients' complaints

2.7. Improvement in project performance

2.8. Recommendations and satisfaction

3. Estimated Factors of Success: Following the literature review, interviews and questionnaires, a long list of factors appeared, that it was warranted to clarify whether they indeed affect the success of implementation of the quality system. This list, along with an explanation on the components served for the quantification thereof, is hereby presented:

3.1. Commitment and Involvement of Top Management

3.2. Experience with a Quality System

3.3. Motives

3.4. Extent of Employee Involvement

3.5. Impact of Quality Manager

3.6. Effect of Time Table Planning

3.7. Training and discussions multiplayer.

What the author is trying to indicate throughout the chapter is to manifest the ISO 9000 standard in the various projects and he's trying to convey it not only in offices but for employees also and watchout not the quantity but provide quality not even in materialistic subjects but the human resources too. The success rate has many factors and the gap between the institutions and local authorities from small to large. The success metric and its factor is highlighted well clearly in the conclusion also.

3. A NEW MODEL OF THE QUALITY MANAGEMENT SYSTEM FOR PUBLIC CONSTRUCTION ENTERPRISES

3.1. Analysis of Main Factors of Success in Implementing ISO-9000:2015 Quality Standard

Introduction. One of the stated research goals was: proposing an effective model for implementation of quality management that will bring about the most benefit. To build such a model there is a need to identify elements of success and elements of no-success [119, p. 463]. Four means will be used in current study to design an effective and productive model for implementation of ISO-9001:2015:

- The first means: analysis of findings on implementation process of ISO-9001:2015 in the 40 Local Authorities that participate in current study, by the interviews performed. This analysis was done in sections 2.2.3. to 2.2.12. [119, p. 470].
- The second means: questionnaires in which different quality managers, engineers and project managers were asked to rank the importance of subjects to successful instilling of ISO-9001:2015, and to point out the key factors to produce the biggest benefit for the long-term from implementation of the ISO-9000 series at their disposal. The results of these questionnaires will be in section 2.3.
- The third means: statistical analysis of the multiple data gathered in interviews and from questionnaires. In this analysis this index will be designed. This index analysis will be presented in section 2.3.
- The fourth means: a conference on the subject of implementation of ISO-9000 series, presented in this study, in which there was a discussion regarding different factors and their effect upon the success of implementation of ISO-9000 series in engineering departments in Local Authorities. In the conference, the feedback on procedures suggested by the researcher were received, attached as appendix 3 of current study.

The Importance of Different Factors for Successful Instilling of ISO-9001:2015: The quality managers in different Local Authorities and interviewed project managers that had sufficient involvement in the implementation process, such as that which enables them to give their opinion, were asked to rank the importance of different subjects for successful instilling of the implementation process. The ranking in the following table is according to a key attached to the table [119, p. 470]. The question that was asked was on the importance of different subjects of ISO-9001:2015 mainly, the answers should be regarded in this manner.

The subject that is most obvious above all other for successful instilling of ISO-9000 series is involvement of Authority management, and the vast majority of repliers regard it as critical for

success of implementation. The subject next in line of importance is involvement of project managers and employees of a Local Authority, but it is not stated what kind of involvement, be it in form of joint discussion or in form of formulating procedures. The third important subject is the instructions. From interviews with quality managers, it can be said that many of them emphasized the subject, the term "*perseverance*" was also repeated in interviews with different project managers, and actually, all those are directed towards a thinking process of recognition and internalization that all employees should go through. The next important subject is connected to all this which is feedback from employees. Many quality managers see the compatibility of the standard to the field as a very important thing, and feedback from employees helps this.

The next important subjects are subjects related to the nature of the procedure in a decreasing order of magnitude: early communication with the qualifying factor and establishment of a steering team. The qualifying factor of the Local Authorities participating in the study is the Israeli Institute of Standards. The Israeli Institute of Standards made a great and impressive effort to instill the ISO-9001:2015 the Israeli market and particularly to the construction branch in Local Authorities [119, p. 467]. Part of this effort was training and instruction of Local Authorities' employees and probably due to that many consider an early connection with the qualifying factor as an important thing. An additional reason might be understanding the demands of the qualifying factor.

Table 3.1. Importance of Different Factors for Success of ISO-9001:2015

Subject	Critical importance	Very important	Important	Slightly important	Not important
Management involvement	65%	30%	8%	0%	0%
Instructions	20%	53%	33%	0%	0%
Establishing steering teams for quality	12%	30%	43%	13%	4%
Involvement of employees	25%	40%	27%	0%	2%
Feedback from clients	0%	22%	35%	35%	6%
Feedback from employees	8%	45%	36%	7%	3%
Early communication with the qualifying factor	8%	40%	35%	8%	4%
Contacting other Local Authorities	0%	5%	33%	25%	40%

Source: Author's research. [170, p. 83]

It is not clear why so many recognize the importance of steering teams and so few create a real steering team. It might be that the perception of the term steering team was distorted under the influence of the researcher. The questionnaire was filled at the end of each interview and during the interview quality managers were asked regarding participants in steering teams as part of the implementation process [119, p. 470]. Probably, the impression received was that a quality manager and consultant constitute together a steering team. The question asked was: "*can a steering team including a quality manager and advisor only be called a steering team or not?*" In any case, it can be understood from the answer on the importance of a steering team that leadership is very important to the implementation process, whether there is one person from the Authority in the steering team or a wider forum [160, p. 36].

The subjects in lowest level of importance, in a decreasing order of magnitude are: feedback from clients and contacting other local authorities. Successful instilling of ISO-9001:2015 the Authority is an internal matter and is not dependent too much on external factors including clients, and these answers are logical. The importance of feedback from clients can produce a bigger benefit from the quality system but it is not connected to its instilling.

Summary: In the opinion of quality managers, successful instilling of ISO-9001:2015 dependent mainly on involvement of management of the Authority, involvement of employees and training for employees. Leadership and early communication with the qualifying factor are important as well, however less [119, p. 467].

Factors to Produce Maximal Benefit from Implementation: All the interviewees and other position holders (especially quality managers) from Local Authorities were asked what, in their opinion, is the key to produce maximal benefit, for the long-term, from implementation of ISO-9001:2015 their disposal. The respondents to this question had to choose from a number of choices, as described in table 3.2. Surely the wording of the question is aimed at choosing a single key factor; however, an option to choose more than one key factor was given. As can be seen, one of the key factors suggested in the questionnaire is not under the control of Local Authorities, and it is: combining many factors in the Local Authority to a chain of quality.

Table 3.2. Key Factors and Maximum Benefits of ISO-9001:2015 According to the Interviewees and other Position Holders from Local Authorities Participating in the Research

	Inclusion of employees	Joining of Local government	Simple and concise procedures	Current operation of teams	Employing ISO-9001:2015 for implementing TQM	Utilizing information on malfunctions for improvement
Quality managers	60%	45%	70%	40%	4%	85%
Interviewed managers	30%	33%	47%	46%	0%	74%

Source: Author's research. [170, p. 84]

In ranking the importance of the key factors according to the number of questionnaires respondents who pointed them out, it can be seen that the first and foremost key factor for successful implementation of ISO-9001:2015 is utilizing information on complaints to improve quality. This answer testifies mainly to the fact that the questionnaire's respondents understand the subject of quality and the principle of prevention as part of the role of a quality system. However, all Authorities participating in the study, with exception of one, have not yet started collection and analysis of data on the complaints.

The second important key factor, regarding which there is as well a consensus between quality managers and the interviewees in the sites, is: concise and simple to execute procedures. As mentioned above, the main difficulty in working with the procedures, formulated following the implementation of ISO-9001:2015 are: abundance of paper and bureaucracy and a high consumption of time. Formulating concise and easy to execute procedures will facilitate this aspect, and in the opinion of many of them will make the implementation of ISO-9001:2015 useful. Formulating concise procedures, especially concise tagging lists, may bring about a lack of proper documentation of malfunctions that are discovered during the process of execution, and there will be more need to rely more on repair actions as the primary means of documentation.

Interesting finding discovered in this questionnaire, is a different addressing of quality managers on one hand, and interviewees in the sites on the other hand, to participation of employees from all levels in shaping the procedures. While most quality managers think that participation of employees at all levels in shaping the procedures constitutes a key to success, most of the interviewees in the field think differently. All interviewees that were not involved in

formulating the procedures, except for one, think that such involvement does not constitute a key to success. As opposed to this, amongst interviewees in sites that were involved in formulating the procedures there are opinions hither and thither.

Another important subject is joining a Local Authority to the quality chain. Many are aware of the fact that as more factors join the quality chain, the implementation of ISO-9001:2015 will be more successful in their organization, specifically.

ISO-9000 series standard can serve as a basis for implementation of total quality management, but it appears that almost comprehensively the questionnaire respondents think that they don't see in that option a key to achieve benefit from the standard [161, p. 463].

As opposed to it, many thinks that operating teams to improve quality can constitute a key for achievement of most benefit from ISO-9001:2015. It is worth mentioning that the interviewees and the questionnaire respondents were not tested on their knowledge and their orientation in subject of quality, but from talking to some of them it appears that many don't know what are quality circles or total quality management (TQM). Despite this, something is positive in the fact that many consider positively the establishment of teams to improve quality, that indicates openness and a desire to extend the quality system and to broaden its efficiency, even assuming that they do not mean quality circles.

3.2. Examination of Correlation Between Estimated Factors of Success and Success

After success and factors of success were quantified, and each Local Authority has a number representing the rate of success and the rates of various factors of success, the author will examine the extent of correlation between various factors and between success.

Examination of the factor of "*Commitment and Involvement of Management*" in Local Authorities

The extent of involvement of management of various Local Authorities appears in the following figure 3.1. Rate of success that is parallel to this figure for all participating Local Authorities in the study appears in the previous figure.

The indexes examined for measuring the involvement of management:

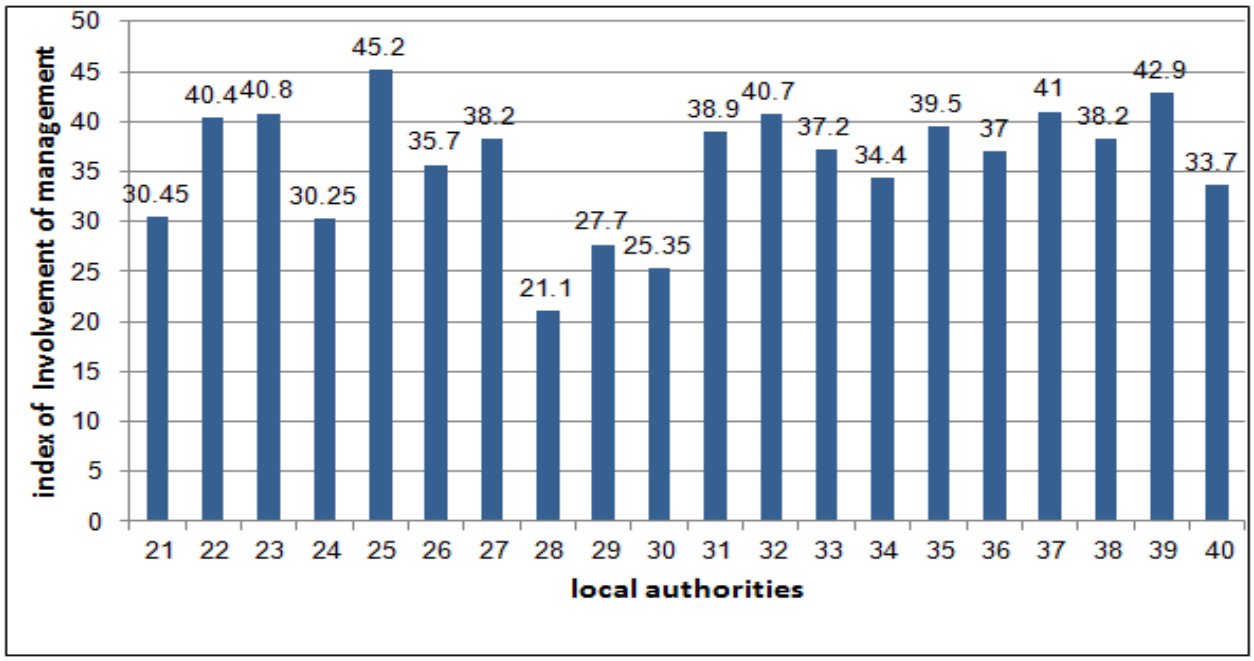


Fig. 3.1. The factor of "*Management Involvement*" for rate of success in Local Authorities

Source: Author's research. [150, p. 196]

Thus through an Excel sheet, a linear regression is run on the data and the following figure is received:

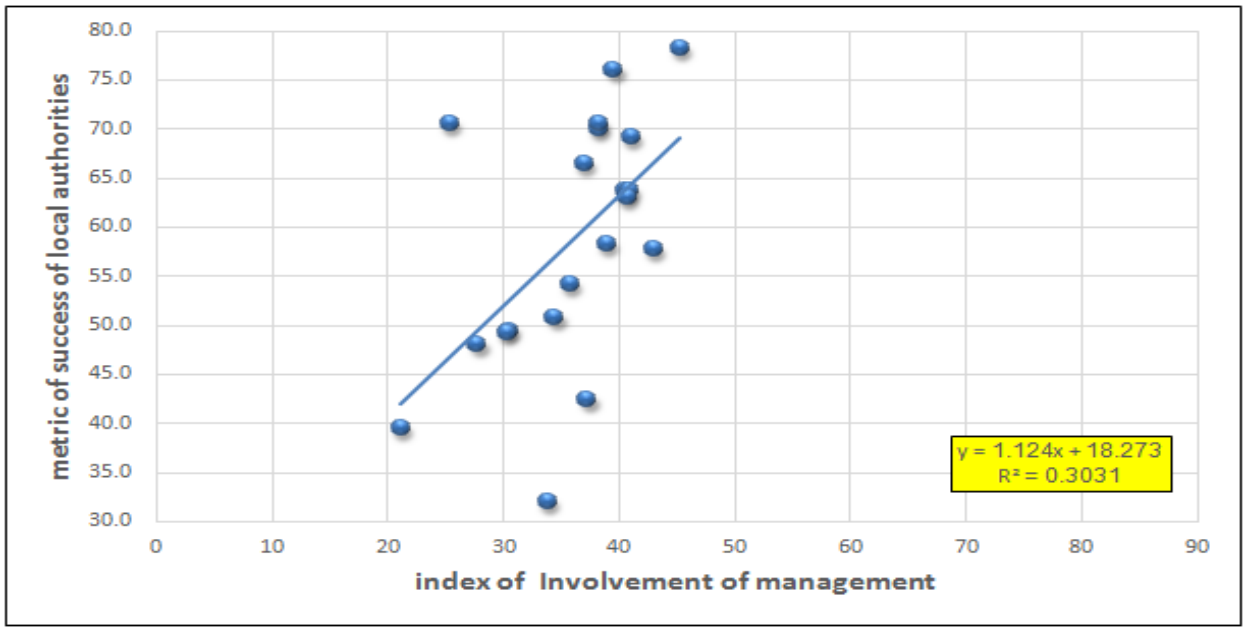


Fig. 3.2. Correlation between the factor "*Index of Involvement of Management*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.303 is received, between involvement and commitment of management and between rate of success, meaning the extent of involvement and commitment of

management affects in a mediocre fashion the rate of success.

Similarly, the level of correlation between rate of success and between the factor of experience with quality:

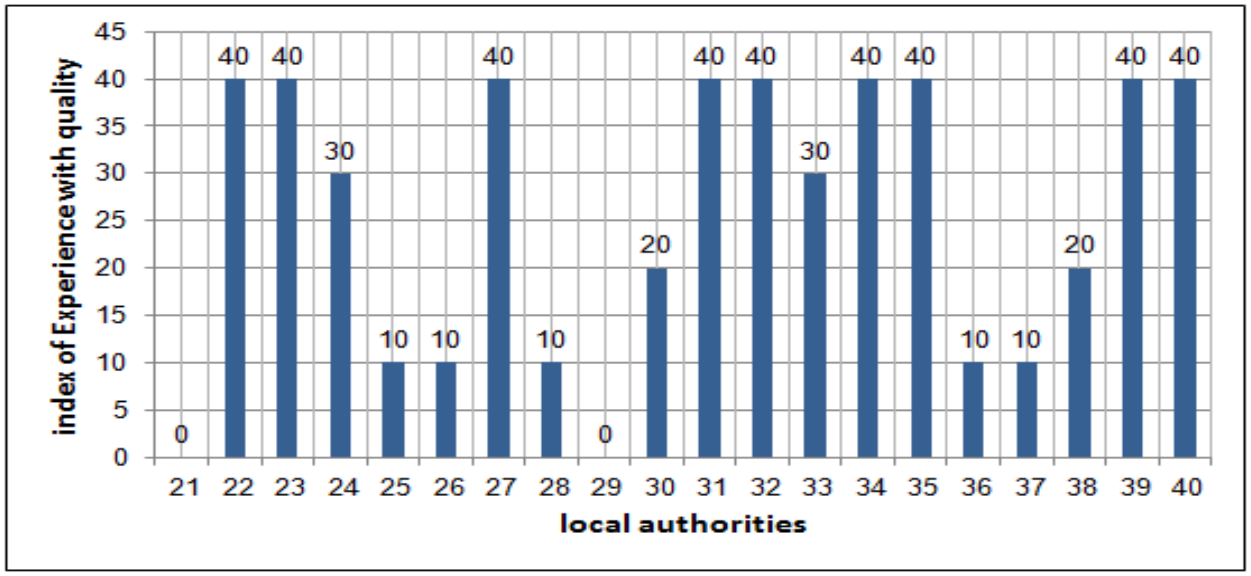


Fig 3.3. The factor of "*Experience*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

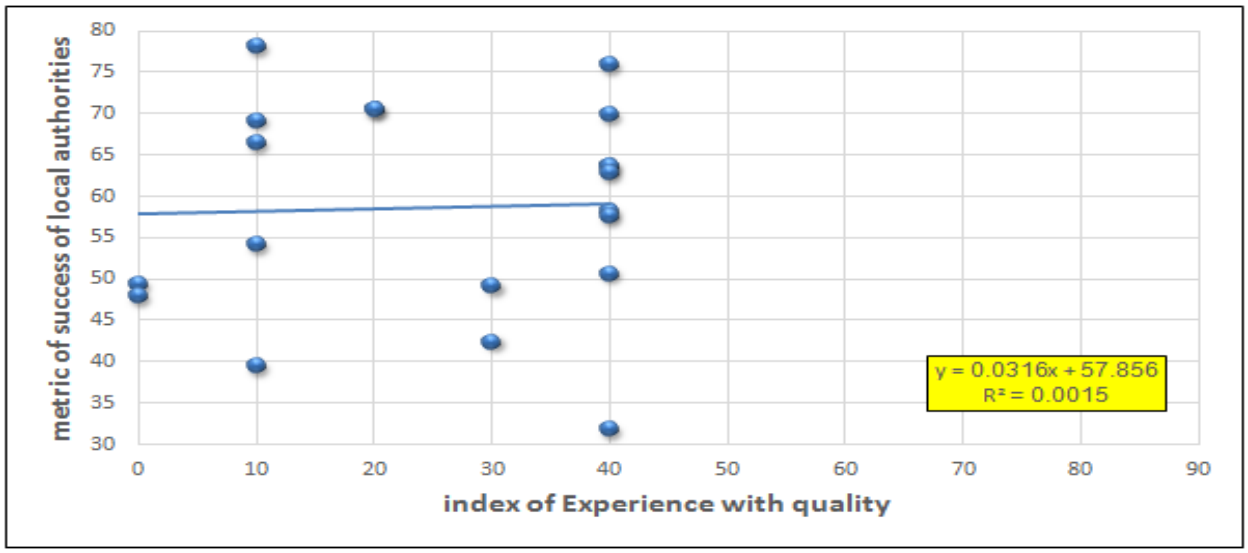


Fig 3.4. Correlation between the factor "*Index of Experience*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.001 is received, between years of experience and between rate of success, meaning, there is no correlation between years of experience and rate of success [119, p. 469].

Examination of the factor of "*Motives for Implementation*" in Local Authorities:

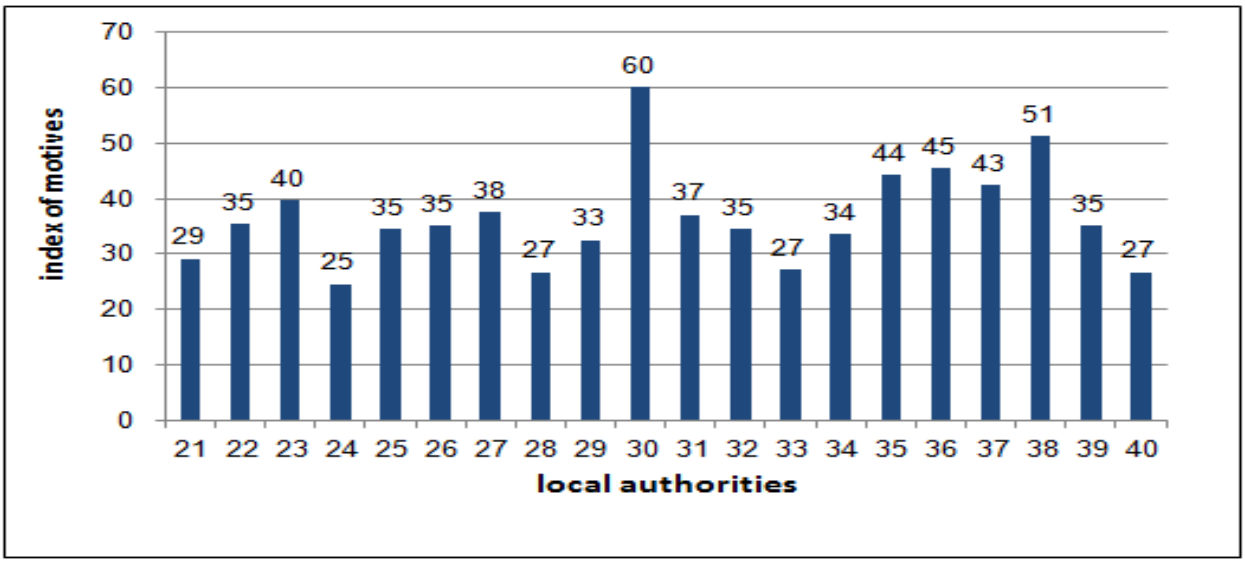


Fig 3.5. The factor of "*Motives*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

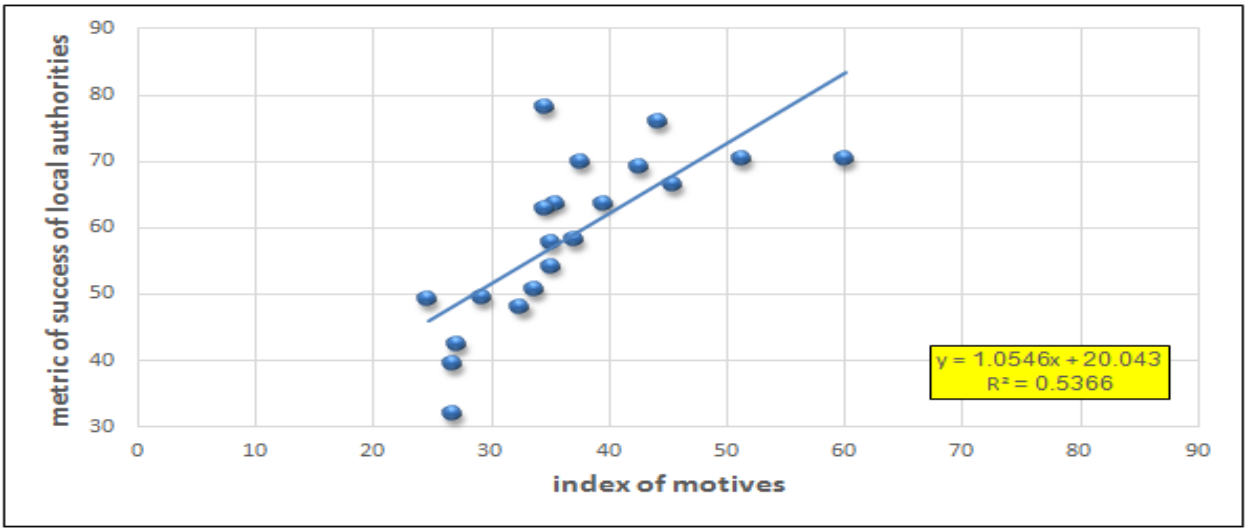


Fig 3.6. Correlation between the factor "*Motives*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.536 is received, between the index of motives and between rate of success, meaning, the index of motives has a mediocre effect on rate of success.

Examination of the factor of "*Employee Involvement*" in Local Authorities:

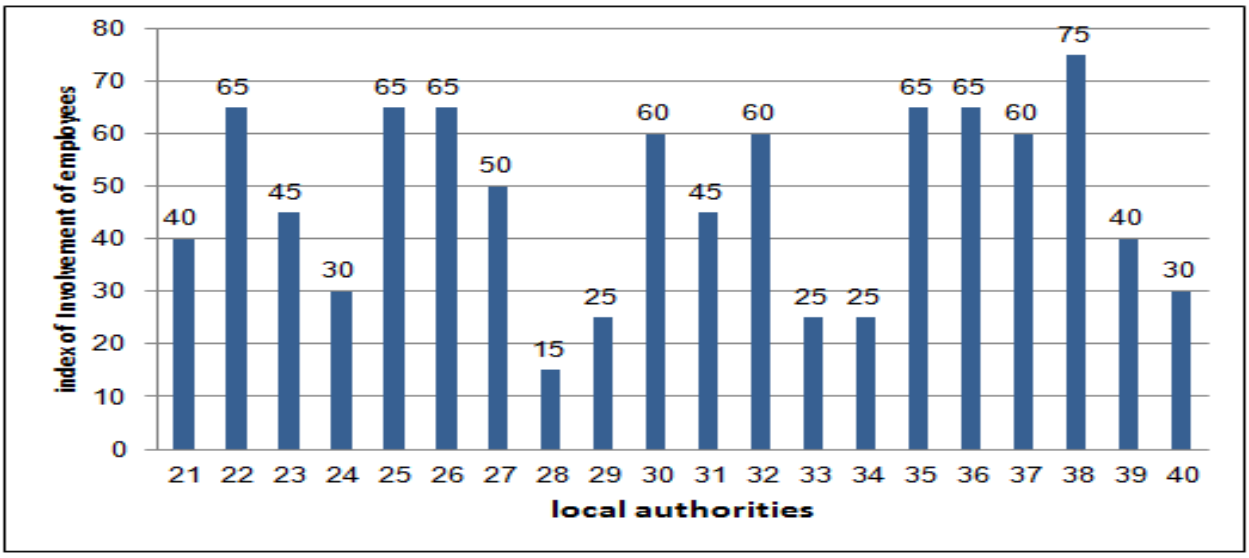


Fig 3.7. The factor of "*Involvement Employees*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

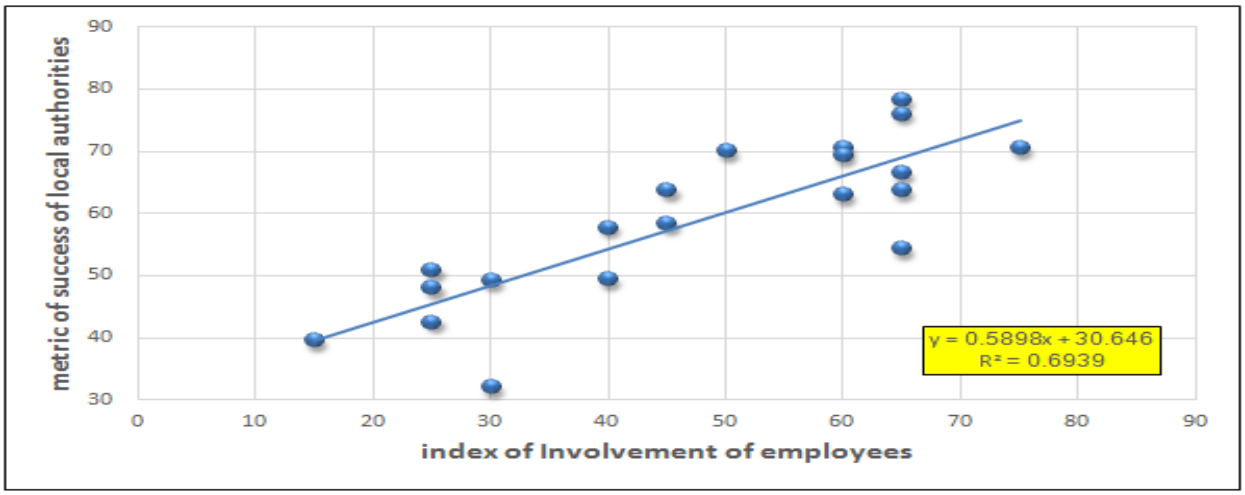


Fig 3.8. Correlation between the factor "*Index of Involvement of Employees*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.693 is received, between extent of employee involvement and between rate of success, meaning, According to Robert Alan Hill [69, p. 48] the extent of employee involvement highly affects the rate of success. As said by D. Carlos, The author must listen to the employees [58, p. 53].

Examination of the factor of "*Impact of Quality Manager*" in Local Authorities:

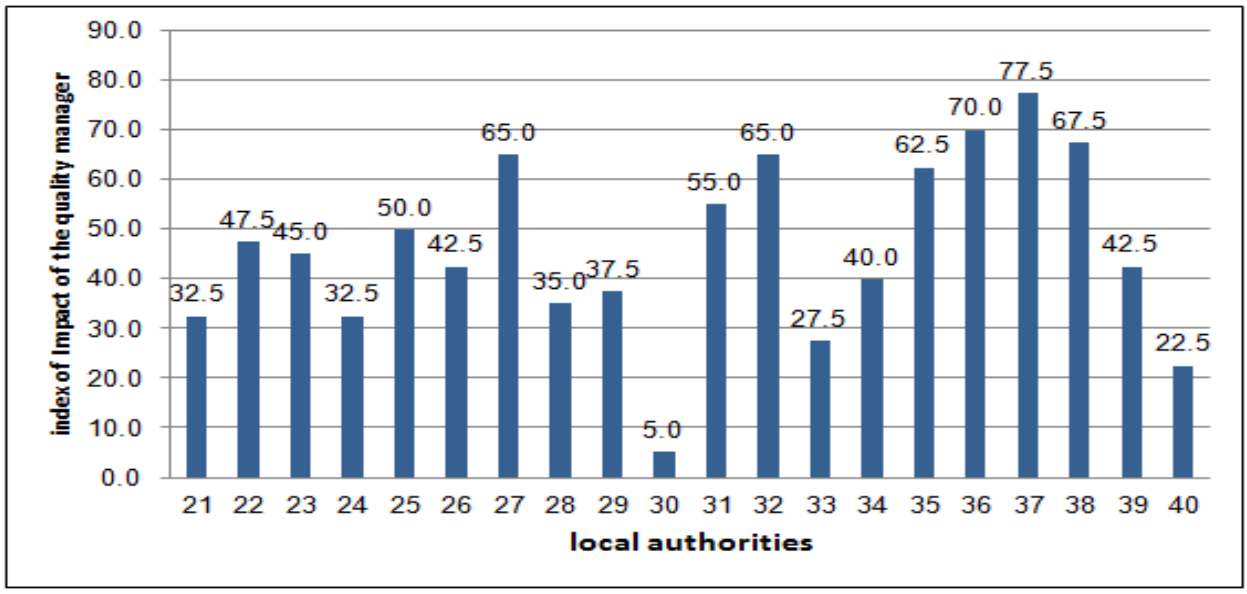


Fig. 3.9. The factor of "*Impact of Quality Manager*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

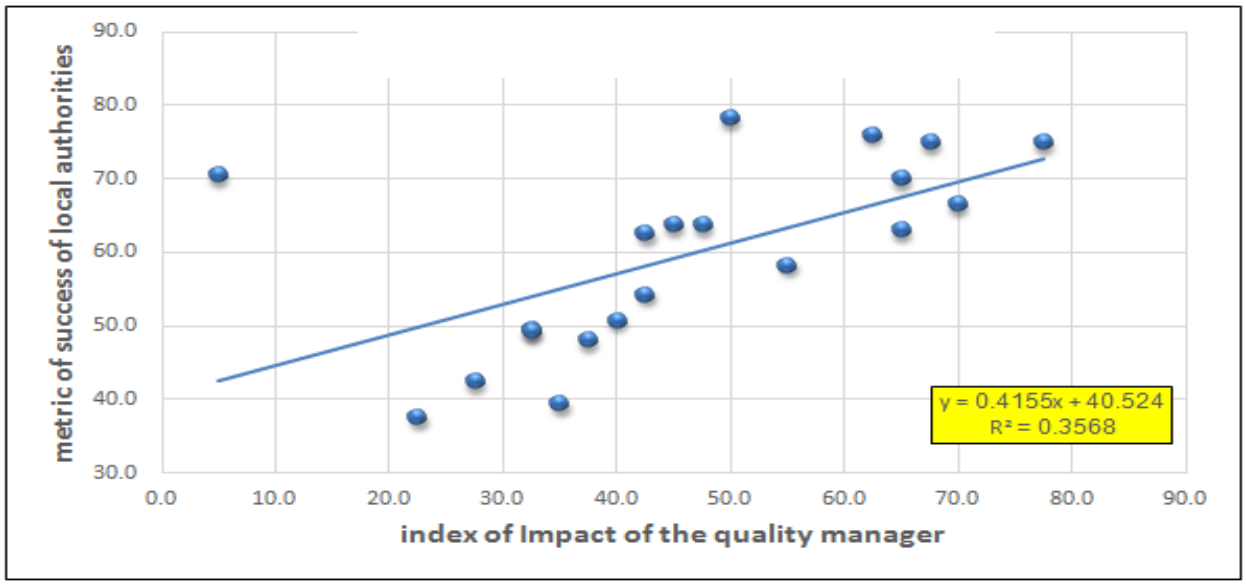


Fig. 3.10. Correlation between the factor "*Index of Impact the Quality Manager*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.356 is received, between extent of involvement of quality manager and between rate of success, meaning, the rate of involvement of quality manager highly affects the rate of success.

Examination of the factor of "*Deadline or Time Table*" in Local Authorities:

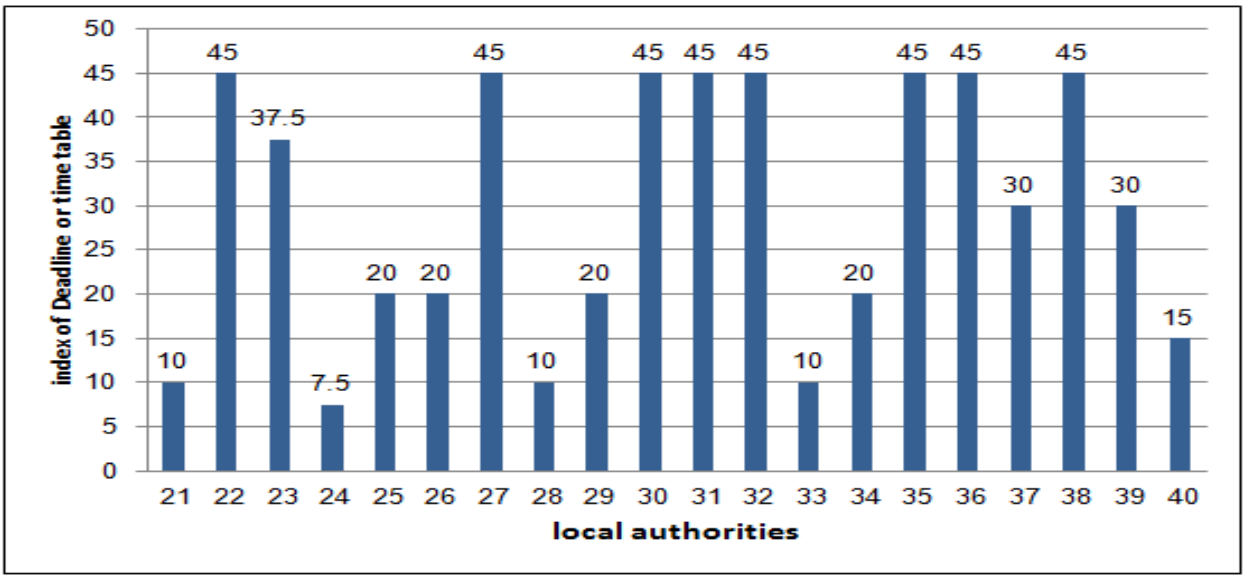


Fig. 3.11. The factor of "*Deadline or Time Table*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

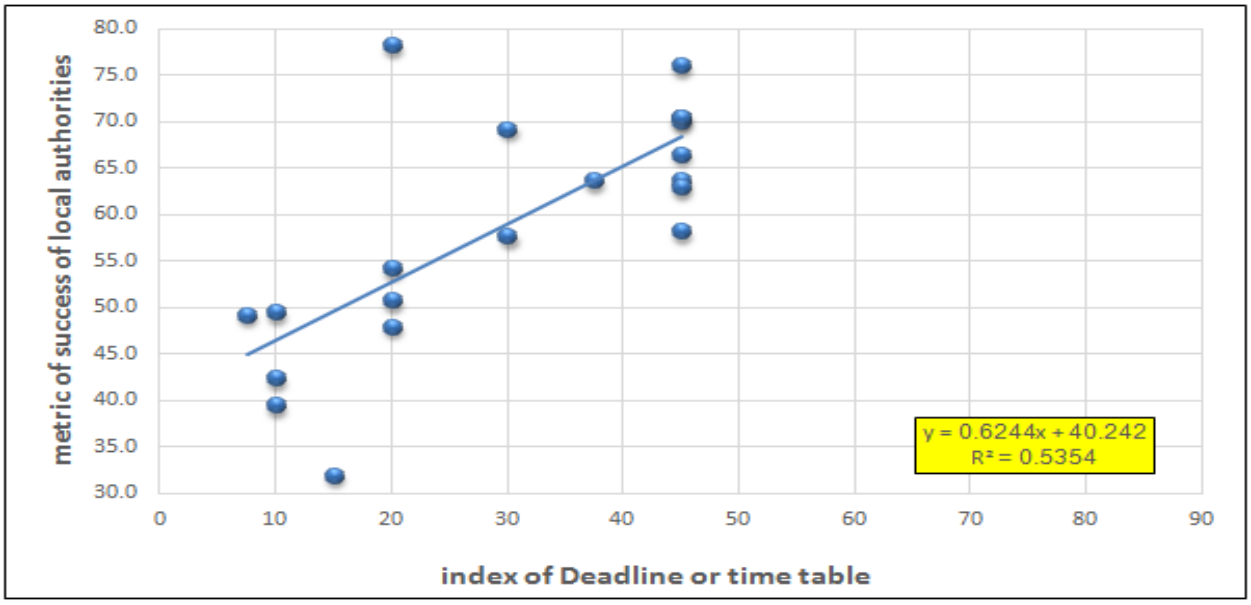


Fig. 3.12. Correlation between the factor "*Index of Deadline or Time Table*" on the effect of the rate of success on the Management of Construction of Local Authority

Source: Author's research specialized for the thesis

A level of correlation of R^2=0.535 is received, between extent of involvement of employees and between rate of success, meaning, the extent of involvement of employees affects in a mediocre fashion the rate of success.

Examination of the factor of "multiple-participant meetings and instructions" in Local Authorities:

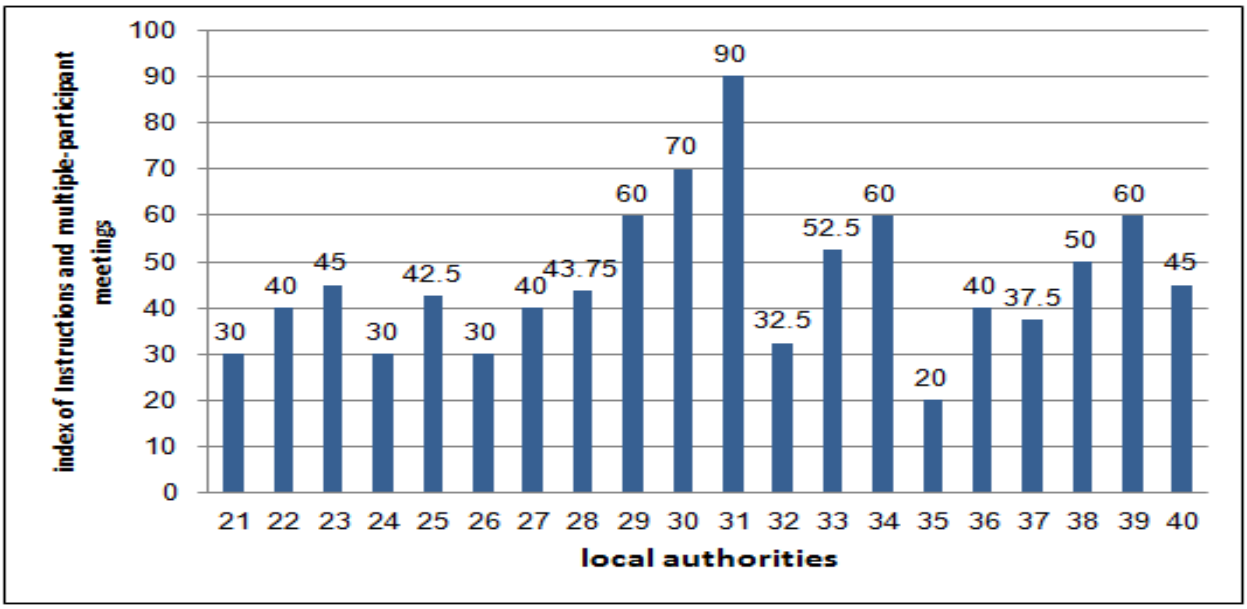


Fig. 3.13. The factor of "*Multiple-participant Meetings and Instructions*" to rate of success in Local Authorities

Source: Author's research specialized for the thesis

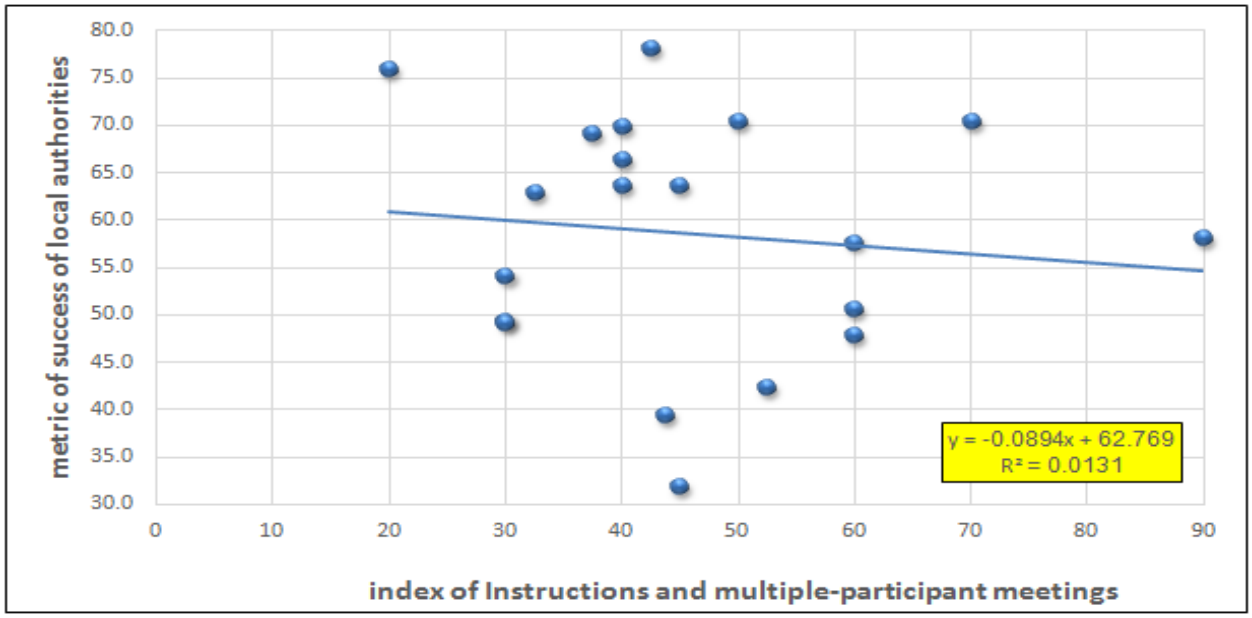


Fig. 3.14. Correlation between rate of success and the level of "*Multiple-participant Meetings and Instructions*" index

Source: Author's research specialized for the thesis

As can be seen, the correlation between the rate of success in managing engineering projects, and between the index of "multiple-participant meetings and instructions" is negative. This means that multiple-participant meetings and instructions have no correlation to the success of engineering projects management in Local Authorities. And if such correlation exists, it is

negative. In a more profound clarification of the phenomenon, it turns out that employees can learn how to work according to quality guides, without multiple-participant meetings and instructions. On the other hand, R^2 is very low which shows that there is a difference between the line of linear regression and between the results of questionnaires.

3.3. The Model of Public Organizations of Constructions (E.M.C.)

The author made a guide for the field of management for dozens of years in the Local Authority, having had over 26 years in the business. The author wrote this guide for employees of the Local Authorities, with appendices along with it. The guide system has instructions and forms, which are included in this guide of approximately one hundred and twenty pages. The book compiles instructionals and suggestions as a way of work in this field. The author took not just his personal experience, but during these years always asked other engineers and managers for their opinions and feedback for quality in the Local Authorities. This maximizes success and reduces the room for error in the Local Municipality, bringing managers and employees to a healthy state of cooperation of workflow. This project has been ongoing for years and ever improving.

The guide itself has all stages of construction projects, starting from the idea, the stages of planning, until the tender bidding, all the way until who won the project. Included in this is the forms and guidelines needed for project contracts, including ongoing project changes. Each stage has instructions and respective forms which are clear and in order from start to finish. This guide even has informational and instructional pages which explain how to deal with his employees and as far as how to save and maintain blue books, contracts and paperwork. The guide is clear and organized to reduce room for error to the utmost degree.

The guide is not only useful for making daily tasks and large projects easier and flow more fluidly, it also helps save time, money and energy, and as such increases the quality of the engineer. Without the guide, there is much room for error as there exists no organizational method for clear instruction as to how to manage the work in the Local Authority. If every Local Authority were to use this guide, it would make tasks and projects much easier. Saving money is in all the stages of the job. For example, when the author was chosen to build two kindergarten classes. Due to the fact that the author used his own guide, he included the leader teacher of the kindergarten class with every step and because he did, he saved himself and his client money and time. Instead of continuing with the project without consulting with his client, he was able to show the teacher everything as it was being constructed and they realized that she wanted the

sink to be outside of the classroom, and not inside in the planning stages. If they had started with the plumbing without consulting with the teacher this would have wasted much money and frustration from both parties. Engineers have clear instructions as to how to deal with the projects as expressed step by step, up to the level of having any forms necessary for work details and ready to be used. This eliminates wasted energy and having to redo tasks which could have been neglected due to negligence, saving money. This clear guide allows projects to be conducted from start to finish in a concise professional manner.

In terms of saving money, the following example is a common and costly issue that Local Authorities face, especially by not using the Guide Quality Management. Based on the Questionnaire, the author illustrated that the time it takes for an employee to locate files and documents for a specific project it take 3 minutes for someone with Guide Quality Management; however for someone unfamiliar with where everything is placed, it could take much longer, up to 10 minutes without the Guide Quality Management. This is a loss of 7 minutes for every time an employee needs to find a file without Guide Quality Management. In one day, typically an employee looks for about 10-16 files, around 13 times. The time lost is 7x13= 91 minutes, an hour and a half. Hourly wages for this employee are 8 € and the money wasted daily is 8x1.5= 12 € per day, and per month 264 €.

Based on the Questionnaire, the project manager conveys that he needs 5 minutes to write a form in the Guide Quality Management, and 12 minutes for someone without the Guide Quality Management, thus losing 7 minutes without the Guide Quality Management. In one day, the average is 10 forms per day. 7x10=70 minutes, 1.2 hours, whose hourly salary is 15 €, resulting 1.2x 15=18 €, monthly 396 €.

Medium size Local Authority usually has 3 employees and 4 project managers, with a monthly total loss of, 264x3=792 € and 396x4=1,584 €, combining a total loss of 2,376 € monthly, and yearly 2,376x12= 28,512 €.

The author's opinion in chapter 3 is clear regarding the research conducted. The correlation between factors and the Guide Quality Management implementation success yielded from three factors. Firstly, involvement of employees, secondly, motives for implementations, thirdly, impact of the deadlines or time tables, and last but not least, the Impact of the quality manager consultant. The involvement of employees was a direct factor to the rate of success in local authorities. The level of correlation received was R^2 =0.693, a very high score in comparison to the other factors tested for the implementation of success. The second factor which is the motives for implementations, strongly affected the success, which received a score of R^2 =0.536. The

third strongest factor of deadlines or time tables was R^2 =0.535. The fourth strongest factor which also had a remarkable effect on the success rates is the Impact of the quality manager consultant, which received a score of R^2 =0.356. The R alone, non-squared, will have a negative effect. The more combinations the author has and improvisations, the more positive an effect there will be.

The other three factors had very little effect or even no effect on the Local Authority due to the fact that the scores were extremely low.

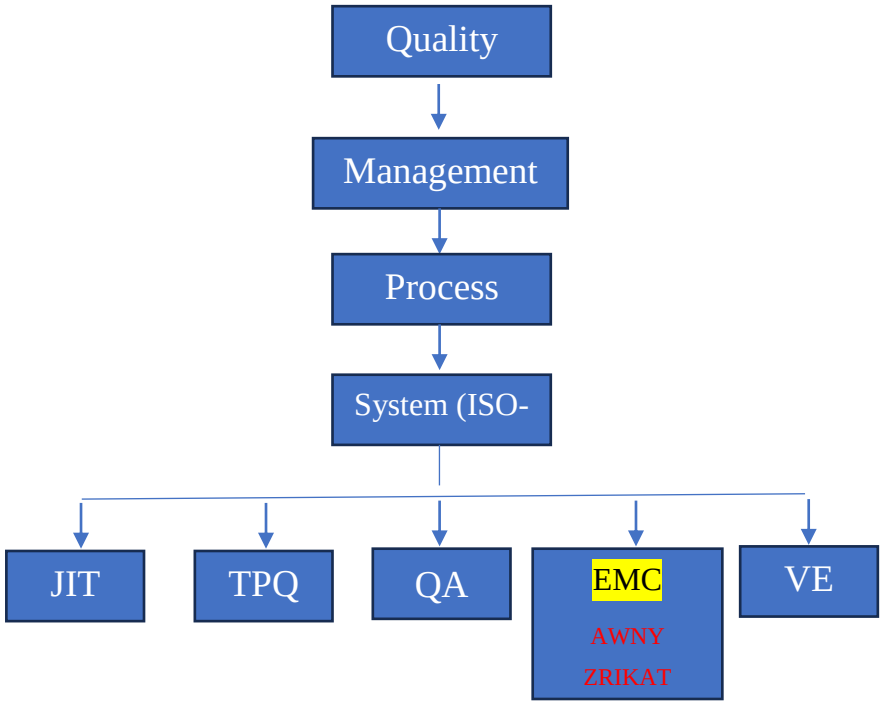


Fig. 3.15. The development from quality to chart includes the author model's **location**

Source: Author's research specialized for the thesis.

As analyzed in this chapter, all levels of correlation between the rest of assumed factors and between the rate of success were examined. The summary of this analysis is presented in table 3.3. From this analysis, it is revealed that the factors most affecting the rate of success are: involvement of top management, motive for implementation, involvement of employees, involvement of quality manager, deadline or timetable. In addition, there is almost no effect of an attempt to work with a quality system and multiple-participant meetings and instructions upon the rate of success of a quality system. Surprisingly, it turns out that experience with a quality system does not affect the rate of success [119, p. 469], maybe due to the fact that the index of success relates mainly to change and improvement, and apparently, this takes place mainly in the immediate period after implementation. Additionally, the effect of multiple-participant meetings

and instructions is not significant. The existence or absence of time tables and time targets has no decisive effect upon the success of implementation.

Table 3.3. Correlation between factors and Guide Quality Management implementation success

Number	The factor	R^2
1	Involvement and commitment of management	0.303
2	Experience with quality	0.001
3	Motives for implementations	0.536
4	Involvement of employees	0.693
5	Impact of the quality manager consultant	0.356
6	Deadline or timetable	0.535
7	Instructions and multiple-participant meetings	0.0219

Source: Author's research specialized for the thesis

The chart above shows the relationship between the factor and its success level within the Guide Quality Management. Experience with quality having the lowest score, and involvement of employees having the highest score.

Assumed factors of success that were revealed to be less affecting, according to the findings' analysis are:

- Experience with a quality system
- Multiple-participant meetings and instructions

The effect of involvement of the index of experience with a quality system does not bring about success of implementation. And it was examined again as part of the convention, such as involvement and commitment of management has much impact and is much more decisive upon the rate of success [119, p. 469]. Experience with a quality system as well does not constitute a key factor for success, apparently due to the fact that the rate of success for the purpose of this data analysis represents the extent of change following implementation and prior experience in fact entails less change.

Introduction: Thus far. The authors have tested the factors of success as well as measured the correlation between the rate of success and the factor levels. Based upon the tests and research, the author found new information that will benefit the continued analysis for this subject. The highest level of success found is the involvement of employees. Following this level of success is the factor for motives, whereas the lowest factor is the experience. This was a major

outcome because contrary to belief, experience has the lowest effect on the rate of success. Moving forward, the author will begin to test by combining various factors with each other, and find the correlations.

Primary Factors of Success

The next stage in this statistical analysis is grouping of several factors of success and examination of the level of correlation between the sum total of all these factors and rate of success. The way of performing this stage started with the adding of factors with high levels of correlation and then a gradual adding of factors with lower levels of correlation [122, p. 11], [88, p. 49-50] until the finding of the highest level of cumulative correlation. In this examination it appears that the primary factors of success are:

- Involvement and commitment of top management
- Involvement and commitment of employees
- Motives for implementation
- Quality manager
- Deadline or planning of time table

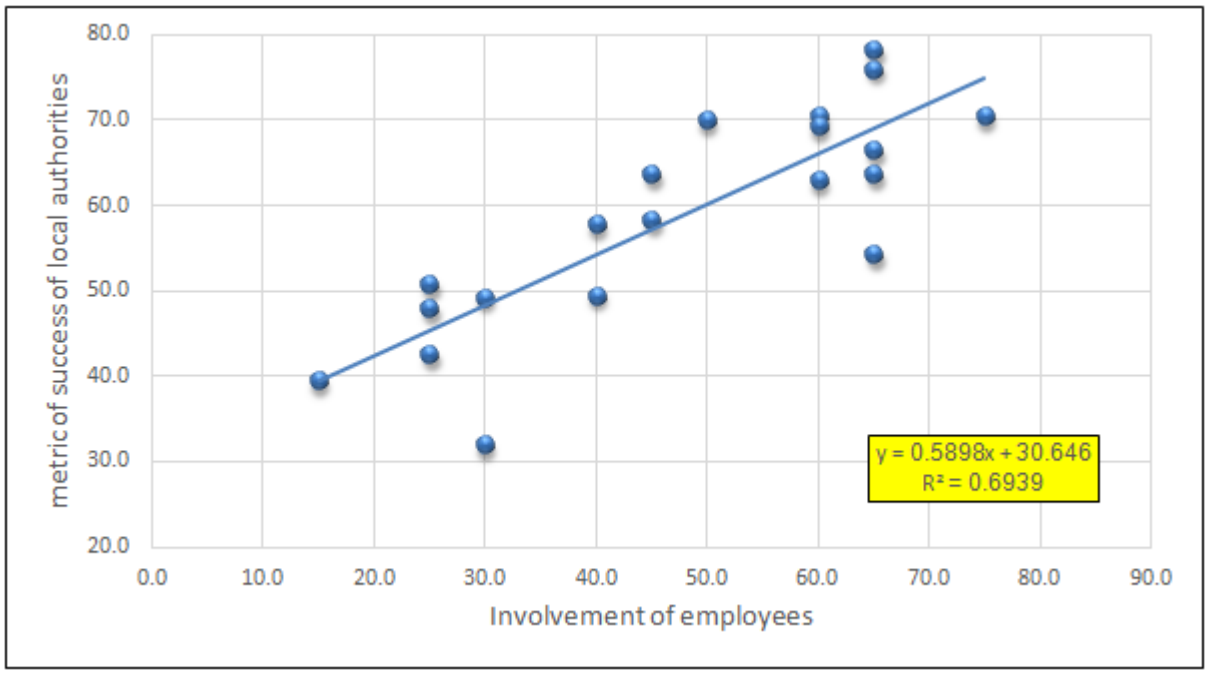


Fig. 3.16. The factor of Involvement of Employees

Source: Author's research specialized for the thesis

The initial figure of the factor of involvement of employees as received in the beginning with level of correlation, yielded a rate of success as 0.693, as seen in Part 2. The involvement of the employees is vital for the business. Involving the employees sets the groundwork for any successful establishment. D. Carlos said that the author must listen to the employees [58, p. 53].

This is in addition so significant, because without the involvement of the employees, the base of the business will not succeed. The involvement of the employees is not just a one time occurrence, or furthermore, not an experience that employees should only enjoy in the beginning. Involvement of the employees should be continuous and habitual throughout.

When the factor of motives for involvement of employees is added, the following figure is received:

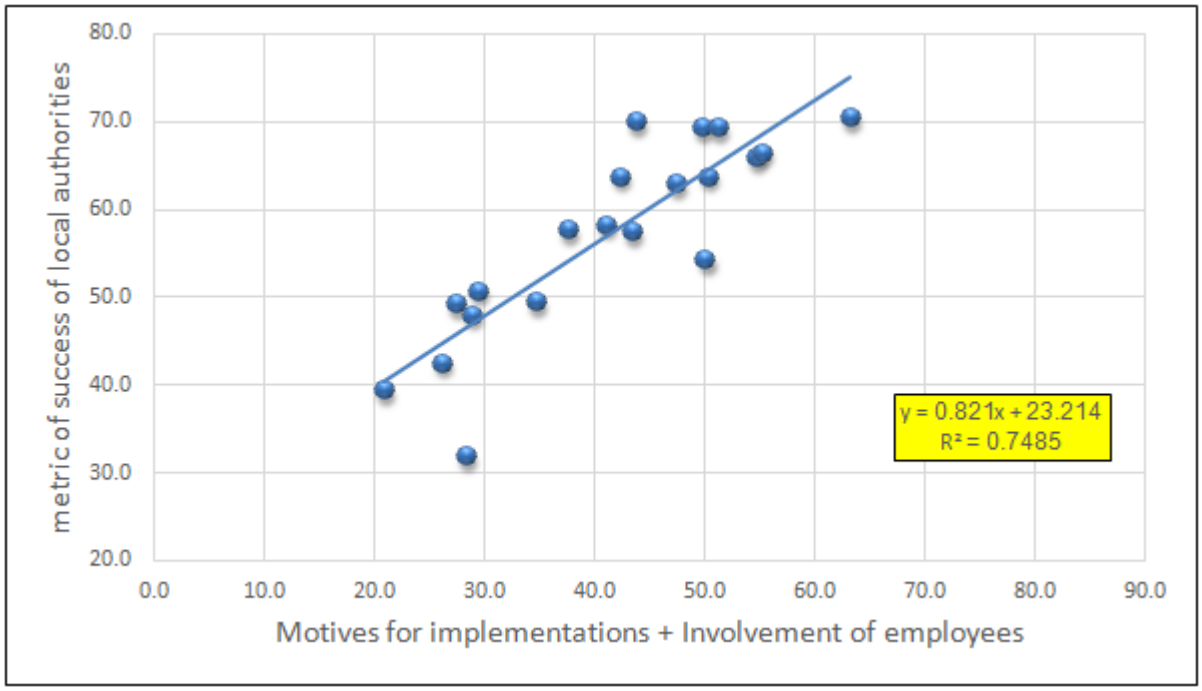


Fig. 3.17. Adding of factor of Motives to Involvement of Employees

Source: Author's research specialized for the thesis

The correlation has risen to 0.748. When one has the factor of motives with the involvement of employees, the author has an increase from Figure 3.16. From Figure 3.17, The author has an increase of the correlation from 0.693 to 0.748. This shows that adding the factor of motives to involvement of employees will increase the rate of success. Once an employee has a personal connection with the given task or challenge, the outcome will be more fruitful for all because this employee will be part of the situation wholeheartedly. This rate is high in comparison to other tests and so once you have these two factors in unison, there will be an increase in the rate of success.

When the factor of quality manager is removed and replaced with the factor of deadline and timetable, the following figure is received:

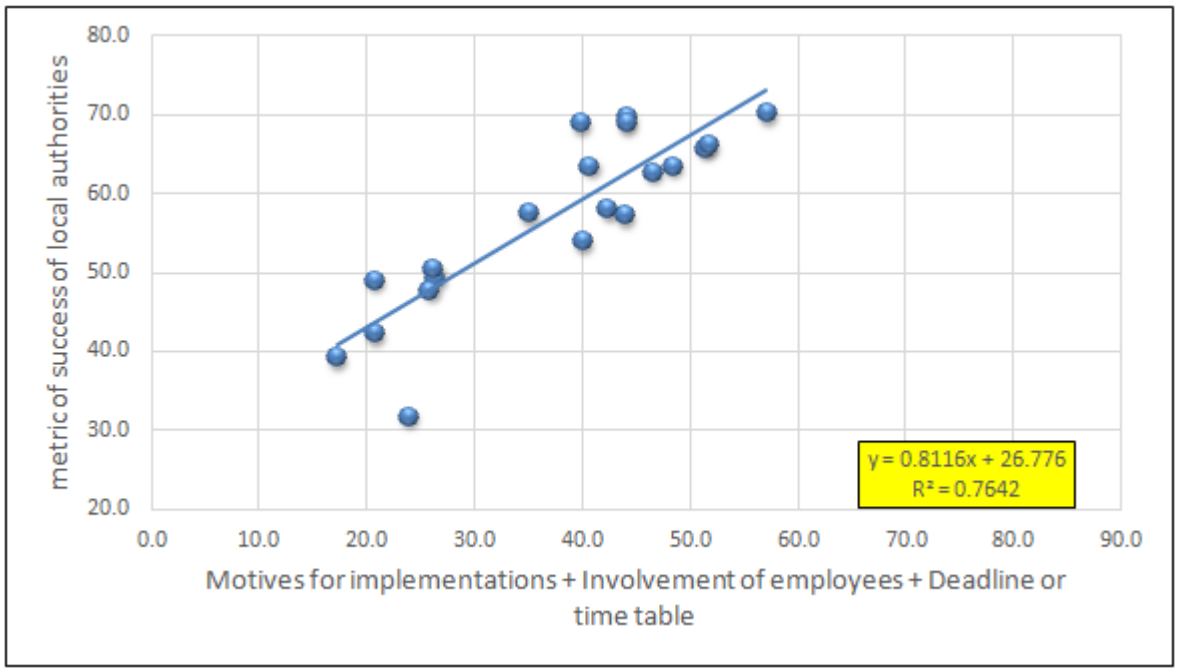


Fig. 3.18. Deducting the factor of Quality Manager and adding the factor of Deadline to the factors of Involvement of Employees and Motives

Source: Author's research specialized for the thesis

The graph shown depicts a drop in the success outcome. The involvement of employees combined with the motives and deadline has decreased the outcome in comparison with the previous figure 3.18. The figure shows the level of correlation has dropped to 0.764. This shows that when the author adds deadlines and timetables as a factor to the involvement of employees and motives, this will drastically drop the rate of success as a whole. The employee will feel pressured when given a timetable or deadline, whereas before a timetable or deadline was given, the employee felt free of limitation.

When the factor of quality manager is added to the two factors of involvement of employees and motives, the following figure is received:

Fig. 3.19. Adding of factor of Quality Manager Consultants to the two factors of Involvement of Employees and Motives

Source: Author's research specialized for the thesis

The involvement of employees and adding the factor of motives are both personal objectives for the employee. Now, once the author adds an outside person such as the quality manager, the author is given a higher rate of success. This shows us that the quality manager appears as the figure of trust for the employees. The quality manager is a professional individual who appears as a temporary figure; therefore, the employees want to benefit from the upper management's advice and system. For the employees, the quality manager is a motivational figure. The employee understands that the quality manager's time with them is not long lasting, therefore the employee wants to benefit as much as possible in correlation with the involvement of employees and their motives.

Level of correlation has risen to 0.828, which is the best level of correlation accepted.

The author shall attempt to examine the condition when the four factors are added with highest level of correlation. The result can be seen in the following figure:

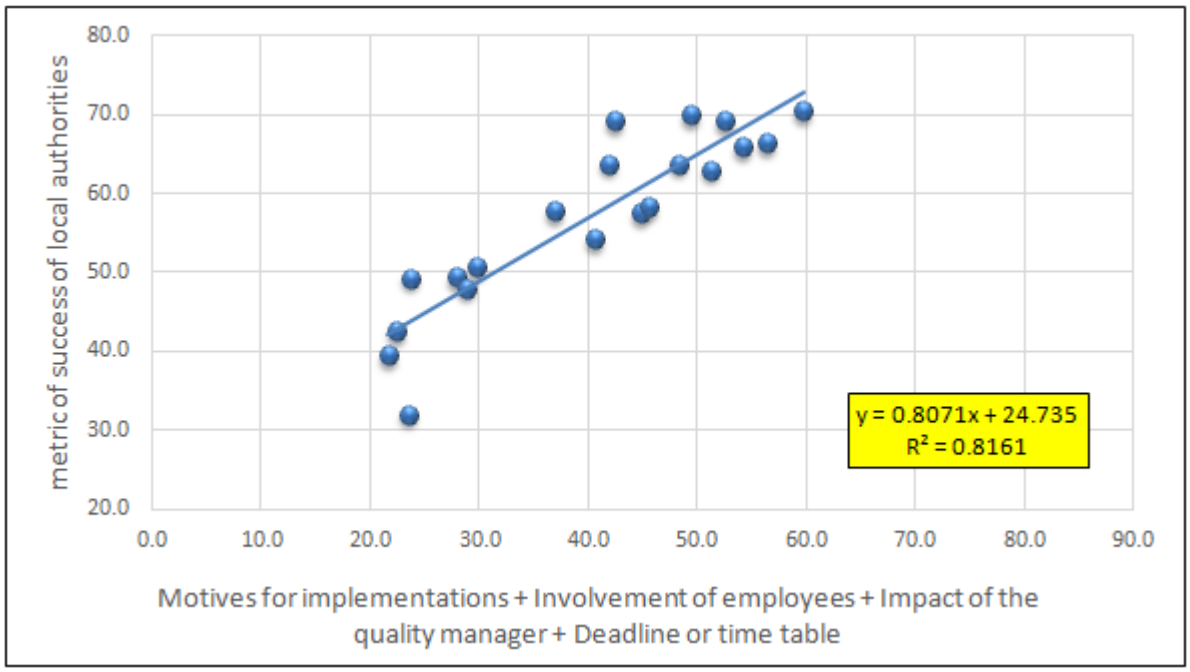


Fig. 3.20. The two factors of Quality Manager and Deadline were added to the factors of Involvement of Employees and Motives

Source: Author's research specialized for the thesis

The involvement of employees, motives, quality manager and deadlines yielded a decrease in the rate of success. The graph above conveys that the given factors joined will yield a drop to 0.816. When the author had this addition of limitations as the author experienced as in the present Figure 3.20, the author saw that the rate of success decreases, making Figure 3.19. the best solution. Thus, the highest level of correlation is made up of factors which are the combination of employees, motives and quality manager, and thus the level of correlation of 0.828 is received, which is Figure 3.19. and has the highest rate. The reason for this is that the employees feel restricted to boundaries and points where perhaps projects or jobs must be completed, and consequences may occur thereafter if not completed. The employee will feel pressured or controlled which will lower the success rate as a whole. In conclusion, the three factors which are employees, motives for implementation and quality manager consultants gave us the preferred outcome which is E.M.C.

Summary: In a cumulative examination, it is understood that the level of correlation between these factors and the rate of success is $R^2 = 0.828$. The result of this correlation can be seen in Figure 3.19. There are two exceptional cases in which the author will experience now. Firstly, the author has one Local Authority in which the rate of success is very high in relation to the level of investment in different factors. The other case is one in which the author have another Local Authority which has only two projects in total. According to the quality manager,

the implementation succeeded, but it referred the experience to the authority engineer who rejected the ISO-9001:2015 completely. Therefore, in this particular project the implementation was not successful. As can be seen, the combination of correlations of involvement of employees, motives and quality manager supply the maximal efficiency in success of engineering projects [120, p. 53].

Implementation of the Study in Several Local Authorities

After completion of the study, copies of a 150 pages quality guide, which has been elaborated according to the study and which includes models and other essential information for managing construction projects at local authorities, were sent to 40 Local Authority engineers in order to implement. In addition, engineers addressed were asked to give their own feedback on how this guide may or have helped them. Many engineers have reviewed the guide and gave their own feedback. Two councils have already started implementing it and use it on a daily basis. From the responses received, it can be seen that the factors of employee involvement, internal motives and quality manager are indeed the most affecting factors for the success of managing engineering projects in Local Authorities.

Conclusion for 3.3. The Model of Public Organizations of Constructions (E.M.C.)

This is my model which was created and studied upon by several local authorities. Previous to my research, there were a lot of costs wasted on wrong planning, poor supervision and management. Time and money were wasted ineffectively. Projects were not finished on time and they were lacking quality in terms of material and labor. The novelty in my findings within the local authorities will save spending's, time and give us the quality in the management of construction and engineering. I am very proud of my research because it has made a huge impact on the local authorities as compared to how things were previously.

It was created in order to create a solution for the chaos and was unorganized by the local authorities. The model E.M.C., creates a coordination among all the moving factors, inside and outside of the physical workplace and the companies involved in the engineering field; this gives the outcome that the project management field is within the local authorities when we implicate the E.M.C. within the local authorities. *Firstly*, the model cares foremost about the employees and gives the employees an ease and comfort when they are given responsibility in order to have a positive outcome because they took part in writing the guides. Due to the fact that they were part of creating a solution for the outcome, it gives all of the employees a motivation in order to give all of their efforts in order to work. *Secondly*, it is very important in order for us to work towards having a high motivation rate for our employees. This includes giving employees their

rights, paying their salaries and giving them bonuses when they do substantial work in a consistent manner. Employees are human and want to feel that they are successful and cared for by being shown appreciation. These factors combined help give employees a huge reason to be motivated. If the employees are not shown care or bonuses from upper management or those who reside over them, then their motivation levels will be deflated and thus, result in negative outcomes within and outside of the workplace. The *third* factor is the quality manager consultants who have a substantial role in writing and delegating the guide in the local authorities. If the quality manager consultant, the benefits will be decreased as opposed to a very experienced and professional consultant.

E.M.C. was created in order to create solutions for public organizations. Most of the other models studied were created with most private sectors in mind, with certain materials in mind. The E.M.C. oversees the general project with management consultants with employees in mind which create a positive overall environment where projects get done efficiently, cost and time effectively.

MANAGEMENT CONSULTANT- According to my research it highlighted that EMC needs an experienced management consultant who is able to prepare and forms models and laws to be used by employees, plus using the programmed part that helps who related to construction projects and having access to the program ,and it ought to be with screen program and organized rules to manufacture the laws, so it needs an experience and firms yet sharing and socialized management consultant that can guide the facility not only on the talk part yet on the do part.

EMPLOYEES- The sharing consultant according ought to my research is the most success relation with the employees and the facilities and it has to be continuous relation, added new subjects and ideas, increase the value of the employees, and the success of this factor is the vitality and vitality of the ideas and fresh minds not just being oldest in the field which that could encourage the fresh bloods and considered as value notes.

MOTIVES- Is essential for construction management, it has to be an internal motive that comes with trust in the leads throughout the projects and that would make it more successful with the public organizations. Motives come in several forms, first of all, after every project reward the employees with upgrading the status of which, reward that employ materialistic part such as in money part or/and the emotional part such as congratulate them in front of all employees and stand ovation.

In the future, each local authority should improve their guide quality manager and this person should be reviewed and checked if they are living up to expectations or be replaced. The

employees should be given bonuses and appreciated if they work consistently and properly. The bonuses should be monthly in order to keep motivation. From within the local authority, we need to be active in writing the guide and constantly keep modifying it for the better.

The E.M.C. model- since 2016 the engineers have been gathering data and samples that approved by the country and industrial ministry, the model contains 110 form and sample of instructions that ready to apply ,those models indicates to manage the engineering projects from planning to implication and tender all the way to planning to the contractor and apply it to the done deal projects, also it follows the procedures, therefore the models are several files while all these steps are on papers the real purpose is to transform it to a more application to computer program with saves us more time and it allow to share it to others to use and being helpful, the model program is formed in google sheets, and several employees can use in the same time and all of this is to done projects in a perfect form and time also to supervise it after.

1. The first part is about making sure that the higher ups approve the projects and models are following the global standards, therefore that model is made by the employees and the consultant of the quantity formed the laws and rules in EMC guides while all employees are excited and how the project is challenging them thus, include them.
2. The second part is the building's design that includes the tenders and contracts of the projects such as schools, playgrounds, clubs and so on.
3. The third part is taken to supervise the engineering projects.
4. The fourth part is about infrastructure such as water pipelines, streets and rainwater sewers.
5. The fifth part is about the project manager and the procedure of the file’s project details and so on.
6. The sixth part is about the structural planning that includes the files, tenders and contracts.
7. The seventh part is about general contracts that take the planning and samples of meetings and samples of the way to choose the project manager.
8. The eight part is about contracts with the main contractor.
9. Ninth part is about the general samples.

In Addition to all model’s forms there are instructions to guide to the steps and how to apply it throughout the process.

Table 3.4. Comparison between ISO-9000:2015 and E.M.C.

	ISO-9000:2015	EMC
date \ year	1985-2015	2022
Purpose	General service jobs	Public construction municipalities
The models purpose	General manage in institutions to gain the required value	Construction projects management in local authorities
Consultant	General consultant that obey general laws	A specialized consultant
Referenced	Every country has its own laws and has to obey them.	Israel laws
Benefits	Its own purpose is finding the required quality no matter the time nor the cost.	reduce time and cost and increase of the value and the quality of the projects

Source: Developed by the author based on his own research

THE ADDED BENEFITS AND EFFECTIVENESS

In regards to the *national economy*, the investment for this development needs work, time and money; however, in the long run, this will save a lot of public money in the local municipality. Not only does this save money, it will also save a lot of time, energy and errors.

The overall benefit will be great and exponential, especially for the *local authorities*. Due to the fact that the workforce is ever changing; every new employee needs to be taught and trained. With a standard guideline, the new employee will become educated by instruction on how to work. With a strong basic foundation, the growth for improvement will be imminent and solid.

3.4. Conclusion of Chapter 3

1. **Employee Involvement:** Several Local Authority engineers addressed the inclusion of employees in each new procedure, holding a constructive discourse and then writing down an orderly procedure for use. And thus, they succeed in managing the engineering projects. "*Every inclusion of employees in every procedure brings about a good result*", so they say [50, p. 73].

A local Authority engineer from Northern Israel says that the involvement of employees brings about success of over 50% in managing engineering projects as they are those who manage the

engineering projects and they are those who need to implement the procedures. Occasionally errors in procedures are revealed, but these are corrected instantly [77, p. 14].

Another member of a small Local Authority in the Galilee shares us as well in his method of employee involvement in writing of engineering procedures. He manages the project management system in a computer, to which any employee of the Authority can log in and correct things. However, the correction needs to be shared by all, which means that first he makes a certain remark, and then he shares it with the Authority engineer who in turn consults additional employees in the Authority and they decide on an agreed-upon wording. And that employee who has proposed the correction, updates the procedures according to what was agreed.

2. Internal Motives: The subject of internal motives has also received much attention from the City engineers whom the study was sent to, although internal motives complements employee involvement on one hand, it brings about immediate results and current activity on the other hand. One of the Authority engineers in the Nazareth region, explains that one of his employees is considered to be the right hand of Authority Mayor, and he assigns him the difficult jobs. "*There will always be a positive result*," he explains. Another engineer in a medium-size Local Authority explains that upon assuming of position of a new Authority Mayor, he brought along with him a new engineer (project expeditor), that engineer was able occasionally to wrap things up better than the Authority engineer himself, he would close contracts, approve bills and bring about much benefit to expediting of engineering projects. Manager of a construction division in a large municipality (about 100,000 residents), explains that the subject of internal motive is a very important one and he uses it constantly. There are 15 project expeditors in his team and when he asks one of them to expedite a certain task he employs internal motive. For example, wage increase, or extra hours or another internal motive, and thus he achieves the purpose faster than what was expected [77, p. 26-28].

3. Quality Management Consultant: The factor of quality manager also constitutes a factor of success in managing engineering projects. The more professional a project manager, the more effective are the results of engineering projects.

In a medium-size municipality, the quality manager is constantly pointed out and they learn from him continuously, he is constantly pulled from one task to another. "*The secret of success of a quality guide lies in him*", they say. The quality manager brings about benefit and industrial peace to all the Authority. He accepts explanations and constraints, he analyzes them and writes down what is good for the system in order to operate properly.

In another small Authority, it was stated that the quality manager does not handle all matters of procedures, he neglects what has been asked to improve and thus the quality guide does not reflect what they want. And it is neglected due to this reason.

In summary of implementation

Indeed, in all Local Authorities that responded to the study, it is indicated that these are indeed the factors that bring about the best results in all matters of managing quality in management of engineering projects in Local Authorities.

Employee Involvement & Motive & Quality Management Consultant,. E. M. C

GENERAL CONCLUSIONS AND RECOMMENDATIONS

General Conclusions:

1. The research conducted regarding the *management of construction and engineering of the local authorities in Israel* has positive results which are presented as suggestions for future research. Their impact on science development in the results showed that the research generally improved. Based on the *guidelines of quality*, the author has found that this can improve the quality of the work management.

In regards to the *national economy*, the investment for this development needs work, time and money; However, in the long run, this will save a lot of public money in the local municipality. Not only does this save money, it will also save a lot of time, energy and errors.

The overall benefit will be great and exponential, especially for the *local authorities*. Due to the fact that the workforce is ever changing; every new employee needs to be taught and trained. With a standard guideline, the new employee will become educated by instruction on how to work. With a strong basic foundation, the growth for improvement will be imminent and solid.

2. Based on the present research, when implementing the "*Quality Guide In Local Municipalities in Israel"* it is important to focus on and take in consideration three main factors as following:

- Employee involvement.
- Employee Motive.
- Quality management consultant.

3. *Engineering Project Management in Local Authorities*. In regards to the original contributions of the research, *the engineering project management process in all local authorities* is usually the same. Some of the authorities (small local authorities) are characterized with a process called "outsourcing", i.e. transferring the engineering project management process to an external body which manages (to some extent) the engineering projects instead of the Local Authority.

4. *Costs Involved in Implementation of a Quality Guide. Quality costs in Local Authorities* is a complex subject that deserves a separate study. In the current study, various data were collected that can explain what are the different components of maintaining a quality system based on ISO-9000 series. It would be difficult to quantify exactly the total costs of maintenance of a quality system as it changes from one Authorities to another, as well as due to lack of data; however, orders of magnitude can be assigned as well as estimations regarding this part. The

disadvantages for the short-term include a lot of money upfront. However, the long-term process is where the advantages occur, when the Local Authority is saving money and seeing positive results.

1. Initial costs for implementation of ISO-9001:2015 (minimal estimation) – 72,420€.
2. Monthly costs for implementation of ISO-9001:2015 (minimal estimation) – 4,706€.

5. *Multiple-participant Meetings and Instructions* and the extent of which initial objectives have been met, as can be seen, the correlation between rate of success in managing of engineering projects and between index of "Multiple-participant Meetings and Instruction" is negative. Meaning, that multiple-participant meetings and instructions have no correlation with success of engineering projects in Local Authorities, and if there is any relation at all, it is negative.

In profound clarification of the phenomenon, it appears that employees can learn how to work according to quality guides, with no instructions and no multiple-participant meetings. On the other hand, R square is very low which shows that there is a difference between the line of a linear regression and between results of questionnaires. The results of the examination indicate a high rate of correlation of employee involvement and of motives and a low level of correlation of experience and instructions and meetings.

6. In section 3, the direction in which research has to be pursued, a statistical analysis was made, in which a number of *factors of success* were gathered for getting the most effective cumulative level of correlation.

After completion of this process, it appears that the adding of *factors of employee involvement, internal motives of employees and quality manager*, supply the highest level of correlation R=0.828.

The respective Conclusions represent answers to the formulated objectives that were achieved as a result of the research.

Regarding the research hypothesis: The research hypothesis was largely confirmed, especially the factors: employee involvement, internal motivation, the guidance of a quality management consultant has the greatest weight in achieving the results of construction projects within local authorities. While, the factors: experience with quality, deadline or calendar, management involvement and commitment - have a less significant impact on success. At the same time, the factors - instructions and meetings with several participants have a negative effect.

Recommendations and Scientific Novelty:

1. In the current study, the various factors that bring about success to engineering projects were examined and analyzed, by operating a quality instructor in an engineering department. And thus, it is the opinion of the researcher that it is warranted to examine the rate of success of engineering projects when a quality instructor is operated in the entire Local Authority, and what then would be the outcome.
2. Adoption and implementation of a quality guide proposed by the researcher would get all Local Authorities to a common ground. It would enhance cooperation. Thus, the researcher appeals to the Ministry of Interior and the Local Government Center, in implementing a quality guide and obligating Local Authorities to act according to it.

   The Author suggests and recommends the Ministry of Interior and Local Government Center to form a kind of reward to the local authorities that applied for such outstanding models and forms of EMC.
3. In present study, the option of preparing a computer software that would manage and operate engineering projects according to the quality guide has not been examined, as operating such a system would necessarily bring about benefit, even if small, to further success in engineering projects in Local Authorities under and according to a quality management system.
4. The remaining unsolved problems which are still present are the Local Authority leaders who are not open to change and trying to implement these scientific changes. Ultimately, these tend to be figures who have been in their position for many years and have no desire to improve and try to find various ways to do business. These figures also prevent and restrict young employees to work according to the Guide. They also convince their employees to stick with the ways in which they have been working without being open to change. Thus, the bigger underlying issue is that these figures cannot be fired from their positions. Thus, it is recommended to conduct workshops where local authority leaders and employees are presented with the benefits of quality management.
5. The important scientific problem solved pertains to the E.M.C. which is the employee involvement, internal motives and the quality management consultants working together to create a better working environment to earn good results for all parties involved. When the Local Authority works according to these three parts, a positive outcome is concluded, on hand, EMC thesis saved financial resources of the country which is important to spend it on the right places for the citizen and on the other hand, EMC thesis save time on the

engineering projects that would makes it superficial on the time record and would makes us ahead of time, to the extend there is some projects that needs to be done on narrow period of time for example the schools that have to be done and ready to be function on the 1st of September, so the EMC can be overall benefit, and in addition EMC can improve the quality work and the quality of material that have been used in the engineering projects.

6. Adoption and implementation of a quality guide proposed by the researcher in various fields and institutions including hospitals, schools, public institutions, corporations, and associations. Therefore, we ought to associate the employers with build the formulas and laws of making, and on this scale the employers would be the rule maker and the main reason to respect and apply by it in the first place and makes the opposition be out of the way completely with that alone the thesis can build and form best environmental workplace.
7. It is recommended to form an independent committee that checks whether employees apply the quality management model appropriately and offers its own independent recommendations and notes, therefore, each facility form a place for the Consultant to inherit the look like HR with the same study field of the research like ISO 9001:2015 of the employees and modernize and develop the details of the rules within the unity based on the EMC thesis model with the emphasis on the Consultant part.
8. It is recommended that other units and departments within the local authorities conduct a similar study and apply a similar model within their own sections, for example the social department sections, educational, financial department and healthcare facilities in the local authorities, research develops its own models and forms suits the facility with each instruction, to avoid the chaos and prevent the fault with the newcomers and work with "build on" formula, for the most important part thing is the laws and the rules that been made is being applied based on the country and universal scales and instructions.
9. It is recommended to always subject the present study results and further results obtained by similar applied models to continuous revision, analysis and development, and it make sure to apply the 3 main factors and make sure to use and analyze another and additional factors that affect the research, for example as new a factor, using the age of employs on the applications of the laws rate, complex engineering projects, foreign and freelancers employees, the places of each disk separate from we each other and co working spaces those models are would be used by several governments facilities and local authorities in the country, and by developing it by each five years regularly by checking the resent data.

BIBLIOGRAPHY

SCIENTIFIC MONOGRAPHS AND STUDIES

1. ABDEL AZIZ, A., Quality Management and Its Role in Development of The Companies. UK, 2010. 204 p.
2. ALBERTO DE, M., Project Management for Facility Constructions: A Guide for Engineers and Architects. Italy: Torino, 2011. 188 p.
3. ANNE B., JAMES S., Motivating Employees. USA: McGraw-Hill, 1999. 175 p.
4. ASHFORD, J.L., The Management of Quality in Construction. UK: London, 1989. 236 p.
5. Association of Contractors and Builders in Israel. Quality Construction. Israel. 1998. 255 p.
6. Bank Of Israel. Research Department. The Effect of Fiscal Performance on Local Election Results in Israel. Israel, 1999. 49 p.
7. BASHAN, A., Quality Management- Quality Assurance and Statistical Quality Control. Israel: Kfar saba, 2001. 366 p.
8. BEERI, I., National Assessment Project of Local Government (NAPLG). University Of Haifa, Israel, 2009. 30 p.
9. BENJAMIN, B., Time of Your Life Tackle Time Wasters and Use your Energy to Full Effect. UK, 2014. 60 p.
10. CHARLES, A., JOHN, E., Cracking the Case of ISO 9001:2008 for Manufacturing: A Simple Guide to Implementing Quality Management in Manufacturing. American Society of Quality. USA, 2009. 207 p.
11. CHARLES, A., JOHN, E., JOSEPH J. ISO 9001:2008 Explained, Third Edition. American Society Of Quality. USA. 2010. 189 p.
12. CHAUHAN, S., Caste, Status, and Power. India: Classical Publishing Company, 1980. 168 p.
13. CHRISTOPHER, J., LARRY M. Job Costing Managerial and Cost Accounting. UK: London, 2010. 43 p.
14. CHRISTOPHER, J., Managerial and Cost Accounting. University of Southampton, 2009. 130 p.
15. CROSBY, B., Quality is free. USA, McGraw-Hill, 1979. 309 p.
16. DANIEL S. Engineering and Infrastructure Construction, Magazine, USA. Nov 15, 2002. 43 p.
17. DANIEL M. Strategic Training: Putting Employees First. USA: Massachusetts, 2007. 170 p.
18. DEKEL, C., Computer Services Engineering Ltd: Stock Prices for the Construction Industry.

Israel, Haifa, 2012. 403 p.

19. DEKEL. Stock Prices Refurbishment Maintenance and Construction of Small-scale. Israel: Dekel Computer Services Engineering Ltd, 2015. 355 p.
20. DEMING, E., Out of Crisis. USA. 2000. 507 p.
21. DEMING, E., Total Quality Management. USA. 1986. 429 p.
22. DENISE, E.R., ISO 9001:2008 for Small and Medium-sized Businesses. Third Edition. USA, 2010. 137 p.
23. DON, J., The Definitive Guide to Quality Application Delivery. UK Headquarters: Newbury, 2009. 41 p.
24. DONALDSON, G., Quality Management in Local Authority Educational Psychology Services. UK: Livingston, 2007. 55 p.
25. DOUGHERTY, L., Union-free Management. Dartnell Corp, 1968. 152 p.
26. DOUGLAS, K., Contract Lifecycle Management. UK: University of Southampton, 2012. 49 p.
27. DRUMMOND, G., KELLY, J., MALE, S., Value Management of Construction Projects. USA. 2004. 303 p.
28. DUNDON, T., et al. Organisational Change and Employee Information and Consultation. Department of Management and the Centre for Innovation & Structural Change (CISC), National University of Ireland, Galway. 2003. 108 p.
29. ELGOR, E., Buildings Magazine for the Construction Industry- Sheet No" 243. Israel, 2003. 155 p.
30. ELRAYAH, H., Awan Establish your Business now. Kuwait: The Distribution Pattern Akraa, 2011. 145 p.
31. Employee Communications and Consultation. UK: London, 2014. p. 19-27. 44 p.
32. FLEMING, W., Project Procurement Management: Contracting, Subcontracting, Teaming Quentin. USA: California. 2003. 285 p.
33. FLYVBJERG, D., Techn, A., From Nobel Prize to Project Management: Getting Risks Right. Aalborg University, Denmark, 2006. 15 p.
34. Fred Brooks. PMBOK Project Management Body of Knowledge the Mythical Man Month. USA. 2008.
35. FRIEDMAN, J., ALON, Y., Ministry of the Interior. Tender preparation and Management of the Local Authority. Tenders Committee the - Division of Municipal Administration, from Netanya. Israel. 1999.

36. Government of Israel. Authorities Authority Engineer. Israel. 1991. 179 p.
37. Government of Israel. The Government Contract 3210. Israel, 2014. 53 p.
38. Government of Israel. Municipalities Regulations (tenders). Israel. 1987. 7 p.
39. Government of Israel. Obligation Tenders Law. Israel, 1992. 177 p.
40. Government of Israel. Order Local Authorities (a). Israel. 1950. 77 p.
41. Government of Israel. The Planning and Construction Law. Israel. 1965. 656 p.
42. Graeme K. Managing Quality in the 21st Century, Principles and Practice. UK: London, 2012. 867 p.
43. HAROLD, K., Project Management: A Systems Approach to Planning, Scheduling, and Controlling. USA: New York. 2009. 1096 p.
44. HARRISON, F.L., DENNIS L. Advanced Project Management: A Structured Approach. USA: Burlington, 2004. 187 p.
45. Health and Safety Authority. Safety Representatives and Safety Consultation Guidelines. Dublin, Ireland: Hogan Place, 2005. 24 p.
46. HOYLE, D., ISO 9000 Quality Systems Handbook - Updated for the ISO 9001:2008 Standard. Linacre House, Jordan Hill, Oxford OX2 8DP, UK, 2009. 801 p.
47. IGOR, E., Accession to the WTO: Part I. Ukraine, 2010. 299 p.
48. Introduction To Performance Management And Construction- Ronnie Navon, Yehiel Rosenfeld, Israel: 2004. 152 p (7 parts).
49. JAMES, J., Total Quality Management. Massachusetts, USA. 2002. 743 p.
50. JESSEN, S., Project Leadership- Step by Step. Norwegia, 2010. 108 p.
51. JOHN S. On Quality Management. Oakland, USA. 1990. 475 p.
52. JURAN, J., Made in U.S.A.: a Renaissance in Quality. USA. 1993. 305 p.
53. KABLAN L. Tender Documents and Engineering Construction Contract. Israel, 2006. 155 p.
54. Kaoru, I., Total Quality Management: Empirical, Conceptual, and Practical Issues. Japan. 1985. 88 p.
55. KENNETH, L., The Manager's Guide to ISO 9000. USA. 1994. 386 p.
56. KHATEEB, M., Time to Act. Israel, Kanna of Galil, 2013. 66 p.
57. KHORRAMI, N., Understanding the PMBOK Guide Guide for the Most Famous Project Management Standard. USA, 2012. 211 p.
58. LAUFER, A., A Guide for Construction Building. Haifa, Israel. Technion, 2006. 647 p.
59. LAUFER, A., Warshawsky, A., A Guide for Planning the Execution of Construction Projects. Haifa, Israel. Technion, 1993. 264 p.

60. LAURA, L., The 7 Qualities of Brilliant Executive Coaching. Genova University Italy. 2014. 212 p.
61. LESTER, A., Project Management, Planning and Control: Managing Engineering, Construction. UK, 2007. 443 p.
62. LUCJAN, K., Business Ethics. Introduction of the Ethics of Values. UK, 2014.
63. MAHFUZ A. Total Management Quality. Judeh, 2009. 10 p.
64. MERAV. Buildings, The Construction Industry Magazine Issue No. 198- Published- Descalo Productions LTD., USA 2002.
65. Ministry of Interior, Local Authorities Audit Division. Professional guidelines accountant. Israel. 2002.
66. Ministry of Interior, Returns to the CEO of the Ministry of Interior, Israel. No. 5/2000- September, 2001.
67. Ministry of Interior. Haifa metropolitan and Haifa Zone- Part 1. Israel, 1998.
68. MINTZBERG, H., Inside Our Strange World of Organization. The Free Press. New York, USA. 1989. 423 p.
69. MINTZBERG, H., The Structuring of Organizations. McGill University in Montreal, Quebec, Canada, 1979. 412 p.
70. MOSHKOVICH, S., Building and Architecture, Sheet No" 145. Israel: TA, 1995.
71. MULLINEUX A. W. Business Cycles and Financial Crises. UK: University of Birmingham, 2011. 145 p.
72. NAVON, R., ROZENFELD, Y., Introduction to the Design and Construction Performance Management. Haifa, Israel. Technion, 1993. 152 p.
73. NEUMANN, Z., ZVIRAN, M., Information Systems Practice. T-A: College of Management. 2004.
74. NOLBERTO, M., Project Management for Environmental, Construction and Manufacturing Engineers. Universitat Polite`cnica de Vale`ncia, Spain, 2013. 300 p.
75. OMBUDSMAN. Annual Report 2012. Israel: Jerusalem, 2013.
76. OSAYAWE, E., ELIZABETH, B., Innovation, Diffusion and Adoption Of Total Quality Management (TQM). Israel. 2005.
77. PERRY, T., HR 2025- Human Resource Management in the Future. UK: Sheffield, 2013.
78. PETER, R., 99 Ways to Keep Employees Happy, Satisfied, Motivated and Productive. USA: Clearance Center, 2004. 111 p.
79. PETER, W., Object Oriented Quality Management- A Management Model for Quality.

Statistics Netherlands, 2009.
80. PORTER, M.E., The Competitive Strategy. The Free Press. New York, USA. 1990. 564 p.
81. Power Systems Protection, Power Quality and Substation Automation, IDC Technologies, USA. 90 p.
82. ROBBIRT, J.T., BERGH, P.A., The ISO 9000 Book, Quality Resource, A Division of The Kraus Organization Limited White Plains. USA: New York. 1994.
83. ROBERT, A., Working Capital and Strategic Debtor Management. UK: National Academic Validation Bodies, 2013.
84. ROSENFELD, Y., Construction Quality Management Systems- Label Implementation Methods Based on Lessons Learned. Technion Haifa,. Israel. 2000.
85. ROSHDI, H., How to Be a Successful Leader. Egypt: Ekholod, 2013.
86. ROTEM E. E-Government in Israeli Local Authorities Comparative Analysis. Haifa University. Israel, 2007. 710 p.
87. RUSSELL, J.P., ARTER D. ISO Lesson Guide 2008: Pocket Guide to ISO 9001-2008, Israel. Third Edition. 71 p.
88. SANJAY, R., Advanced Macroeconomics. India: University of Mumbai, 2012. 237 p.
89. SCHLICKMAN, J., ISO 9001:2000 Quality Management System Design. UK: British Library Cataloguing in Publication Data, 2002. 402 p.
90. SHARLYN, J., Motivating Employees. USA: Internal Talent Management, 2004. 16 p.
91. SHOHAT, J., ROSENFELD, YEHIEL. Rehabilitation, renovation, or reconstruction? Techno-economic Model, Research Report 790-776, National Institute of Building Research. Haifa: Technion, 1996.
92. SHOR, K., Quality Engineering. Israel: TA, 1998
93. SHTUB, A., Enterprise Resource Planning (ERP): The Dynamics Of Operations Management. 2004. 148 p.
94. SHTUB, A., Factory Management Operations Management- System MRP/ERp. Israel: TA, 1997. 405 p.
95. SHTUP, A., GLOBERSON S. Project Management Planning and Execution Control. Haifa. Technion. 2008. 256 p.
96. SOROKKA, Y., Calculating the amounts of construction work. Israel: Technion, 1995. 65 p.
97. State Comptroller. Reports on local government audit for 2011-2012. Israel: Jerusalem, 2013. 363 p.
98. SUI, P., JOY, O., Project Quality Management. Department of Building National University

of Singapore. 2014. 183 p.

99. TANG, S.L., Construction Financial Management. Singapore, 2014. 121 p.

100. The Inter-Ministerial Government. The General Specifications For The Construction Work, The Blue Book. Jerusalem, 2008. 670 p.

101. The Israel Standards Institute. ISO 2002, ISO 9002. Israel. January 1990. 324 P.

102. The Ministry of Defence. Engineering, Tender Documents and Construction Contract. Israel. 1999. 67 p.

103. The Ministry of Defense Publications. General Specifications Interministerial part 00, Chapters 00 to 57. Israel, 2015. 24 p.

104. The National Committee for the Heads of the Arab Local Authorities in Israel. The Future Vision of the Palestinian Arabs in Israel, 2006. 321 p.

105. The State Comptroller. Audit Reports on Local Government. (2002). 393 p.

106. The World Bank Washington. Managing Project-Related Technical Assistance the Lessons of Success, U.S.A. 1983.

107. THOMAS, C., Data Quality: The Field Guide. USA: Butterworth Heinemann, 2001. 192 p.

108. THOMAS, C., Total Quality Management as Competitive Advantage: A Review and Empirical Study. USA. 1995. 228 p.

109. TREWAKS, S., Theory Construction Processes and Materials. Israel, 2010. 55 p.

110. WESLEY, D., State Practices & Zionist Images- Shaping Economic Development in Arab Towns in Israel. Israel, 2006. 256 p.

111. WHITELEGG, J., Quality of Life and Public Management: Redefining Development in the Local Environment. USA: NY, 2013. 189 p.

112. WILLIAM, R., A Guide to The Project Management Body Of Knowledge - Director of Standards, USA: Pennsylvania, 2008. 474 p.

113. WILLIAM, R., PMBOK- Project Management Institute. USA: Pennsylvania, 2000.

114. Rikesch, S., JayeSchkumar, P., Quality Control Management in Building Construction. collage of science and technology, India. 2020. https://drive.google.com/drive/folders/1DRPHAEwoU4PBEV4IzFhkWZHEfGALAxqE

115. YOMI, B., Sui, p., Cross-Cultural Management and Quality Performance. National University of Singapore, 2015. 461 p.

116. ZRIKAT, A., *Civil engineering scientific articles, material and research in construction management engineering*. Nazareth: The Salam Company ltd, 2019.

SCIENTIFIC JOURNALS AND WEBSITES

117. Arab Culture Website. [quote 05.11.2016]. ttp://www.faceiraq.com/inews.php?id=1685205.

118. CARLOS, J.F., A Contingent Strategy Framework. The International Journal of Applied Management, 2001, Vol. 2, No. 3, p. 139-156.

119. CARLOS, J.F., Charting Service Quality Gaps. Total Quality Management, Vol. 11, No. 4/5&6, 2000, p. 463-472.

120. CARLOS, J.F., Contrasting Portuguese and International Service Quality Management in Algarve Hotel Industry. The International Journal of Applied Management, 2003, Vol. 4, No. 1, p. 37-54.

121. CARLOS, J.F., Is TQM more Difficult to Implement than Other Transformational Strategies. Total Quality Management, Vol. 22, No. 11, 2011, p. 1139-1164.

122. CARLOS, J.F., Service Quality Strategy Implementation: A Model and the Case of Algarve Hotel Industry. Total Quality Management, Vol. 16, No. 1, 2005, p. 3-14. Algarve, 2005. p. 3-14.

123. CARLOS, J.F., The Implications of Service Quality Gaps for Strategy Implementation. Total Quality Management, Vol. 12, No. 7&8, 2001, p. 825-833.

124. Central Bureau of Statistics. Israel. [quote 17.12.2017]. http://www.cbs.gov.il/reader. 2015.

125. Contents of the ILO Encyclopedia of Occupational Health and Safety. http://www.ilocis.org/documents/chpt21e.htm

126. Efficiency and Quality in Local Government Management. The Case of Spanish Local Authorities. [quote 02.09.2017]. http://econpapers.repec.org/paper/bbewpaper/200202.htm.

127. Employment Lawyers Association. Response to BIS Consultation. Time to Train? Consultation on the Future of the Right to Request Time to Train Policy. 2010.

128. Executive Director Human Resources & Workforce Development. Consultation Requirements for Managing Workplace Change Policy. 2010.

129. HALL, M., PURCELl, J., Employee Consultation a Mixed Picture, IRRUBRIEFING, No" 20, 2011.

130. Historic England. [quote 03.03.2015]. https://historicengland.org.uk/advice/constructive-conservation/

131. ISO Central Secretariat. Quality Management Principles. CH-1211 Geneva, Switzerland, 2009.

132. KOC, T., Does ISO 9000 Limit Companies in Flexibility to Changes. Istanbul Technical University Industrial Engineering Department, 80680 Marka, Istanbul, Turkey, 2011.

133. Management Systems for Local Authorities. [quote 22.08.2017]. http://www.saiglobal.com/our-company.
134. Ministry for the Environment. Resource Management Act Survey of Local Authorities 2012/2013. New Zealand, 2014.
135. Neighbourhood Plan. Business and Employment Consultation Meeting. p. 1-6. K M Hawes, 2014.
136. NOIMAN, G., ISO-9000. Standards Institute of Israel. Israel: TA, 1999.
137. Policy Statement. on Communication and Consultation. UK: Hamilton, 2010.
138. Salt Lake Community College Policies and Procedures Manual. Business Services Consultation and Other Employment Activities. 2012.
139. SHOSANI, R., Quality Guide of Company B.S.T. Nazareth. Israel: Nazareth, 1999. 234 p.
140. The Highland Council. Protocol for Informing and Consulting with Highland Council Employees. UK, 2015.
141. The Standards Institution of Israel: QCD is a Leading Certification Body: http://www.sii.org.il/14-he/SII.aspx.
142. The University of Bath. Staff & Student Consultation Policy. Claverton Down. United Kingdom: Bath, 2014.
143. Union of Local Authorities in Israel. [quote 06.06.2017]. http://www.masham.org.il. 2015.
144. Website: MISP is a Leading Training Provider in Classroom and Online Training with Number of Professional Certification Courses to Address the Skill set of Professionals and Organizations. [quote 01.04.2018]. http://misptraining.com/product-category/project-management.
145. Website Dun & Bradstreet. http://www.dbisrael.co.il.
146. Website Ministry of Housing. [quote 01.12.2017]. http://www.moch.gov.il/Pages/HomePage.aspx.
147. IS/ISO 8042: Shock and Vibration Measurements- Characteristics to be Specified for Seismic Pick-ups. [quote 01.10.2016]. https://archive.org/details/gov.in.is.iso.8042.1988
148. Website ISO 9000 and the public sector, by Dr. Lawrence D. Eicher, ISO Secretary-General. [quote 01.12.2017]. www.iso.org/iso/livelinkgetfile?llNodeId=21838&llVolId=-2000%20
149. ZOABI, S., Quality Guide of Company Tawfik Darawshe Nazareth. Israel: Nazareth, 2002.
150. ZRIKAT, A., The Success Metrics and The Success Factors. In: Studia Universitatis Moldaviae. Chisinau: USM, 2018, Nr.2(112), p. 195-199, ISSN 1857-2073. Categoria B.

[quote 01.03.2019]. http://oaji.net/articles/2017/2054-1543831688.pdf.

151. JICA, O., Qatus Ualitryeport Assurance, And Quality Control Manual, 2011, P. 17.
152. ECHOUR, S., NBIGUI, T.A., ISO 9001 Quality Approach and Performance Literature Review, 2021, p. 142.
153. ZRIKAT, A., The Quality Management In Local Authorities In Israel. In: Paradigme moderne in dezvoltarea economiei naționale si mondiale, Conferinta stiintifica internationala jubiliara, 02-03 noiembrie 2018, Chisinau, Universitate de Stat din Moldova, 2018, pg. 513-516, 0,58 c.a. ISBN 978-9975-142-57-1. [quote 01.03.2019]. http://ojs.studiamsu.eu/index.php/exact-economic/article/view/529.
154. ZRIKAT, A., Systemic Treatment of Quality Management. In: Studia Universitatis Moldaviae, Chisinau: USM, 2014, Nr.7(77), p. 171-174, ISSN 1857-2073. Categoria C. [quote 01.12.2014]. http://studiamsu.eu/wp-content/uploads/26.-p.171-174.pdf.
155. ZRIKAT, A., Conceptualization of Notion of Quality in Evolution Approach. In: Studia Universitatis Moldaviae, Chisinau: USM, 2014, Nr.7(77), pg 166-170, ISSN 1857-2073. Categoria C. [quote 01.12.2014]. http://studiamsu.eu/wp-content/uploads/25.-p. 166-170.pdf.
156. ZRIKAT, A., The Opportunity of Applying Models of Quality Management System in Public Construction Enterprises. In: Studia Universitatis Moldaviae, Chisinau: USM, 2015, [quote 01.11.2015]. Nr.2(82), P. 212-216, ISSN 1857-2073. Categoria B. [quote 05.05.2015]. http://studiamsu.eu/wp-content/uploads/35.p.212-216_82.pdf.
157. ZRIKAT, A., Models of Quality Management System: Content and Scope. In: Studia Universitatis Moldaviae. Chisinau: USM, 2015, Nr.2(82), p. 207-211, ISSN 1857-2073. Category B. [quote 01.10.2015]. http://studiamsu.eu/wp-content/uploads/34.p.207-211_82.pdf.
158. ZRIKAT, A., *Civil engineering scientific articles, material and research in construction management engineering*. *Journal*. Nazareth: The Salam Company ltd, 2017.
159. LIZHEN, H., YONGPING, L., GURI, K., FRED, J., Life cycle assessment and life cycle cost of university dormitories in the southeast China: Case study of the university town of Fuzhou, Gjøvik, Norway, 2017.
160. CARLOS, C., CARMELO, M., MIGUEL, P., CRISTINA, C., The influence of motivations and other factors on the results of implementing ISO 9001 standards', Madrid, Spain, 2017.
161. WALTER, L., Handbook of Sustainability Science and Research, Hamburg, Germany, 2018

162. Low, P., Lau, H., Construction Quality and the Economy- A Study at the Firm Level, Singapore, 2019.
163. MUKHERJEE, S.P., Quality Domains and Dimensions, India Studies in Business and Economics, Howrah, West Bengal, India, 2019.
164. STEVE, G., Sustainable Construction Processes, School of Architecture, Design and Environment Plymouth University, UK, 2016.
165. ROGER, F., CAROL, J., New Code of Estimating Practice- The Chartered Institute of Building, Chennai, India, 2018.
166. SANDRINE, F., The Multiple Facets of Innovation Project Management- Innovation between Risk and Reward Set coordinated by Bernard Guilhon and Sandra Montchaud, London, U.K. 2017.
167. HAROLD, K., Project Management Best Practices- Achieving Global Excellence, by International Institute for Learning, Inc. New York, 2018.
168. ISO 9000 Quality Systems Handbook - updated for the ISO 9001:2008 standard (6th ed.) [quote 01.10.2012]. https://www.ebooks.com/en-us/453025/iso-9000-quality-systems-handbook-updated-for-the-iso-9001-2008-standard/hoyle-david.
169. ZRIKAT, A., The Quality Management Process In Public Organization of Constructions: Difficultes in the Implementation Way. In: Trade Co-operative University of Moldova, Chisinau: Journal of Research on Trade, Management and Economic Development Volume 5, E-ISSN 2345-1483, ISSN 2345-1424, 2(10)/2018, p. 110-111. [quote 02.10.2018]. https://ibn.idsi.md/sites/default/files/j_nr_file/Revista%20JRTMED%20vol%205%20nr%202%20%2810%29%202018%20.pdf.
170. ZRIKAT, A., The Theoretical Approach of Concepts of Models for Quality Management System in the Application Context of Public Construction Enterprises. In: The materials of the National Scientific-Practical Conference with International Participations. CZU, 2022. p. 82-85.
171. Anders, F., Johan, L., Yvonne, L., Bjarne, B., Quality 2030 consists of five collectively designed themes for future QM research and Practice. 2020. p. 14. [quote 12.02.2001] https://www.tandfonline.com/doi/full/10.1080/14783363.2020.1863778
172. Ida, G., Jan, L., Mattias, E., Jason, M., Increasing the value of quality management systems, Department of Technology Management and Economics, Chalmers University of Technology, Gothenburg, Sweden, Chalmers University of Technology, Gothenburg, Sweden, and Linköping University, Linkoping, Sweden, 2021. [quote 05.04.2001].

https://www.emerald.com/insight/1756-669X.htm

173. Menahem, L., Corrective activity and preventive activity, 2022. P. 2. [quote 02.02.2003]. https://isq.org.il.

APPENDIX

Appendix 1.

Table of Related Books and Articles

Name	Born/ Died	Books	University	Ideas
Walter A. Shewhart	1891 1967	1. *A study of the accelerated motion of small drops through a viscous medium* 2. *Economic control of quality of manufactured product* 3. *Statistical method from the viewpoint of quality control*	University of California	1. Reducing variability is equivalent to quality. improvement 2. He is considered to be the grandfather of quality control.
W. Edwards Deming	1900 1993	1. *Out of the Crisis* 2. *Statistical Adjustment of Data* 3. *Some Theory of Sampling*	New York University	1. The father of quality. 2. His contribution was in improving quality, by setting 14 points principles which should be the foundation for achieving quality improvements
Joseph M. Juran	1904 2008	1. *Quality Control Handbook* 2. *Managerial Breakthrough* 3. *Management of Quality Control* 4. *Juran on Planning for Quality*	University of Minnesota	He helped Japan rebuild its devastated economy and he showed U.S. manufacturers how to compete successfully in the world market
Kaoru Ishikawa	1915 1989	1. *General Principles of the QC Circle* 2. *How to Operate QC Circle Activities* 3. *Introduction to Quality Control*	The Engineering Department of Tokyo University	"Ishikawa diagram" or Fishbone Diagram
Dr. Genichi	1924	1. *Bringing*	Astronomical	Taguchi proposed that as

Taguchi	2012	*Quality Engineering Upstream* 2. *Learn How to Boost Quality while Reducing Costs & Time to Market.* 3. *A Pattern Technology System*	Department of navigation Institute	conformance values moves away from the target, loss increases as a quadratic function. This means that smaller differences from the target result in smaller costs.
Armand V. Feigenbaum	1922 2014	1. *Quality Control: Principles, Practices and Administration* 2. *Total Quality Control*	MIT	Every single person in organization must have a truly commitment to improve the quality. Learning from other's success story is essential.
Philip B. Crosby	1926 2001	1. *Quality is Free* 2. *Quality Without Tears* 3. *The Art of Getting Your Own Sweet Way*	Western Reserve University	He held a variety of quality control jobs starting as line inspector.

Appendix 2.

Dr. Deming Speaks About Quality in Japan - Paris, November 23th, 1980

Japanese companies don’t depend on automation

Many people talk about automation and about quality in Japan. Automation, that's all right, but the Japanese don’t depend on automation. They learn efficient methods ever and ever. Machinery the hell! A lot of people in America think that when they will have new machinery they will increase productivity; they are totally wrong. New machinery will only give them new headaches. American industry has not learnt how to use present machinery efficiently; they have not learnt supervision; they do not understand improvement of process; they think they will get improvement by investing in new machinery, and what they will get is a new set of headaches, a new set of problems. I have seen so much of it! But it is not 100 percent true. There are some industries in America, some isolated plants, they are highly automated, and they have had a devoted workforce, and intelligent management and they can make use of automation.

Prerequisites for automation

Automation is not the answer in Japan. Quality and productivity in Japan do not result from automation. You asked me a question about the Japanese achievement’s prerequisites. Yes, some kind of automation can improve quality and reduce cost. Automation requires knowledge about the machines, how to operate them, how to maintain them, how to repair them. Another requirement is to have almost perfect incoming materials. Any defects along the line stops the whole thing. A stoppage for one minute runs up costs, terrifically. Americans forget that. They find it too late. Quality control is more and more important with automation because of the high cost of stoppage. Training people cannot be accomplished, methods of training cannot be understood, when you have no idea about statistical methods. The Americans have not come to that stage yet, they have been out for many years. Here is the road now, as we say in English.

Quality is everybody's job

In France, you said, many questions are asked about Japanese industry and especially about Japanese quality. You asked me what is the main ingredient of Japanese quality. Well, I think I told you that in my speech last night, and in the speech I gave to you the day before yesterday. In the Japanese industry, quality is everybody's job. They cannot get quality with a quality control department only. A quality control department too often in America is a police department, and later becomes a fire department. Quality has to be everybody's job. I think here in France you have some quality control departments that are making quality everybody's job in the plant, and teaching statistical methods to everybody in the plant, and teaching everybody how to use them. Now that's

good. We don't have enough of it in America, and I am sure you don’t have enough of it in France.

Lectures with top management

I don't know if I mentioned what happened in Japan with the top management in 1950 and in the 18 visits that I made since. They listened to my talks, about how management can make use of statistical methods in industry all the way from incoming materials to consumer research. I emphasized that the two ends of the line are important points; incoming materials and the consumer. Without the consumer we don't have any production. The whole world knows how they have done it. Innovation, new products, and improvement of all the products; it's fantastic. Japanese management uses difficult methods, everywhere. On reception of incoming materials, they do not accept defective materials. They teach vendors quality control. Japanese manufacturers also learnt something that is useful in production, namely to share their manufacturing concerns with all the others; so the entire industry improves. I taught top management in all my visits, 18 in all, and their eagerness to learn how to use statistical techniques was very great.

Courses for engineers

And of course I taught hundreds of engineers. What happened in Japan in 1950 was an explosion. And different forces came together to make that explosion. One of them was my conferences with top management. The first one was held in 1950. Of course I held others in 1951, 52, 55 and so on. Another force in 1950 was my teaching to engineers, several hundreds of them. Our third force was that in two previous visits I had made it the purpose of life to help the leading Japanese statisticians hold together, to invite them for the evening at my hotel, with some food and something to drink, to tell them how fortunate they could be for the reconstruction of Japan. I had been to Japan for social surveys, reports on the labor force, led by the Census. That is the third force. So, when 1950 came, the leading statisticians were ready to teach statistics to hundreds and thousands of engineers. The great JUSE, the Union of Japanese Scientists and Engineers, was ready to expand teaching of statistics for industry, to teach management, to teach engineers. As a matter of fact, JUSE taught, between 1950 and 1970, 15,000 engineers. The courses were rudimentary statistical methods to use in production. They also do give courses, more and more, advanced courses for statisticians, advanced courses of statistics for engineers. And continuously, courses for management. The courses for management are difficult, yet they are booked up for seven months ahead, today. All these four forces came together in 1950 and produced the explosion. And the explosion has continued.

Quality Control Circles

Then about 1960 there was the formalization of Q.C. circles, by Dr. Kaoru Ishikawa. A lot of

people in the world talk about Q.C. circles; they don't realize that the environment is right in Japan and may not be right in America or in France. So, I think people are going to have problems about Q.C. circles, because they do not have the proper environment for them. In Japan, you see, everybody works for the company, is in the company for life, the company is his, they are all used to working in groups, and the Q.C. Circle formalization is simply Dr Kaoru Ishikawa's method of making the best possible use of this group's efforts, which involves Japanese work. They instituted regional meetings so that top management could bring Q.C. circles from a part of the company to another. So they learn if something valuable somewhere may be applied elsewhere. The Q.C. circles use statistical methods, to understand what problems are important, to measure if their efforts are effective. They need statistical methods, very simple ones, where culture is important, and they work on the most important faults. And now they say they measure the effects of the changes. Now Dr. Ishikawa has brought about regional meetings of Q.C. circles for all kinds of companies, where they talk to one another to show what they have accomplished, in hope that what they have learnt will apply to other companies. And there is a national convention, twice a year. I just attended one, three weeks ago in Tokyo. 1 800 young people, I should imagine about aged 23. Think of it, from industry all over Japan, from all kinds of industry, including construction, printing, railway, manufacturing of all kinds, heavy industry, light industry, electronics. I call them boys and girls, because they are young people, almost always. All of them come together with a great determination, and they are so much involved. They have to tell all these other people what they have done and the pride they put in doing this, the happiness they work with, that's fantastic to me, fascinating.

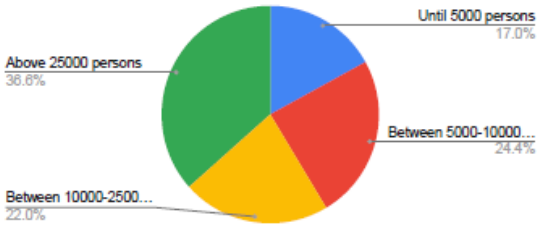
American management is not looking very far

It's hard for me to imagine that this will happen in America. Maybe... but I don't think so, because in America we don't like long term employment. Management is not looking very far. How could you imagine Q.C. circles working hard on problems of production, in America, when a man who has some business in April has a chance to lose his job in December. How could you have a Q.C. circle made of people we hired and some other that we picked on the streets? How could you imagine they could be really interested in the problems of the company? I cannot. It may be possible for some companies in America to create employment in which Q.C. circles could be effective, but I think it will take a long time, a large study from the top management. The management has so far not put it up yet. I don’t see it in the future. Could be. But I cannot make any predictions. I can't be so certain of the success.

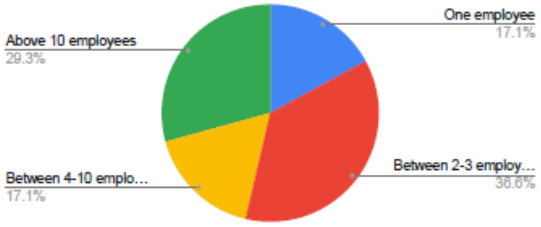
Appendix 3.1

Outcome of Questionnaire and Interviews

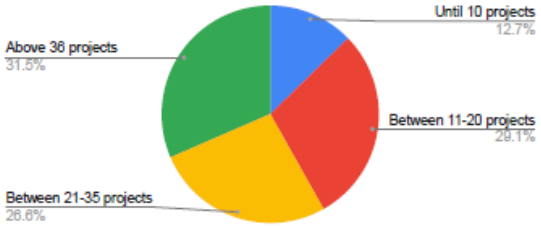
1	The number of the residents in my possession is?	
a	Until 5000 persons	17.00%
b	Between 5000-10000 persons	24.40%
c	Between 10000-25000 persons	22.00%
d	Above 25000 persons	36.60%



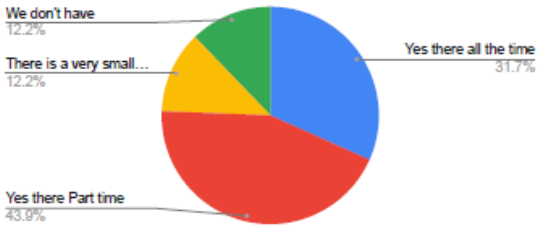
2	The number of employees in the engineering department?	
a	One employee	17.10%
b	Between 2-3 employees	36.60%
c	Between 4-10 employees	17.10%
d	Above 10 employees	29.30%



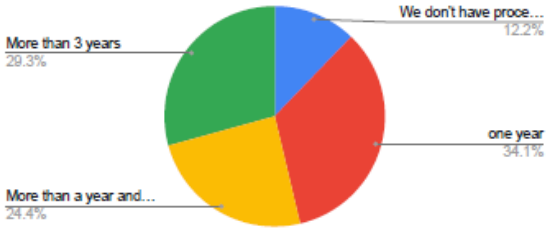
3	how many engineering projects do you carry out per year	
a	Until 10 projects	12.80%
b	Between 11-20 projects	29.30%
c	Between 21-35 projects	26.80%
d	Above 36 projects	31.70%



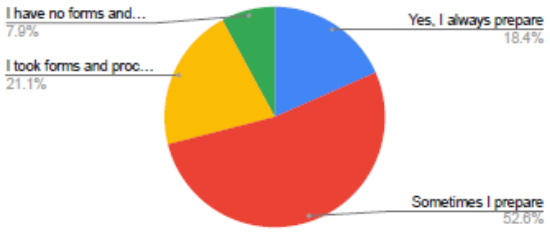
4	Do you have procedures for managing engineering projects in an orderly and complete manner?	
a	Yes there all the time	31.70%
b	Yes there Part time	43.90%
c	There is a very small part	12.20%
d	We don't have	12.20%



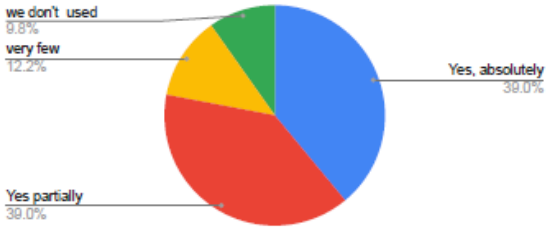
5	How long do you have procedures for quality management in engineering projects?	
a	We don't have procedures	12.20%
b	one year	34.10%
c	More than a year and less than 3 years	24.40%
d	More than 3 years	29.30%



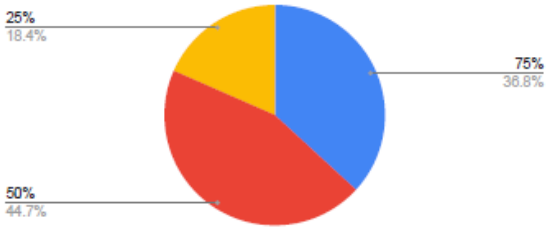
6	If not, do you prepare forms and procedures from time to time for your use and for the use of the employees in the department from time to time?	
a	Yes, I always prepare	18.40%
b	Sometimes I prepare	52.60%
c	I took forms and procedures from the author and I use them	21.10%
d	I have no forms and procedures	7.90%



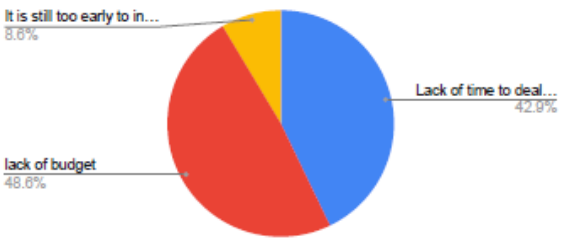
7	If you have procedures for quality management or material that you have prepared, do the employees of the department use them?	
a	Yes, absolutely	39.00%
b	Yes partially	39.00%
c	very few	12.20%
d	we don't used	9.80%



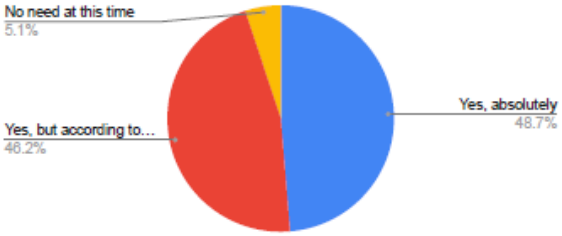
8	If you have procedures for quality management in engineering projects, to what extent do you think there is success in managing these managerial projects?	
a	75%	36.80%
b	50%	44.70%
c	25%	18.40%
d	5%	0.00%



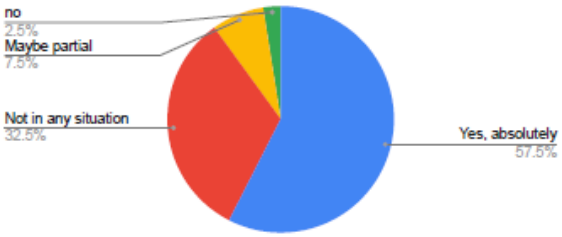
9	If you do not have procedures for managing engineering projects, what is the reason?	
a	Lack of time to deal with it	42.90%
b	lack of budget	48.60%
c	It is still too early to introduce procedures	8.60%
d	We oppose procedures	0.00%



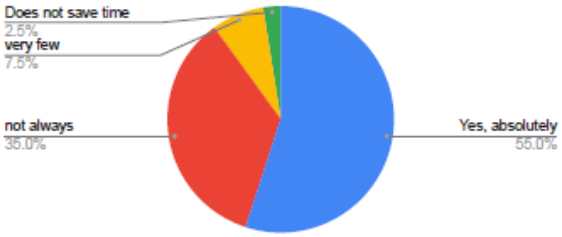
10	Would you agree to the introduction of project management procedures as part of the department's work?	
a	Yes, absolutely	48.70%
b	Yes, but according to my instructions	46.20%
c	No need at this time	5.10%
d	I am opposed to project management procedures	0.00%



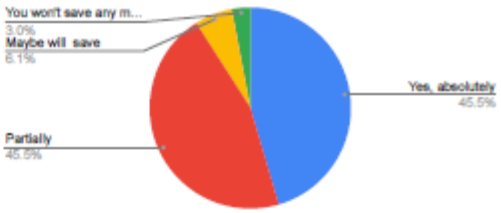
11	Do you think that introducing project management procedures will bring general benefit?	
a	Yes, absolutely	57.50%
b	Not in any situation	32.50%
c	Maybe partial	7.50%
d	no	2.50%



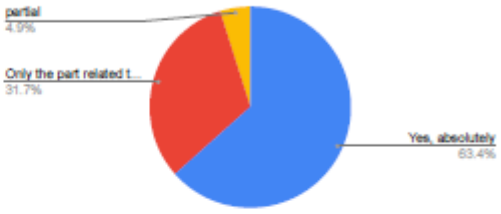
12	Do you think project management procedures save time for department employees?	
a	Yes, absolutely	55.00%
b	not always	35.00%
c	very few	7.50%
d	Does not save time	2.50%



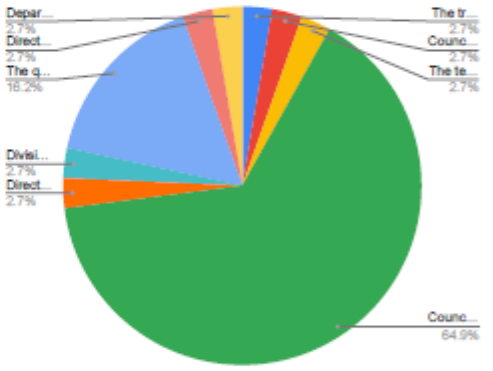
13	Do you agree that project management procedures will save public money?	
a	Yes, absolutely	36.60%
b	Partially	36.60%
c	Maybe will save	4.90%
d	You won't save any money at all	2.40%



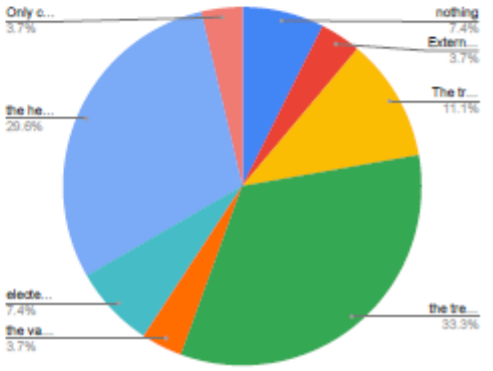
14	Do you think they should be transparent and open to the public?	
a	Yes, absolutely	63.40%
b	Only the part related to the public	31.70%
c	partial	4.90%
d	no	0.00%



15	Who is taken care of regarding the preparation of forms/procedures if there is no quality guide?	
a	The treasurer of the authority or the secretary	1
b	Council management	1
c	The team and I are self-prepared	1
d	Council Engineer	24
e	Director of the construction department	1
f	Divisional Organization and Finance Manager	1
g	The quality manager	6
h	Director of the engineering department	1
i	Department managers	1

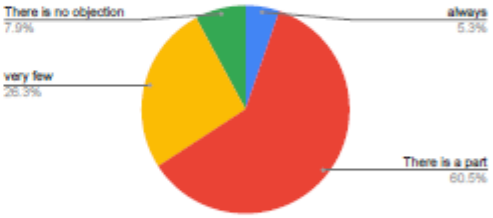


16	Who are the factors that interfere with certain procedures or forms that can interfere with working according to the procedures?	
a	nothing	2
b	External parties who fund and demand to follow their procedures	1
c	The treasurer of the Authority	3
d	the treasurers	9
e	the various providers	1
f	elected officials	2
g	the head of the authority	8
h	Only conservative workers	1



17	What is the frequency of changing a procedure or form in the quality procedures?	
a	Every day	0.00%
b	every week	31.60%
c	Every month	34.20%
d	Once a year	34.20%

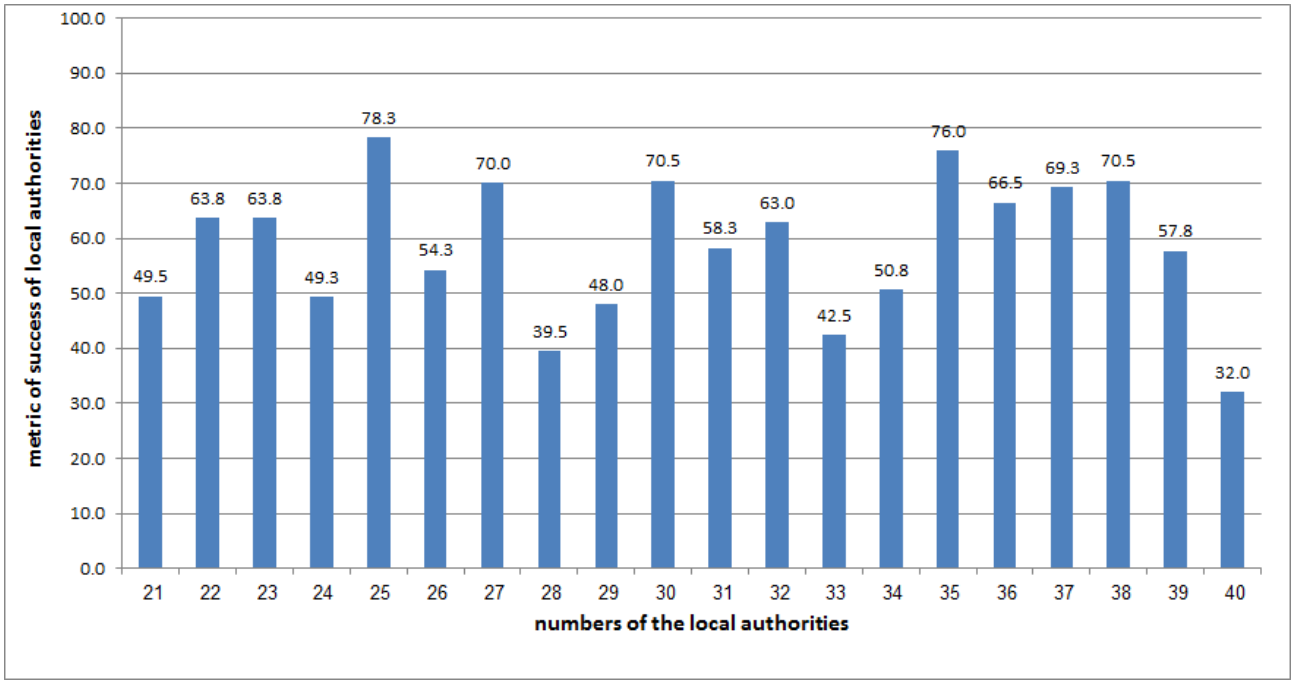
18	Is there any objection in the Authority to any procedures or quality guide?	
a	always	5.30%
b	There is a part	60.50%
c	very few	26.30%
d	There is no objection	7.90%



19	Who are the opponents of the procedures or the quality guide?	
a	the managers	25.70%
b	the workers	42.90%
c	The customers (contractors, suppliers)	14.30%
d	Other colleagues at work: for example treasurers, education, etc	17.10%

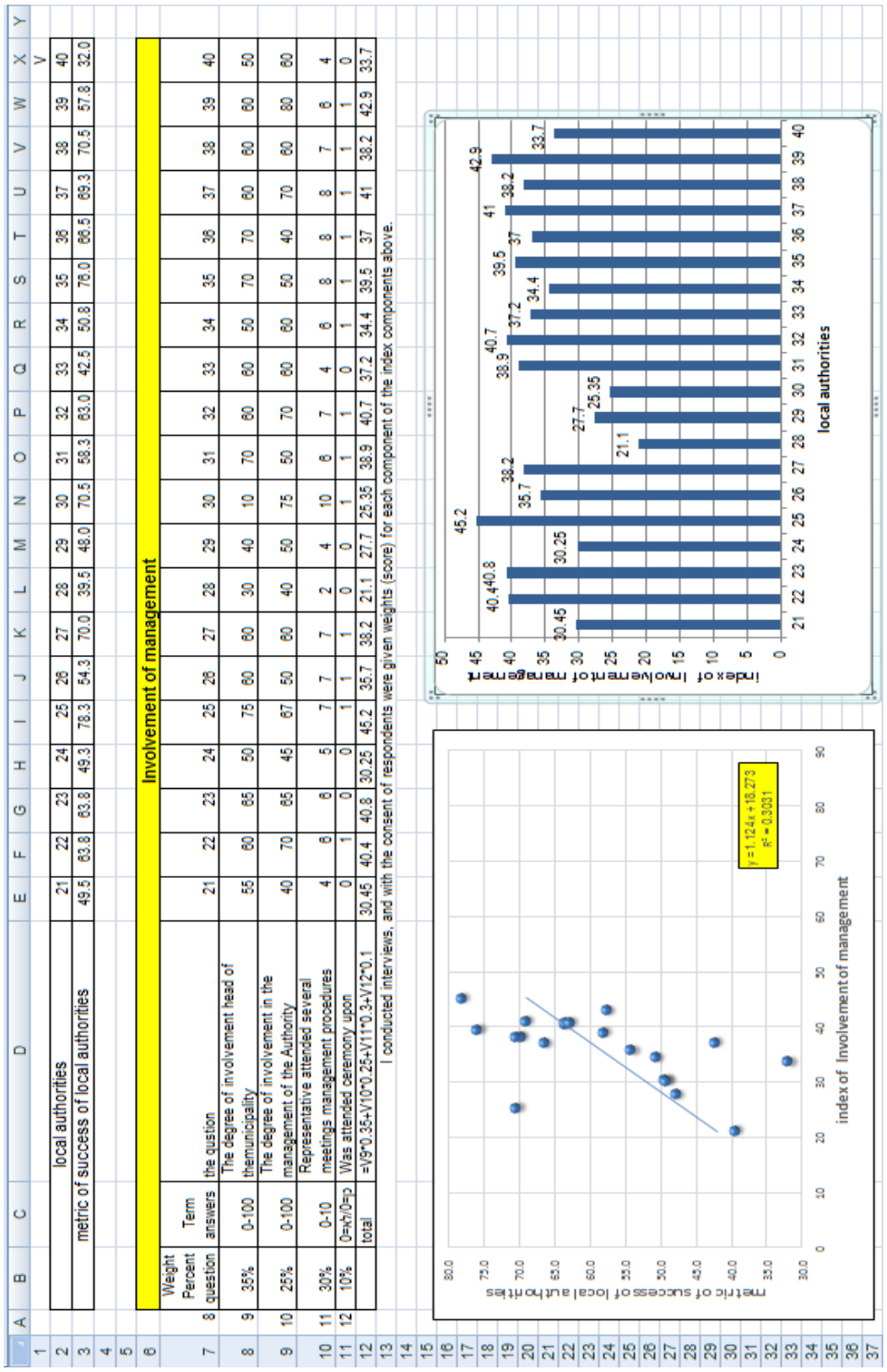
Appendix 3.2

Metric of success of authorities



Appendix 3.2.1.

The correlation between Involvement of management and the success of authorities

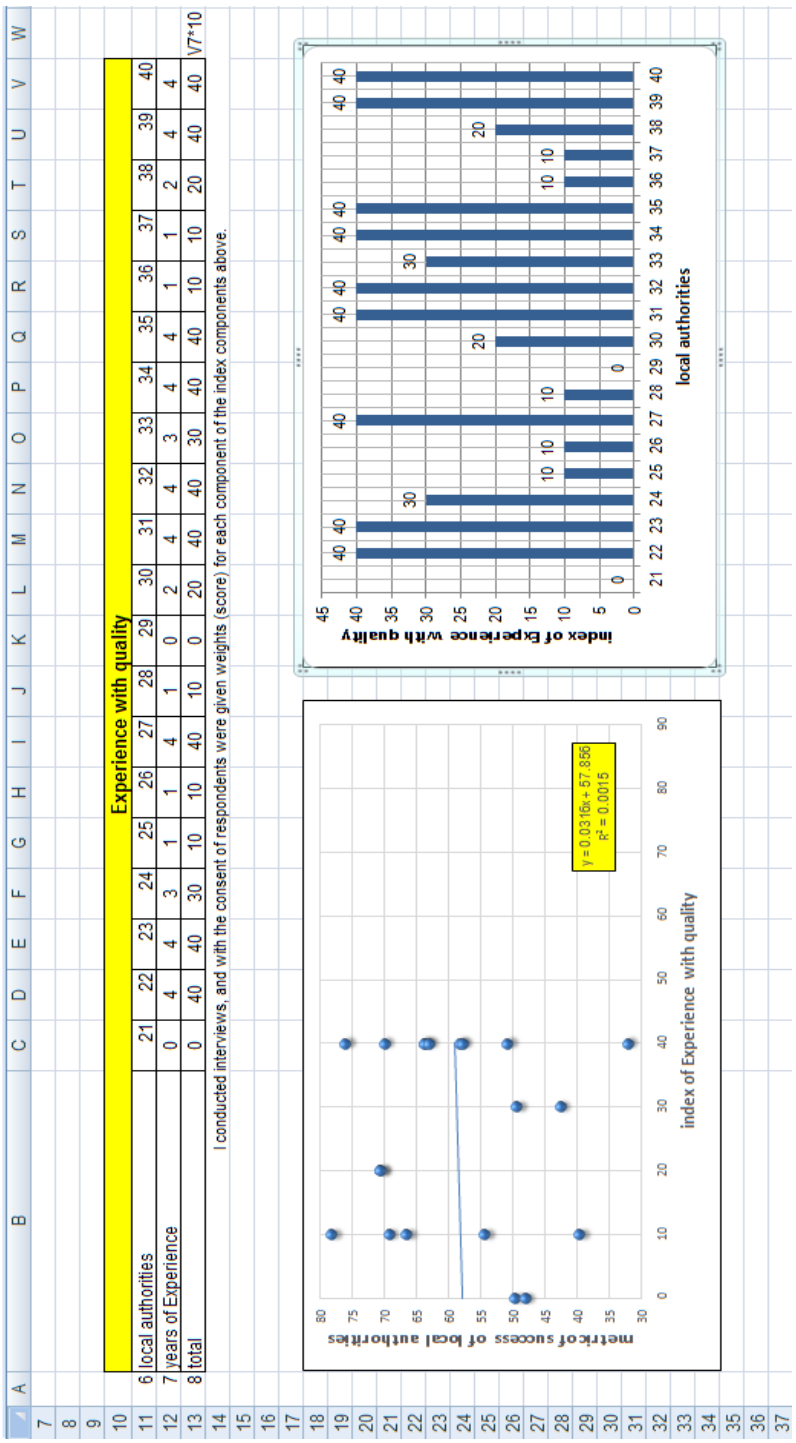


	local authorities		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	metric of success of local authorities		49.5	63.8	83.8	49.3	78.3	54.3	70.0	39.5	48.0	70.5	58.3	63.0	42.5	50.8	76.0	66.5	89.3	70.5	57.8	32.0
		Involvement of management																				
	Weight Percent question	Term answers	the qustion																			
				21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	35%	0-100	The degree of involvement head of themunicipality	55	60	65	50	75	60	60	30	40	10	70	60	60	50	70	70	60	60	60	50
	25%	0-100	The degree of involvement in the management of the Authority	40	70	65	45	67	50	60	40	50	75	50	70	60	60	50	40	70	60	80	60
	30%	0-10	Representative attended several meetings management procedures	4	6	6	5	7	7	7	2	4	10	6	7	4	6	8	8	8	7	6	4
	10%	0=k/0=p	Was attended ceremony upon	0	1	0	0	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	0
		total	=V9*0.35+V10*0.25+V11*0.3+V12*0.1	30.45	40.4	40.8	30.25	45.2	35.7	38.2	21.1	27.7	25.35	38.9	40.7	37.2	34.4	39.5	37	41	38.2	42.9	33.7

I conducted interviews, and with the consent of respondents were given weights (score) for each component of the index components above.

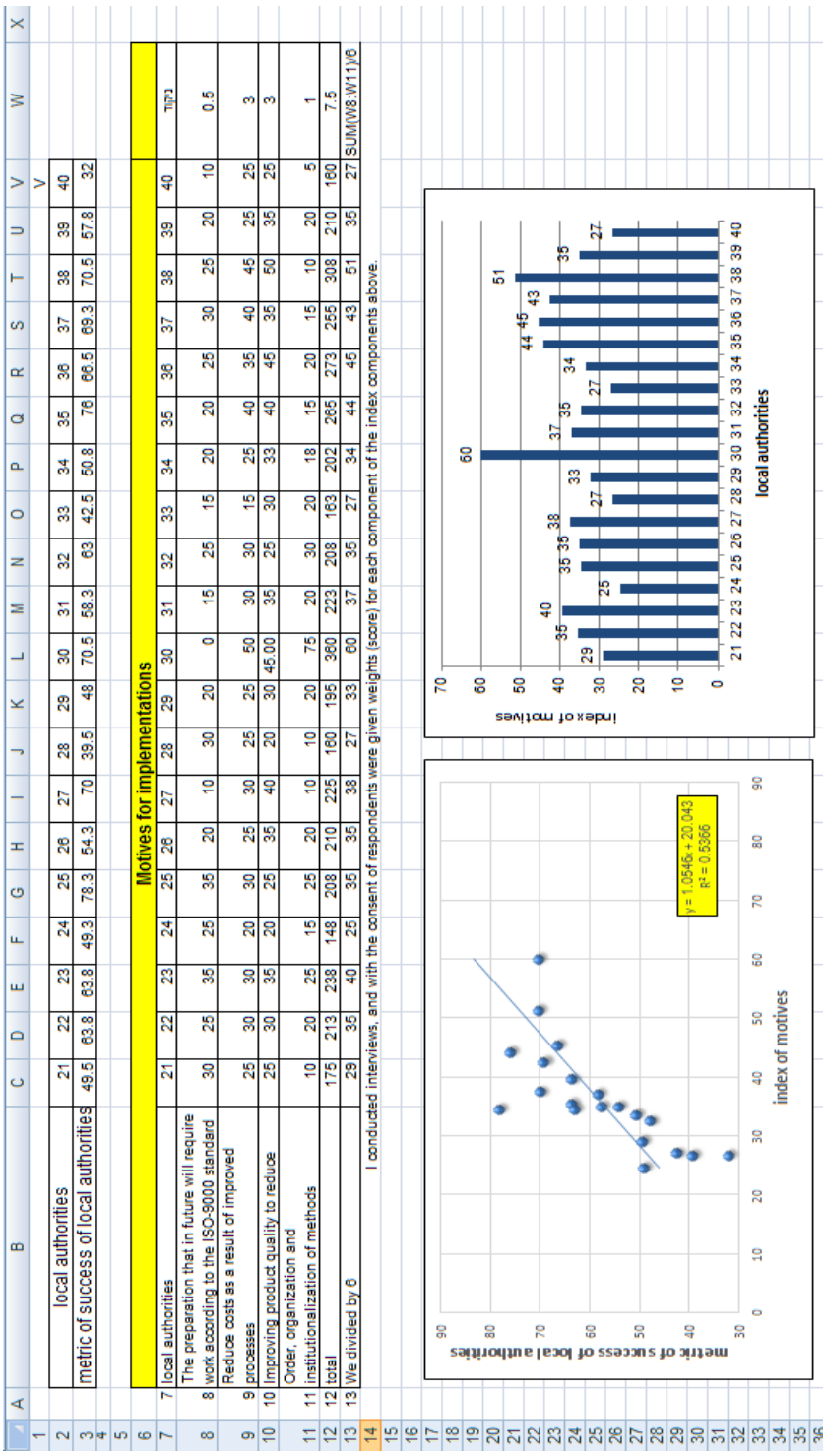
Appendix 3.2.2.

The correlation between Experience with quality and the success of authorities



Appendix 3.2.3.

The correlation between motives and the success of authorities



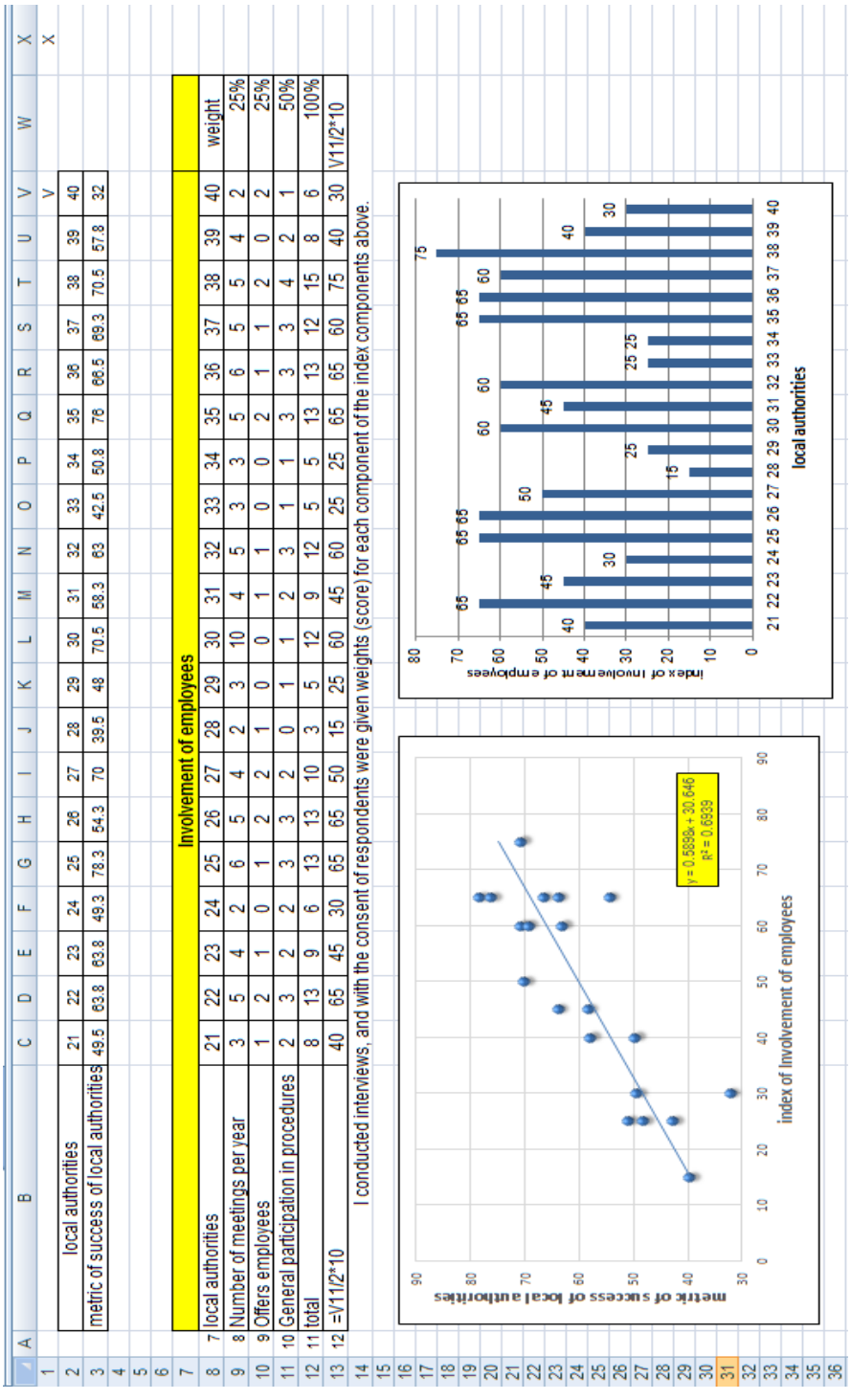
local authorities	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
metric of success of local authorities	49.5	63.8	63.8	49.3	78.3	54.3	70	39.5	48	70.5	58.3	63	42.5	50.8	76	66.5	69.3	70.5	57.8	32

Motives for implementations																					
local authorities	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	מדד
The preparation that in future will require work according to the ISO-9000 standard	30	25	35	25	35	20	10	30	20	0	15	25	15	20	20	25	30	25	20	10	0.5
Reduce costs as a result of improved processes	25	30	30	20	30	25	30	25	25	50	30	30	15	25	40	35	40	45	25	25	3
Improving product quality to reduce	25	30	35	20	25	35	40	20	30	45.00	35	25	30	33	40	45	35	50	35	25	3
Order, organization and institutionalization of methods	10	20	25	15	25	20	10	10	20	75	20	30	20	18	15	20	15	10	20	5	1
total	175	213	238	148	208	210	225	160	195	360	223	208	163	202	265	273	255	308	210	160	7.5
We divided by 6	29	35	40	25	35	35	38	27	33	60	37	35	27	34	44	45	43	51	35	27	SUM(W8:W11)/6

I conducted interviews, and with the consent of respondents were given weights (score) for each component of the index components above.

Appendix 3.2.4.

The correlation between Involvement of employees and the success of authorities



local authorities	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
metric of success of local authorities	49.5	63.8	63.8	49.3	78.3	54.3	70	39.5	48	70.5	58.3	63	42.5	50.8	78	66.5	89.3	70.5	57.8	32

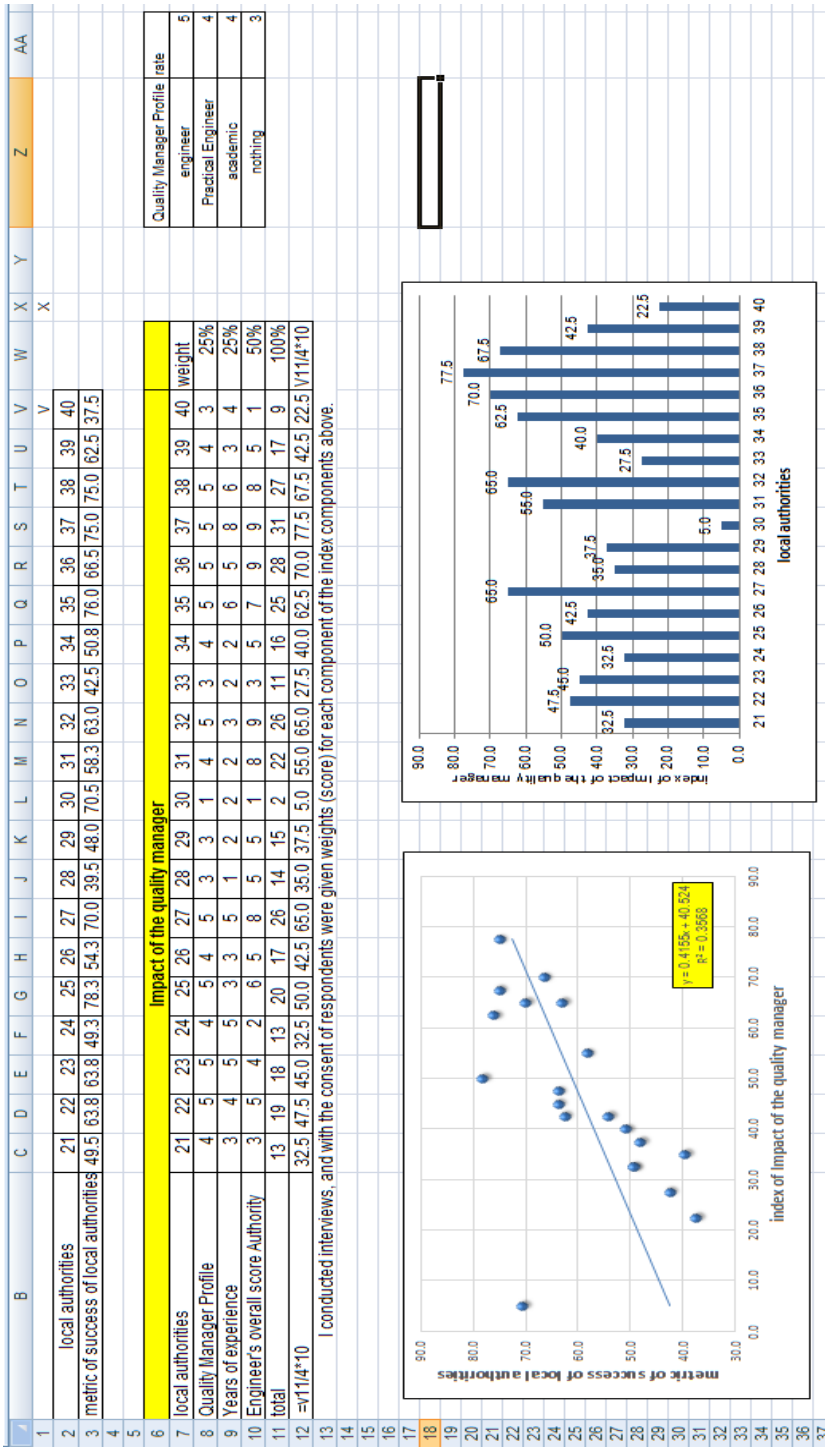
Involvement of employees																				
local authorities	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Number of meetings per year	3	5	4	2	6	5	4	2	3	10	4	5	3	3	5	6	5	5	4	2
Offers employees	1	2	1	0	1	2	2	1	0	0	1	1	0	0	2	1	1	2	0	2
General participation in procedures	2	3	2	2	3	3	2	0	1	1	2	3	1	1	3	3	3	4	2	1
total	8	13	9	6	13	13	10	3	5	12	9	12	5	5	13	13	12	15	8	6
=V11/2*10	40	65	45	30	65	65	50	15	25	60	45	60	25	25	65	65	60	75	40	30

weight
25%
25%
50%
100%
V11/2*10

I conducted interviews, and with the consent of respondents were given weights (score) for each component of the index components above.

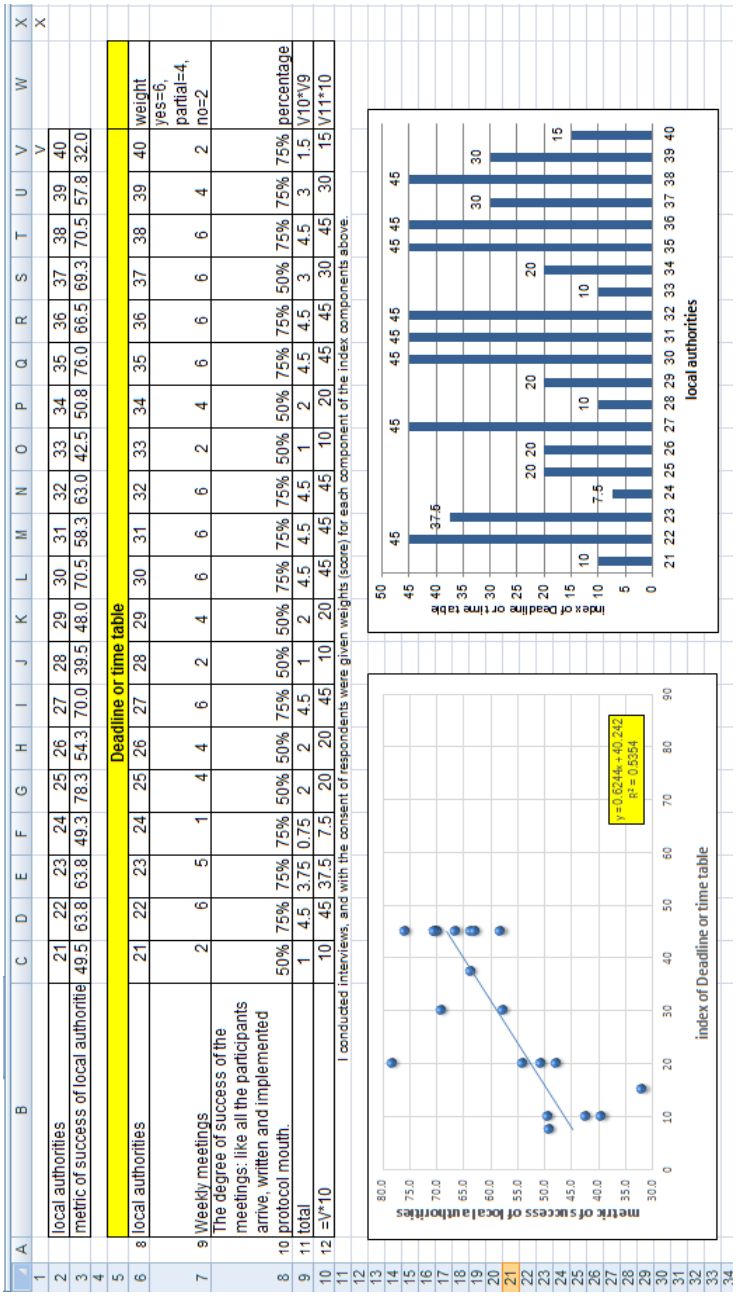
Appendix 3.2.5.

The correlation between Impact of the quality manager and the success of authorities



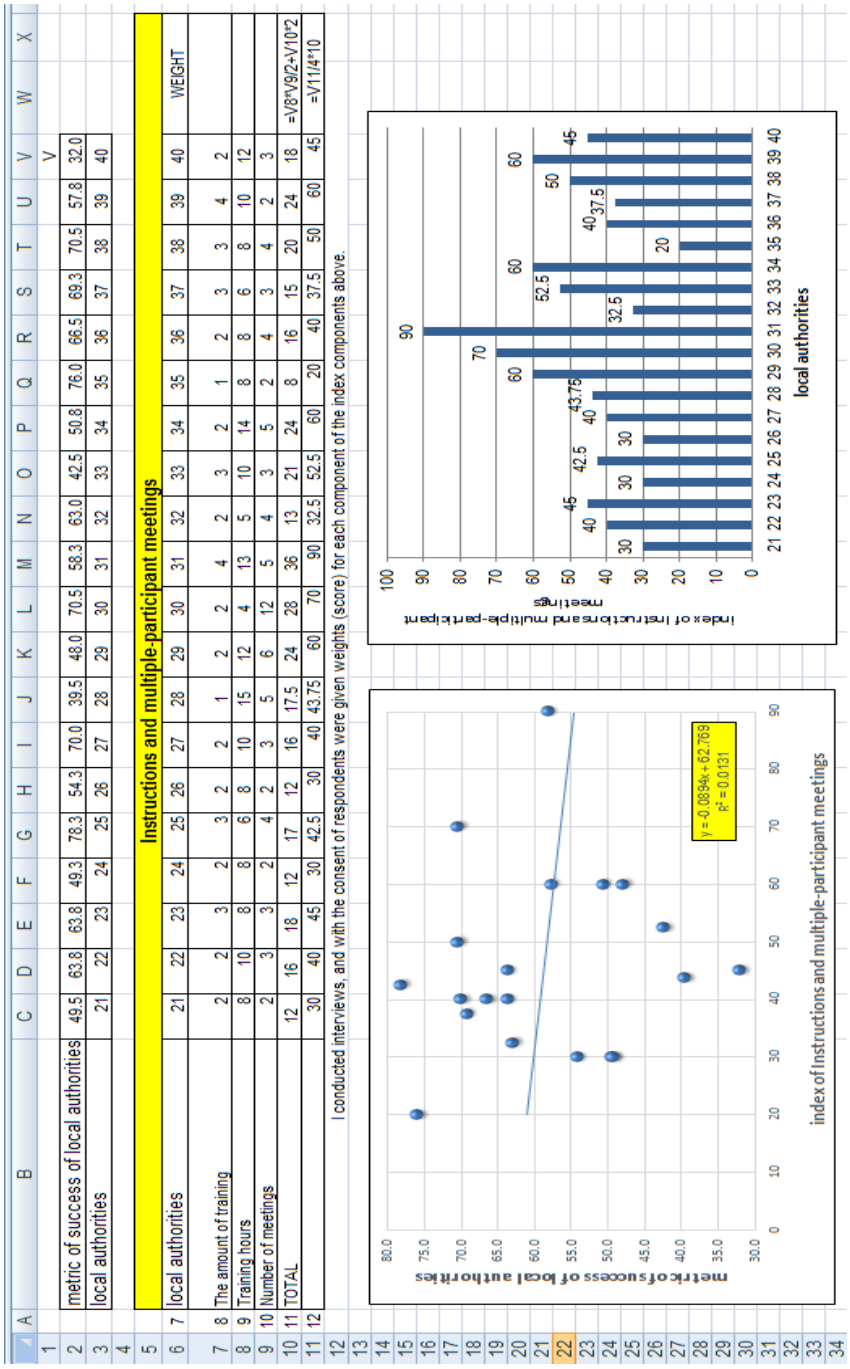
Appendix 3.2.6.

The correlation between Deadline or time table and the success of authorities



Appendix 3.2.7.

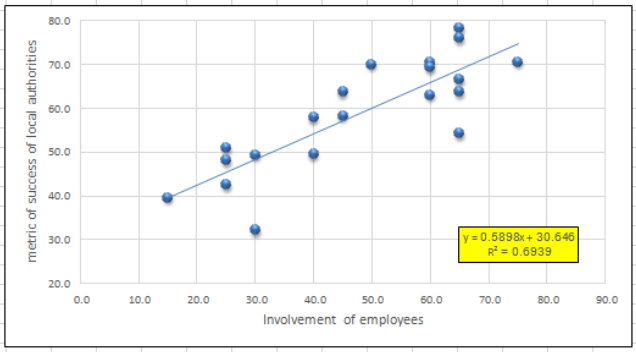
The correlation between Instructions and multiple-participant meetings and the success of authorities



Appendix 3.2.8.

The correlation between Involvement of employees and the success of authorities

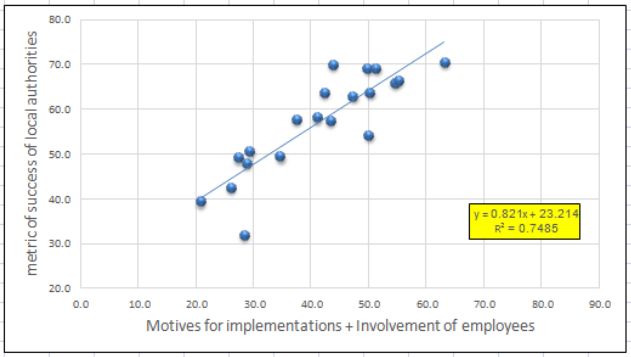
r^2	number	number of local authority	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		metric of success of local auth	49.5	63.8	63.8	49.3	78.3	54.3	70.0	39.5	48.0	70.5	58.3	63.0	42.5	50.8	76.0	66.5	69.3	70.5	57.8	32.0
0.303	1	Involvement of management	30.5	40.4	40.8	30.3	45.2	35.7	38.2	21.1	27.7	25.4	38.9	40.7	37.2	34.4	39.5	37.0	41.0	38.2	42.9	33.7
0.001	2	Experience with quality	0.0	40.0	40.0	30.0	10.0	10.0	40.0	10.0	0.0	20.0	40.0	40.0	30.0	40.0	40.0	10.0	10.0	20.0	40.0	40.0
0.536	3	Motives for implementations	29.2	35.4	39.6	24.6	34.6	35.0	37.5	26.7	32.5	60.0	37.1	34.6	27.1	33.7	44.2	45.4	42.5	51.3	35.0	26.7
0.693	4	Involvement of employees	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	60.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0
0.357	5	Impact of the quality manage	32.5	47.5	45.0	32.5	50.0	42.5	65.0	35.0	37.5	5.0	55.0	65.0	27.5	40.0	62.5	70.0	77.5	67.5	42.5	22.5
0.535	6	Deadline or time table	10.0	45.0	37.5	7.5	20.0	20.0	45.0	10.0	20.0	45.0	45.0	45.0	10.0	20.0	45.0	45.0	30.0	45.0	30.0	15.0
0.013	7	Instructions and multiple-par	30.0	40.0	45.0	30.0	42.5	30.0	40.0	43.8	60.0	70.0	90.0	32.5	52.5	60.0	20.0	40.0	37.5	50.0	60.0	45.0
		4	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	60.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0



Appendix 3.2.9.

The correlation between Involvement of employees + motives and the success of authorities

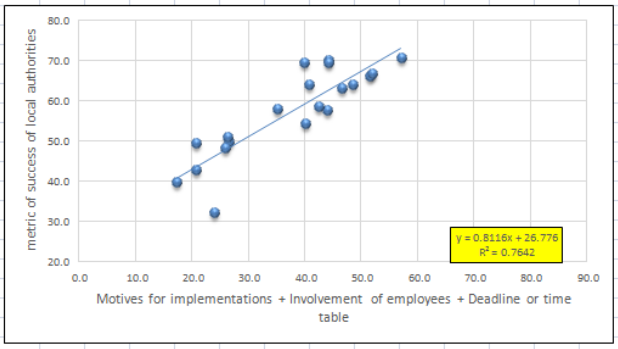
r^2	number	number of local authority	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		metric of success of local auth	49.5	63.8	63.8	49.3	69.3	54.3	70.0	39.5	48.0	57.5	58.3	63.0	42.5	50.8	66.0	66.5	69.3	70.5	57.8	32.0
0.303	1	Involvement of management	30.5	40.4	40.8	30.3	45.2	35.7	38.2	21.1	27.7	47.4	38.9	40.7	37.2	34.4	39.5	37.0	41.0	38.2	42.9	33.7
0.001	2	Experience with quality	0.0	40.0	40.0	30.0	10.0	10.0	40.0	10.0	0.0	20.0	40.0	40.0	30.0	40.0	40.0	10.0	10.0	20.0	40.0	40.0
0.536	3	Motives for implementations	29.2	35.4	39.6	24.6	34.6	35.0	37.5	26.7	32.5	36.7	37.1	34.6	27.1	33.7	44.2	45.4	42.5	51.3	35.0	26.7
0.693	4	Involvement of employees	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	50.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0
0.357	5	Impact of the quality manage	32.5	47.5	45.0	32.5	50.0	42.5	65.0	35.0	37.5	47.5	55.0	65.0	27.5	40.0	62.5	70.0	77.5	67.5	42.5	22.5
0.535	6	Deadline or time table	10.0	45.0	37.5	7.5	20.0	20.0	45.0	10.0	20.0	45.0	45.0	45.0	10.0	20.0	45.0	45.0	30.0	45.0	30.0	15.0
0.013	7	Instructions and multiple-par	30.0	40.0	45.0	30.0	42.5	30.0	40.0	43.8	60.0	28.8	90.0	32.5	52.5	60.0	20.0	40.0	37.5	50.0	60.0	45.0
		3+4	34.6	50.2	42.3	27.3	49.8	50.0	43.8	20.8	28.8	43.3	41.0	47.3	26.0	29.3	54.6	55.2	51.3	63.1	37.5	28.3



Appendix 3.2.10.

The correlation between Involvement of employees + motives + Deadline or time table and the success of authorities

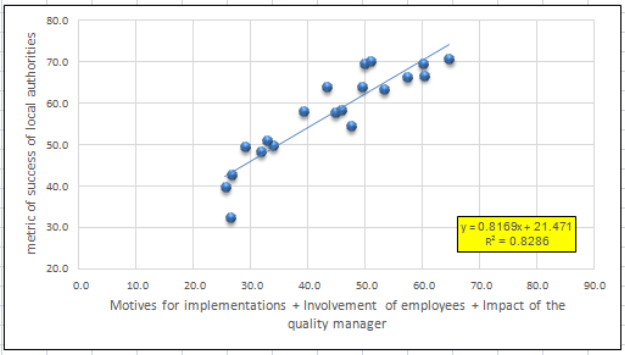
r^2	number	number of local authority	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		metric of success of local auth	49.5	63.8	63.8	49.3	69.3	54.3	70.0	39.5	48.0	57.5	58.3	63.0	42.5	50.8	66.0	66.5	69.3	70.5	57.8	32.0
0.303	1	Involvement of management	30.5	40.4	40.8	30.3	45.2	35.7	38.2	21.1	27.7	47.4	38.9	40.7	37.2	34.4	39.5	37.0	41.0	38.2	42.9	33.7
0.001	2	Experience with quality	0.0	40.0	40.0	30.0	10.0	10.0	40.0	10.0	0.0	20.0	40.0	40.0	30.0	40.0	40.0	10.0	10.0	20.0	40.0	40.0
0.536	3	Motives for implementations	29.2	35.4	39.6	24.6	34.6	35.0	37.5	26.7	32.5	36.7	37.1	34.6	27.1	33.7	44.2	45.4	42.5	51.3	35.0	26.7
0.693	4	Involvement of employees	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	50.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0
0.357	5	Impact of the quality manage	32.5	47.5	45.0	32.5	50.0	42.5	65.0	35.0	37.5	47.5	55.0	65.0	27.5	40.0	62.5	70.0	77.5	67.5	42.5	22.5
0.535	6	Deadline or time table	10.0	45.0	37.5	7.5	20.0	20.0	45.0	10.0	20.0	45.0	45.0	45.0	10.0	20.0	45.0	45.0	30.0	45.0	30.0	15.0
0.013	7	Instructions and multiple-par	30.0	40.0	45.0	30.0	42.5	30.0	40.0	43.8	60.0	28.8	90.0	32.5	52.5	60.0	20.0	40.0	37.5	50.0	60.0	45.0
		3+4+6	26.4	48.5	40.7	20.7	39.9	40.0	44.2	17.2	25.8	43.9	42.4	46.5	20.7	26.2	51.4	51.8	44.2	57.1	35.0	23.9



Appendix 3.2.11.

The correlation between Involvement of employees + motives + Impact of the quality manager and the success of authorities

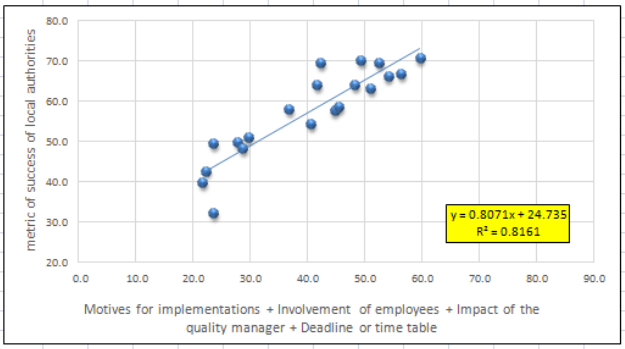
r^2	number	number of local authority	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		metric of success of local auth	49.5	63.8	63.8	49.3	69.3	54.3	70.0	39.5	48.0	57.5	58.3	63.0	42.5	50.8	66.0	66.5	69.3	70.5	57.8	32.0
0.303	1	Involvement of management	30.5	40.4	40.8	30.3	45.2	35.7	38.2	21.1	27.7	47.4	38.9	40.7	37.2	34.4	39.5	37.0	41.0	38.2	42.9	33.7
0.001	2	Experience with quality	0.0	40.0	40.0	30.0	10.0	10.0	40.0	10.0	0.0	20.0	40.0	40.0	30.0	40.0	40.0	10.0	10.0	20.0	40.0	40.0
0.536	3	Motives for implementations	29.2	35.4	39.6	24.6	34.6	35.0	37.5	26.7	32.5	36.7	37.1	34.6	27.1	33.7	44.2	45.4	42.5	51.3	35.0	26.7
0.693	4	Involvement of employees	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	50.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0
0.357	5	Impact of the quality manage	32.5	47.5	45.0	32.5	50.0	42.5	65.0	35.0	37.5	47.5	55.0	65.0	27.5	40.0	62.5	70.0	77.5	67.5	42.5	22.5
0.535	6	Deadline or time table	10.0	45.0	37.5	7.5	20.0	20.0	45.0	10.0	20.0	45.0	45.0	45.0	10.0	20.0	45.0	45.0	30.0	45.0	30.0	15.0
0.013	7	Instructions and multiple-par	30.0	40.0	45.0	30.0	42.5	30.0	40.0	43.8	60.0	28.8	90.0	32.5	52.5	60.0	20.0	40.0	37.5	50.0	60.0	45.0
		3+4+5	33.9	49.3	43.2	29.0	49.9	47.5	50.8	25.6	31.7	44.7	45.7	53.2	26.5	32.9	57.2	60.1	60.0	64.6	39.2	26.4



Appendix 3.2.12.

The correlation between Involvement of employees + motives + Impact of the quality manager + Deadline of time table and the success of authorities

	r^2	number	number of local authority	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
			metric of success of local auth	49.5	63.8	63.8	49.3	69.3	54.3	70.0	39.5	48.0	57.5	58.3	63.0	42.5	50.8	66.0	66.5	69.3	70.5	57.8	32.0
	0.303	1	Involvement of management	30.5	40.4	40.8	30.3	45.2	35.7	38.2	21.1	27.7	47.4	38.9	40.7	37.2	34.4	39.5	37.0	41.0	38.2	42.9	33.7
	0.001	2	Experience with quality	0.0	40.0	40.0	30.0	10.0	10.0	40.0	10.0	0.0	20.0	40.0	40.0	30.0	40.0	40.0	10.0	10.0	20.0	40.0	40.0
	0.536	3	Motives for implementations	29.2	35.4	39.6	24.6	34.6	35.0	37.5	26.7	32.5	36.7	37.1	34.6	27.1	33.7	44.2	45.4	42.5	51.3	35.0	26.7
	0.693	4	Involvement of employees	40.0	65.0	45.0	30.0	65.0	65.0	50.0	15.0	25.0	50.0	45.0	60.0	25.0	25.0	65.0	65.0	60.0	75.0	40.0	30.0
	0.357	5	Impact of the quality manage	32.5	47.5	45.0	32.5	50.0	42.5	65.0	35.0	37.5	47.5	55.0	65.0	27.5	40.0	62.5	70.0	77.5	67.5	42.5	22.5
	0.535	6	Deadline or time table	10.0	45.0	37.5	7.5	20.0	20.0	45.0	10.0	20.0	45.0	45.0	45.0	10.0	20.0	45.0	45.0	30.0	45.0	30.0	15.0
	0.013	7	Instructions and multiple-par	30.0	40.0	45.0	30.0	42.5	30.0	40.0	43.8	60.0	28.8	90.0	32.5	52.5	60.0	20.0	40.0	37.5	50.0	60.0	45.0
			3+4+5+6	27.9	48.2	41.8	23.6	42.4	40.6	49.4	21.7	28.8	44.8	45.5	51.1	22.4	29.7	54.2	56.4	52.5	59.7	36.9	23.5



Appendix 4.

About the ISO- 9000 series

The ISO 9000 family of standards, Includes a large number of standards for each field separately, for example:

1. ISO 9000:2015: This standard provides an overview of the concepts and principles of quality management. It defines terms and outlines the fundamental principles of quality management that are used throughout the ISO 9000 series. ISO 9000:2015 helps organizations understand the context of quality management and serves as a foundation for implementing other standards in the series.

2. ISO 9001:2015: This is the core standard in the ISO 9000 series and specifies the requirements for a QMS. ISO 9001:2015 sets out criteria for organizations to demonstrate their ability to consistently provide products and services that meet customer and regulatory requirements. The standard emphasizes a process approach, risk-based thinking, and continual improvement. It is designed to be flexible and applicable to organizations of all sizes and industries.

3. ISO 9004:2018: This standard provides guidelines for enhancing the overall performance of an organization, beyond the requirements of ISO 9001. ISO 9004:2018 focuses on achieving sustained success through a focus on stakeholders, leadership, strategy, and resource management. It encourages organizations to adopt a holistic approach to quality management and continual improvement.

4. ISO 19011: While not part of the ISO 9000 series, ISO 19011 provides guidance on auditing management systems, including QMS. It helps organizations conduct internal audits and external audits (such as for certification purposes) effectively and efficiently.

The ISO 9000 series is based on principles such as customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making, and relationship management. Organizations that implement ISO 9000 standards benefit from improved consistency in operations, enhanced customer satisfaction, better management of resources, and increased efficiency.

Certification to ISO 9001:2015 by an accredited certification body demonstrates an organization's conformity to the standard and its commitment to quality management. It can enhance an organization's reputation, improve its competitiveness, and open doors to new business opportunities.

Overall, ISO 9000:2015 and its related standards provide a robust framework for organizations to establish, implement, maintain, and continually improve their QMS, ultimately leading to enhanced performance and customer satisfaction.

Appendix 5.

Requirements of ISO-9001 series

Management	4.1	Management Responsibility
Management	4.2	Quality System
The company	4.5	Document and Data Control
The company	4.8	Product Identification and Tractability
The company	4.12	Inspection, Measuring and Testing Status
The company	4.13	Control of Nonconforming Products
The company	4.14	Corrective and Preventive Action
The company	4.16	Control of Quality Records
The company	4.17	Internal Quality Audits
The company	4.18	Training
Requirements	4.3	Order Entry
Requirements	4.4	Design Control
Requirements	4.6	Purchasing
Requirements	4.7	Control of Customer Supplied Products
Requirements	4.9	Process Control
Requirements	4.10	Inspection and Testing
Requirements	4.11	Inspection and Testing Equipment
Requirements	4.15	Handling, Storage, Packaging, and Delivery
Requirements	4.19	Servicing
Requirements	4.20	Statistical Techniques

Appendix 6.

Proposed Quality Guide for Local Authorities, (in Hebrew)

(Attached)

The model since 2016 the engineers have been gathering data and samples that approved by the country and industrial ministry, the model contains 110 form and sample of instructions that ready to apply, those models indicates to manage the engineering projects from planning to implication and tender all the way to planning to the contractor and apply it to the done deal projects, also it follows the procedures, therefore the models are several files while all these steps are on papers the real purpose is to transform it to a more application to computer program with saves us more time and it allow to share it to others to use and being helpful, the model program is formed in google sheets, and several employees can use in the same time and all of this is to done projects in a perfect form and time also to supervise it after.

1. The first part is about making sure that the higher ups approve the projects and models are following the global standards, therefore that model is made by the employees and the consultant of the quantity formed the laws and rules in EMC guides while all employees are excited and how the project is challenging them thus, include them.
2. The second part is the building's design that includes the tenders and contracts of the projects such as schools, playgrounds, clubs and so on.
3. The third part is taken to supervise the engineering projects.
4. The fourth part is about infrastructure such as water pipelines, streets and rainwater sewers.
5. The fifth part is about the project manager and the procedure of the file’s project details and so on.
6. The sixth part is about the structural planning that includes the files, tenders and contracts.
7. The seventh part is about general contracts that take the planning and samples of meetings and samples of the way to choose the project manager.
8. The eight part is about contracts with the main contractor.
9. Ninth part is about the general samples.

In Addition to all model’s forms there are instructions to guide to the steps and how to apply it throughout the process.

Local authority _____						
QM AZ	Engineering department		77****	Code	Address	
XXXXX@basmat.org.il		E-mail	04-999999	Fax	04-8***8	Telephone
Version: 1	Quality Policy Statement			Name	1.1.1F	Instructions

1.Definitions:

1.1. The quality policy - the set of goals of the implementation department, in the city improvement and engineering department of the local authority in the field of quality, and the steps taken to achieve them.

2. Quality policy statement of the execution department:

2.1. The execution division in the engineering department of the local authority is establishing a system of quality assurance in order to improve the quality of service of the public construction for the well-being of the residents, the procedure file of the quality manual complies with the ISO 9001:2015 standard. The execution division of the local authority has undertaken these obligations for the benefit of the residents. The council's engineer, the department manager, the project managers, the officials and the employees are obligated to comply with the procedures and obligations contained in the procedures file and to work according to them. The department manager believes that these obligations will help the department to improve the quality of construction and service.

3. The target:

3.1. The department's commitment is to a long-term excellent level of quality while constantly improving quality.

4. The method:

4.1. The director of the department, the engineer of the council as well as the head of the council, will allocate the necessary resources to operate the ISO 9001:2015 system of IT procedures.

4.2. The director of the department will ensure that the policy of the executive department is understood by all employees of the department. To this end, the authority appointed a quality assurance manager responsible for the implementation of the ISO 9001:2015 standard. All the procedures and obligations included in this file were reviewed and approved by the department manager, the council's engineer and the head of the council.

4.3. All employees of the department are responsible for implementing the requirements specified

in this set of procedures, to ensure the level of quality specified in all phases of construction. The management of the department will ensure that all employees are informed of the quality assurance procedures, through regular training and refresher activities.

4.4. The quality supervisor in the division will be the quality manager in the authority.

5. Responsibility: the quality assurance manager at the Authority.

6. The quality policy has been approved by:

6.1. Name of the head of the council: _____ Date: _____ Signature: _____

6.2. Department manager's name: _____ Date: _____ Signature: _____

6.3. Name of Council Engineer: _____ Date: _____ Signature: _____

6.4. Quality Assurance Manager Name: _____Date: _____ Signature: _____

Local authority _____					
QM AZ	Engineering department	77****	Code	Address	
XXXXX@basmat.org.il	E-mail	04-999999	Fax	04-8***8	Telephone
Version: 1	Internal quality checks		Name	1.1.1E	Instructions

1.Target

1.1. Detail and guide the quality assurance department, in the process of performing internal quality checks related to quality assurance procedures according to ISO 9001:2015.

1.2. To serve as a tool for administrative control of the projects.

1.3. Establish a clear and uniform method for performing internal quality checks.

2. The method:

2.1. Internal quality checks of the execution processes of the ISO 9001:2015 it practices will be conducted with the frequency of an annual round.

2.1.1. The inspections will be conducted by the quality assurance manager or someone authorized by him. The inspector will be an independent factor regarding the inspected entity.

2.1.2. The inspections will be conducted according to an annual plan that determines the inspection schedule for the entire department Form No. 1.1.3 with the help of a pre-written checklist. At the discretion of the quality assurance manager, additional internal quality

inspections will be conducted in addition to this list.

2.2. In these inspections, all sections of the standard related to quality assurance procedures according to ISO 9001:2015 will be tested in order to examine and verify their compliance with the requirements of the standard, as well as control of the audited documentation including applicable documents.

2.3. In the tests, the employees of the department will be asked about the whole range of activities they perform, about the aspects of quality involved in their work, and their level of understanding of their role and their awareness of the ISO 9001:2015 it procedures will be tested.

2.4. The quality checks will be carried out according to a checklist for carrying out internal checks which will be contained on form 1.1.3 and will be documented in the department's offices in the internal quality checks file. Comments will be detailed on an additional printout page that will be attached to the test summary.

2.5. The summaries of the internal tests will be discussed in the management survey. If necessary, corrective action will be taken by the test editor or quality assurance manager (department manager) project manager.

2.6. A copy of the internal quality check will be sent to the manager of the project reviewed in the check.

2.7. In the management survey, the effectiveness and performance of the repairs and corrective actions will be examined, and if necessary, a repeat inspection will be conducted.

2.8. Changes/updates to the annual schedule for performing the tests will be made by the quality assurance manager.

2.9. The examiners will be trained for their role.

3. responsibility:

3.1. Responsibility for implementing this procedure applies to the Quality Assurance Manager.

4. Applicable Documents:

4.1. Annual plan to perform internal quality checks No. 1.1.2

4.2. Internal quality check form No. 1.1.3

<table>
<tr><td colspan="7">Local authority _____</td></tr>
<tr><td>QM AZ</td><td colspan="2">Engineering department</td><td>77****</td><td>Code</td><td colspan="2">Address</td></tr>
<tr><td colspan="2">XXXXX@basmat.org.il</td><td>E-mail</td><td>04-999999</td><td>Fax</td><td>04-8***8</td><td>Telephone</td></tr>
<tr><td>Version: 1</td><td colspan="3">The quality system</td><td>Name</td><td>1.1.1D</td><td>Instructions</td></tr>
</table>

1. Definition:

1.1. Quality system - the organizational structure, responsibilities, procedures, processes and resources used for quality management.

2. targets:

2.1. To operate a documented quality system, based on the procedures of ISO 9000

2.2. To detail and guide the employees of the department and the quality assurance manager, in matters where involvement and executive responsibility is required.

2.3. Determine a clear and uniform method for operating the quality system in the construction department of the council.

3. The method:

3.1. The authority and responsibility of the department's employees derives from the department's quality policy statement.

3.2. The quality system is divided into four levels of the "documentation pyramid":

<table>
<tr><td colspan="3">Forms, quality plan, quality records</td></tr>
<tr><td colspan="3">Laws, specifications, standards and regulations</td></tr>
<tr><td>Quality assurance procedures</td><td></td><td>Internal procedures</td></tr>
</table>

3.2.1. Procedures - instructions for carrying out the works and managing projects, tests, etc.

3.2.2. Forms - are used to implement and control procedures and work instructions.

3.3. Quality plans - as part of the quality system, a quality plan will be implemented for each construction project. The quality plan will be compiled by the project manager and approved by the department manager. The quality plan will include the following sections:

3.3.1. Description of the project.

3.3.2. Organizational structure of the project team.

3.3.3. budget/financial control.

3.3.4. Reference to procedures and work instructions relevant to the project.

3.3.5. Internal testing program.

3.3.6. Test programs during the project.

3.3.7. Program of audits within the framework of management.

3.3.8. Consultants and planners.

3.4A complete and updated copy of the main procedures file will be kept by the following parties:

3.4.1. The head of the council.

3.4.2. The council engineer.

3.4.3. Treasurer of the Council.

3.4.4. Secretary / CEO of the Council.

3.4.5. Department manager.

3.4.6. Quality Assurance Manager.

3.4.7. The project managers.

3.5. All office holders in the department will act according to their job description and in accordance with the department's organizational structure, and will also have in their possession the procedures that belong to their field.

3.6. Procedures that have been canceled or changed and replaced with new procedures must be destroyed.

3.7. All employees of the department, at all levels, will perform the work according to the appropriate instructions and specifications, in accordance with the ISO 9001:2015 quality assurance procedures

3.8. The director of the department in collaboration with the council's engineer will allocate the necessary resources for the operation of the ISO 9001:2015 system of procedures and their ongoing implementation according to the following schedule:

3.8.1. Administrative personnel - The quality assurance manager of the council will serve as the authority's quality assurance manager.

3.8.2. Training days for employees, as detailed in the employee training procedure, appropriate equipment as required.

3.9. The Council's quality assurance manager will maintain close contact with the various departments in the Authority and the various construction projects regarding the implementation of procedures, quality examination, internal inspections, detailing reports and forms.

3.10. The objectives of the quality system

3.10.1. Verify that the execution conforms to the requirements of the specifications and the contract.

3.10.2. Verify the Council's ability to meet the requirements of the contract.

3.10.3. Ensure the existence of a dynamic and advanced quality assurance system, which will adapt itself to current requirements of the performance levels.

3.10.4. Discovering defects and problems in real time, in order to reduce the damage or avoid it.

3.10.5. Gathering data and analyzing problems discovered for the purpose of drawing lessons.

3.10.6. Monitoring the implementation and execution of quality assurance instructions by all department employees.

3.10.7. Continuous improvement of the system.

4. Warranty:

4.1. The responsibility for implementing this procedure applies to the quality assurance manager.

5. The quality policy has been approved by:

5.1. Name of the head of the council: _____ Date: _____ Signature: _____

5.2. Name of the department manager: _____ Date: _____ Signature: _____

5.3. Name of Council Engineer: _____ Date: _____ Signature: _____

5.4. Name of Quality Assurance Manager: _____Date: _____ Signature: _____

Appendix 7.1.

Letter from Islam Amara General Manager Canna of Galilee Local Council

המועצה המקומית כפר כנא לשכת מנכ"ל המועצה 04-8847658 mancal.cana@gmail.com	CANNA OF GALILEE LOCAL COUNCIL	مجلس محلي كفركنا جناح مدير عام المجلس المحلي 04-8847620 CODE: 16930

May 12th, 2023

re: the topic of "The Model of Quality Management System in Public Organizations of Constructions", by Awny Zrekat, PhD student at the State University of Moldova

To whom this may concern:

I, Islam Amara, am the General Manager of the Canna of Galilee Local Council. I testify and confirm the implementation of the Quality Management Guides of which Awny Zrekat has introduced to us over two years ago. Since then, the Engineering and construction projects we have been involved with have become so much better. Everything gets done faster and without problems. Examples of this are the 1,200sq. meter school which was completed in only 6 months time. In addition, the widening of the road project 'Road No. 2'.which was put on hold for 6 years until the successful integration of the Quality Management Guidelines. I attest that the results we have seen have made a huge improvement in our public organization of construction.

With all respect,

Islam Amara

General Manager

Canna of Galilee Local Council

Appendix 7.2.

Letter from Talal Affan Engineer of Elbatof Regional Council

August 19th, 2023

re: the topic of "The Model of Quality Management System in Public Organizations of Constructions", by Awny Zrekat, PhD student at the State University of Moldova

To whom this may concern:

I, Talal Affan, am the Engineer of Albatuf Regional Council. I testify and confirm the implementation of the Quality Management Guides of which Awny Zrekat has introduced to us over two years ago. Since then, the Engineering and construction projects we have been involved with have became so much better. Everything gets done faster and without problems. I attest that the results we have seen have made a huge improvement in our public organization of construction.

With all respect,

Talal Affan

Engineer of the Albatuf Regional Council

Appendix 7.3.

Letter from Jamal Zubidat Engineer of Basmat Taboun Local Council

המועצה מקומית בסמת טבעון
المجلس المحلي بسمة طبعون

April 24th, 2023

"The Model of Quality Management System in Public Organizations of Constructions"

by Awny Zrekat, PhD student at the State University of Moldova

I, Jamal Zubidat, am the Engineer of Basmat Taboun local Council. I testify and confirm the implementation of the Quality Management Guides of which Awny Zrekat has introduced to us over four years ago. Since then, the construction projects we have been involved with have become so much better. Everything gets done faster and without problems.

I attest that the results we have seen have made a huge improvement in our public organization of construction.

With all respect,

Jamal Zubidat

Engineer of the Basmat Taboun local Council

רחוב ראשי 29 בסמת טבעון ת"ד 6030 מיקוד 36008 טל: 04-9832403 פקס 04-9531398 דוא"ל: bosmat@bosmat.org.il
www.basmattabun.muni.il

Appendix 7.4.

Letter from Majed Awawdi the Head Of Engineering Department of Canna Of Galilee Local Council

המועצה המקומית כפר כנא
לשכת מנכ"ל המועצה

04-8847658 Fax
mancal.cana@gmail.com

CANNA OF GALILEE
LOCAL COUNCIL

مجلس محلي كفركنا
جناح مدير عام المجلس المحلي

04-8847620
CODE: 16930

January 22th, 2024

re: the topic of "The Model of Quality Management System in Public Organizations of Constructions", by Awny Zrekat, PhD student at the State University of Moldova

To whom this may concern:

I, Majed Awawdi, The Head of Engineering Department of the Canna of Galilee Local Council. I testify and confirm the implementation of the Quality Management Guides of which Awny Zrekat has introduced to us over these days. The Engineering and construction projects we have been involved with have become so much better. Everything gets done faster and without problems. I attest that the results we have seen have made a huge improvement in our public organization of construction.

With all respect,

Majed Awawdi
The Head of Engineering Department
Canna of Galilee Local Council

STATEMENT OF ACCOUNTABILITY

Undersigned, I, ZRIKAT AWNY, declare personal responsibility that the materials presented in thesis are the result of My research and scientific achievements. Aware that in the event not, will suffer the consequences in accordance with the law.

ZRIKAT AWNY

CURRICULUM VITAE

Personal information

Date of birth: 04/01/1966

Surname: Zrikat

First name: Awny Said

Address: Haifa Mashash harav 15

Postal code: 3216705

Country: ISRAEL

Telephone: +972-4-6519468

Mobile: +972-52-6200038

E-mail: awny.eng@gmail.com

Work experience:

2011 - now: Lecturer in Sami Shamun college in Beer-Sheva – teaching of construction management and computerization subjects.

2011 - now: Lecturer in the national college for practical engineers in the Technion - teaching of construction management subjects.

1992 – 2018: Local council engineer of Kafar Kana - planning, development and supervision of public projects. Team management of practical engineers.

2006-2010: Hashalom College manager, Kafar Kana, specializing in the subjects of construction, management and safety

2003-2004: Lecturer for the subjects of construction organizing and management, practical engineers school of Tel-Aviv college, Nazareth Elite.

2000-2003: Consultant for procedures writing for local authorities, projects management procedures implementation for external contractors.

1997-2003: Lecturer and construction faculty coordinator, Gernata college, Kafar Kana, for subjects of: theory of construction, construction, calculation of quantities.

1992-1998: Designer in A. A. Planning and Supervision, engineering design and architecture firm, Tiberius

1991-1992: Teacher in a construction college in Tiberias. Subjects: construction site management, statistical calculations, work safety, theory of construction

Education and training

2004-2006: MBA, Master's Degree in business management, Technion, Haifa

2000-2003: Master's Degree in civil engineering, Technion, Haifa

1999-2000: Completion of all professions of construction management chain, in civil engineering, Technion, Haifa, total 24 points.

1996-1998: Bachelor degree in civil engineering – University of Sankt-Petersburg for civil engineering and architecture, Saint Petersburg, Russia

1992-1994: Practical engineers for teaching– Nazareth– Elite college, Nazareth -Elite.

1984-1986: Constructions practical engineer, graduate with honors of national school for adult practical engineers, Technion, Haifa

Languages: Arabic, Hebrew, English

Additional information and annexes

Courses and apprenticeships:

2008: Constructions safety and civil construction for civil engineers, Ilan Karmon safety ltd., Haifa.

2003-2004: Transport managers – national institute for transport, Haifa.

2000: Arbitrator diploma – national institute for specialist opinions and arbitrators, Haifa

Additional activity:

2003: Winner of the Sapir Award for practical research in Local Government.

Complete proficiency in AutoCAD, MS-Project, Word, Excel and C.

Coordinator for city engineers activity in the Galilee area.

Specialty - Director of Quality Assurance and Reliability.

Implementation of work procedures in local authorities.

Conference:

13-15.4.2015: Tel-Aviv Conference. Urban Development Featuring in Local Authorities Engineers in Israel.

12.11.2014: Nazareth Conference. Related Quality of Local Authorities Guide Featuring in Local Authorities Engineers. Sponsored by INJAZ.

27-30/10/2014: Conference tight with ISIN Unified ISSN 2345-1112, International Scientific Conference on the Management of Changing World.

30.4.2014: Nazareth Conference. Land and Housing Related Featuring a Wide Public and Municipal Workers. Sponsored by the Center for Alternative Planning.

Publications:

24.3.2015: www.mcd.org.il: Main Problems in Working to a Quality Guide.

2015: Studia Universitatis Moldaviae, Nr.2 (82), 2015. Models of Quality Management System:

Content and Scope.
2015: Studia Universitatis Moldaviae, Nr.2 (82), 2015. the Opportunity of Applying Models of Quality Management System in Public Construction Enterprises.
2014: Studia Universitatis Moldaviae, Nr.7 (77), 2014. Conceptualization of Notion of Quality in Evolution Approach.
2014: Studia Universitatis Moldaviae, Nr.7 (77), 2014. Systemic Treatment of Quality Management.
2005: The civil engineering, study material and definitions in construction management engineering.
2002: Writing procedures for projects management in local authorities.