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Factors Affecting Maintenance Management in Gaza Strip Governmental Hospitals

العوامل المؤثرة على ادارة الصيانة في المستشفيات الحكومية
بقطاع غزة

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إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

العوامل المؤثرة على ادارة الصيانة في المستشفيات الحكومية بقطاع غزة
**Factors Affecting Maintenance Management in Gaza Strip
Governmental Hospitals**

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بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ اسماعيل عبد ربه عبد الله الهسي لنيل درجة الماجستير في كلية الهندسة قسم الهندسة المدنية - إدارة المشروعات الهندسية وموضوعها:

العوامل المؤثرة على إدارة الصيانة في المستشفيات الحكومية بقطاع غزة Factors Affecting on Maintenance Management in Gaza Strip Governmental Hospitals

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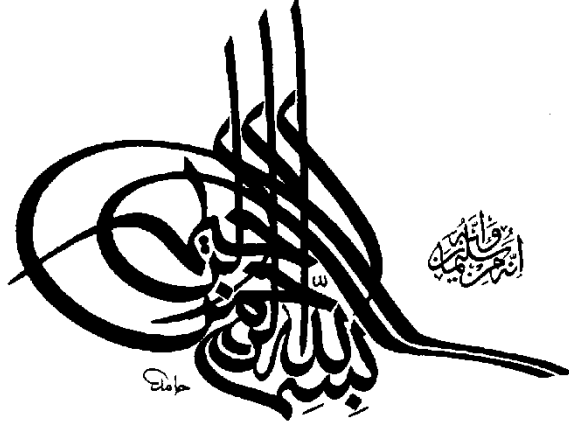
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نائب الرئيس لشئون البحث العلمي والدراسات العليا

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﴿وَقُلْ رَبِّ زِدْنِي عِلْمًا﴾

[طه: 114]

DEDICATION

To...

*My family for their patience and support,
and my friends for their love.*

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I address my sincere gratitude to Allah as whenever I faced any problem I used to pray to God to help me and he always was there protecting and saving me. Then, I would like to express my deep gratitude to my supervisor Dr. Khalid Al Hallaq, who spared much time in supporting me with all concern. I also want to thank Dr. Nabil Al-Sawalhi and Dr. Azam Abu Habib for their valuable role and comments throughout my research work and for agreeing to take part in my defense.

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ABSTRACT

As known the working at hospitals is 24 hours a day. A mistake in hospital maintenance can cost a life of a human. The Ministry of Health (MOH) is considered the main health service provider in Gaza Strip. Through interviews with maintenance managers in MOH, they commented that maintenance represents events of general plans, a set of actions. This research aims to put an effective plan by decision makers who work in filed to determine factors affecting on maintenance management. These factors are categorized into the human resources factors, maintenance projects factors, effect of policy and vision of the organization factors, effect of internal and external environment factors, effect of crisis policy factors, effective methods of treatment to reduce maintenance operations factors as illustrated in the questionnaire.

The choice of maintenance depends on type of work, items priority, efficiency, performance level, method of implementation, timing, the expected cost for every process. Classifications of maintenance vary from one department to another; depend on the number of engineers and technicians in the maintenance department, type of medical services, and system of procurement of services. The ways to carry out maintenance work are summarized as implementation of maintenance by a specialized department in hospitals, maintenance contracting with other parties out of hospitals, merge the last two ways.

The data analysis and discussion was included to identify factors affecting on hospitals maintenance management according to available data, discussion with maintenance managers and made a comparison with results shown in previous studies and papers. Maintenance projects in MOH include good comprehensive plans, accurate, criteria, complexity, etc. There were standards, priorities, a clear vision, and so on. Inadequate resources, maintenance of services has still not integrated into the design and installation, , insufficient instrumentation for monitoring, etc. Political instability, siege, challenges, wars, crises, , restrictions, conditions imposed by some donors, lack of investment in maintenance, lack of a comprehensive program all of these factors may be change the situation in MOH according to the questionnaire . A total of 226 from 250 completed copies had been received, representing valid response rate 90.4%.researcher recommended for determining priorities, needs, intelligent maintenance method.

ملخص البحث

من المعروف ان المستشفيات تعمل لمدة 24 ساعة في اليوم، والخطأ في الصيانة يكلف فقدان حياة شخص. ومن هذا المنطلق فإن الصيانة في المستشفيات لها أولوية في المشاريع نظراً لأهميتها. ومن خلال المقابلة مع مدراء الصيانة بوزارة الصحة تبين ان خدمة الصيانة تمثل احداث لخطط عامة لتوفير الخدمات وجعل المستشفيات تعمل بفعالية لتحقيق الاهداف. و يوجد العديد من انواع الصيانة مثل الصيانة الطارئة و الدورية والشاملة وانواع اخرى. وتنص العقود على وجود كفالة للصيانة في اي مشروع جديد تحدد بزمان يقدر بسنة منذ تسليم المشروع بشكل مبدئي. ونوع الصيانة يعتمد على نوع العمل والاولوية والكفاءة ومستوى الاداء وطريقة التنفيذ وعدد الكوادر المطلوب والتكلفة المتوقعة لكل عملية صيانة. و تعتبر وزارة الصحة المزود الرئيسي للخدمة الصحية في قطاع غزة موزعة على 5 محافظات.

وهدف البحث الرئيسي هو مساعدة اصحاب القرار بالمستشفيات الحكومية ايجاد العوامل المؤثرة على ادارة الصيانة واعداد الخطط الفعالة لعملياتها. و صنفنا الاهداف الفرعية حسب اراء الخبراء بالمستشفيات مع بعض التعديلات حسب الدراسات السابقة، عوامل متعلقة بالموارد البشرية و اخرى متعلقة بمشاريع الصيانة وعوامل تخص سياسة ورؤية الوزارة و اخرى متعلقة بالبيئة الداخلية والخارجية وعوامل متعلقة بسياسة الازمات الخارجية المؤثرة على الوزارة و متعلقة بوجود طريقة فعالة للعلاج وتقليل عدد عمليات الصيانة لأطول فترة ممكنة لتكون متوافقة مع اهداف البحث كما في الاستبانة.

وتصنف الصيانة بطرق مختلفة حيث تختلف من قسم لأخر حسب عدد المهندسين والفنيين في اقسام الصيانة ونوع الخدمات الصحية المقدمة والنموذج الاداري للدوائر ومناسبة التصنيف لأداء العمل واشتراء الخدمة. ويوجد ثلاثة طرق لتنفيذ الصيانة اما عن طريق الطواقم المختصة بالصيانة داخل المستشفى او طواقم صيانة من خارج المستشفى او كلاهما معا. ومسؤولية اقسام الصيانة هو المحافظة على حياة العاملين والمرضى اثناء العمل. و طبقاً للبيانات المتوفرة من قبل مدراء الصيانة في المستشفيات تم وضع البيانات في استبانة بعد معالجتها وازدادة بعض التعديلات و ايجاد النتائج ومقارنتها بالنتائج القياسية حسب الدراسات السابقة وفق منظومة شاملة. ولكن هذه الخطط تواجه تعقيدات في اتصالات التمويل والغموض في جداول الكميات وانظمة المشتريات. ولتوفر مقاييس جيدة واولويات لاتخاذ القرار، ولا بد من وجود تنسيق مع ادارة التعاون الدولي بالوزارة ورؤية واضحة من حيث الضمانات والانظمة المتبعة سواء الحوسبة والبرامج ووضع افكار مبدئية وبتطبيق انظمة الاستدامة وانظمة التحكم الحديثة لمشاريع الصيانة الشاملة.

و في الخمس سنوات الاخيرة طرأ تحسن على البيئة الداخلية والخارجية للوزارة رغم الحصار المطبق حيث اصبحت الخدمة افضل من ذي قبل ويرجع ذلك للتعامل مع متخصصين وخبراء وانظمة تعاقد وتعاون جيد. ولكن هناك نقص في المصادر وعدم اكتمال ادراج الصيانة ضمن الاعتبارات اثناء مرحلة التصميم لقلّة الثقة وحجم التعقيدات وعدم كفاية ادوات الرقابة وصعوبة التركيبات للمواد وقلّة التدريب الخارجي والكفاءات غير كافية وكذلك سوء الفهم في بعض التقييمات. وعدم الاستقرار السياسي والانقسام والحصار والتحديات والحروب والازمات والعقاب الجماعي المفروض على القطاع ادى الى تقييد بعض انظمة التمويل بعدم الاستثمار بمجال الصيانة ودفعهم الى اعتبار الصيانة شئ ثانوي مقارنة بالمشاريع الاخرى وذلك لعدم شمولية البرامج التي يمكن ان تغير الكثير في اداء الصيانة في المستشفيات بقطاع غزة.

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LIST OF ABBREVIATIONS

AME	Annual Maintenance Expenditure
ANOVA	Analysis of Variance
BD	Breakdown Maintenance
BIFM	The British Institute of Facilities Management
BMS	Building Management Systems
BPI	Building Performance Indicator
BRI	Building Risk Indicator
CBM	Condition-Based Maintenance
DF	Degree of Freedom
GDMM	General Directory of Maintenance and Management
GMO	Global Maintenance Order
GM	Green Maintenance
GS	Gaza Strip
ICRC	International Committee of Red Cross
IDP	Integrated Design Process
IFMA	International Facilities Management Association
IHS	Indian Health Service
FAC	Facility Coefficient
FEM	Facility Engineering Maintenance
FM	Facility Management
FMM	Facility Maintenance and Management
MAI	Maintenance Achievement Index
MEI	Maintenance Efficiency Indicator
MOF	Ministry of Finance
MOH	Ministry of Health

MM	Maintenance Management
M&R	Maintenance and Repair
NAME	Normalized Annual Maintenance Expenditure
PD	Procurement Department
PI	Performance Indicator
PM	Preventive Maintenance
PP	Projected Performance
RII	Relative Important Index
RMO	Reliability Maintenance Order
SD	Standard Deviation
SPSS	Statistical Package for the Social Science
TQM	Total Quality Management
UNDP	United Nations Development Programme
UNESCO	United Nations Educational Scientific & Cultural Organization
VMO	Value-Based Maintenance Order
VBM	Vibration-Based Maintenance
WHO	World Health Organization

1. CHAPTER ONE: INTRODUCTION

This chapter presents a general introduction to the study which introduced an overview about the situation of the maintenance management in Gaza strip governmental hospitals. It also provided problem statement, the important of study, the research aim and objectives, and an overview of chapters.

1.1 Background

To achieve excellent maintenance is to have a maintenance management that matches as closely as possible the expected requirements of the user (Zawawi et al, 2010). Each hospital is comprised of a wide range of services (Carr, 2010). Iyagba and Adenuga believed that is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, requisite building materials and methods (Adenuga et al., 2007). Hartman (1987) stated that good design is in itself maintenance, and non-maintenance is a factor/product of good design (Lam, 2004). The Ministry of Health (MOH) is considered the main health service provider in Gaza Strip as it runs 13 hospitals as shown in table (1.1):

Table 1.1: Basic data of hospitals in Gaza Strip (2010)(ref)

No.	Hospital Name	No. of Patients per year	No. of Beds	Built Area (m2)	Age (year)	No. of Maintenance Employees
1	Kaml Odwan Hospital	8,059	93	2,920	8	14
2	Beit Hanoun	4,775	53	1,440	4	6
3	AlShifa Hospital	50,225	585	21,500	64	91
4	Al Nasr Pediatric Hospital	8,996	159	1,500	48	10
5	Al Rantesi Hospital	1,595	47	2,200	5	8
6	Eyes Hospital	3,995	42	1,200	45	7
7	Psycho Hospital	314	42	980	30	7
8	Al Dorra Hospital	4,819	98	1,300	10	10
9	Al Aqsa Martyrs Hospital	16,228	126	4,000	9	25
10	Gaza European Hospital	13,822	250	5,500	23	34
11	Naser Hospital	39,480	315	10,000	52	49
12	Al Najjar Hospital	3,957	75	5,000	10	9
13	Emirates Crescent Hospital	16,228	52	800	10	5
Totals			1,937	58,340	285	

1.2 Problem Statement

Making decisions about hospital resource management is not a trivial activity and incorrect decision making can have serious consequences on the quality of health care services provided to the community (Amaral and Costa, 2014). Based on previous studies and interviews, in this research a list of factors affecting maintenance management in Gaza Strip governmental hospitals were developed. The research focused on MOH maintenance projects in Gaza strip to investigate, also who's responsible of decision making and the impacts of priority on maintenance projects process. A huge amount of expenditures, time consuming, resources usage, and how to get benefits, all of these purposes are needed to make an effective maintenance. Gaza hospitals have very small built area while the occupancy rate is very high. Maintenance function has continuously gone up in terms of its importance (Hartman, 1987). Good design is in itself maintenance, and non-maintenance is a factor/product of good design (Lam, 2004).

The effectiveness of maintenance management in hospitals on the overall services provided depends on:

1. What the important role played by the maintenance departments for the hospital?
2. What is the impact of maintenance management to reduce financial expenses?
3. What is the effect on the success of the organizational structure maintenance management process?
4. Classification and procurement procedures and the mechanism for implementing maintenance?
5. Maintenance work orders?

This study was chosen because there is an overlapping between roles in maintenance management, very large expenses of maintenance operation, effects of maintenance on the environments surrounded of patients, complexity of work, and little previous studies about this field.

1.3 Aim

To assist decision maker to plan maintenance effectively to minimize faults and measure factors affecting maintenance management in public hospital buildings in Gaza Strip.

1.4 Objectives

The principal objectives of this study are to:

- 1- To identify main factors that may influence decision making of maintenance management with reducing the overall costs of buildings maintenance in Gaza strip governmental hospitals.
- 2- To determine the criteria of the maintenance project items specially time and cost to do the maintenance.
- 3- To investigate the contradiction between the documents (specifications, drawings, bill of quantities) of the maintenance project to improving the internal environment of the buildings maintenance.
- 4- To increase staff productivity with life span of buildings in the hospital to minimize the private emergency and safety of patients in hospital.

1.5 Research Hypotheses

Hypothesis 1:

H0: Green maintenance is not an attempt to make maintenance more environmentally.

H1: Green maintenance is an attempt to make maintenance more environmentally.

Hypothesis 2:

H0: There is a relationship between the use of modern methods of maintenance management and the degree of real reducing of financial expenses.

H1: There is no relationship between the use of modern methods of maintenance management and the degree of real reducing of achievement of financial expenses.

1.6 Research Methods

Stage 1: This chapter shows the main methodologies used in previous studies and the methodology used in this research in order to achieve the required objectives.

Stage 2: Pilot study: Data collection was taken the form of a structured questionnaire; an initial pilot study was conducted to test the validity of the questionnaire through in-depth interviews with managers and decision maker in the MOH to explore their perceptions of decision making of maintenance management.

Stage 3: Research data was driven from managers and decision maker. The study was identified number of governmental participants.

The pilot study should prepare the ground for designing the main study questionnaire which will be used to identify main factors that may influence the maintenance management in public hospitals, to improve the performance and implementation.

The required data was collected also by personal interviews with managers and decision maker to:

- 1- Discuss who is the decision maker and his responsibility.
- 2- Determine the causes and cases that related to the choice items and its criteria that need maintenance.
- 3- Discover some hidden aspects of the research that enrich research opportunity.
- 4- Improve project maintenance management within the high quality and minimum time and cost.

1.7 Thesis Structure

This research consists of six main chapters as followings:

- Chapter one (Introduction): this chapter shows the main objectives of research, statement of the problem.
- Chapter two (Literature review): this chapter shows a historical review from previous studied to identify the main factors affecting maintenance in Gaza strip governmental hospitals, review the past experience and report that

related to the maintenance projects in hospitals and its impacts, and will also include review of methods of maintenance in hospital building.

- Chapter three (Research design and methodology)
- Chapter four: Analysis of the results: this chapter shows analysis, description and discussion of research results
- Chapter five (Case studies): includes two case studies which aimed to identify the effect of decision making of maintenance management such as conflicts on project through the implementation.
- Chapter six (Conclusions and recommendations): This chapter involves writing up suggested conclusions and recommendations for further study.
- Appendix

2. CHAPTER TWO: LITERATURE REVIEW

The literature review was undertaken using many scientific sources. Books, related studies, relevant scientific journals and other publications on factors affecting on maintenance management at governmental hospitals in order to make a tight foundation to this research. In this chapter, a view of factor affecting on maintenance management in hospitals firstly was introduced, secondly background about type and natural of maintenance in hospitals with its performance indicators and then some of appoint view about the design for maintenance and its choice, after that took about previous related research, properties affecting the maintenance, classifications of maintenance and its benefits, ways of implementing maintenance, responsibility, programs, obstacles. At last, the chapter stated the services procurement and contracts of maintenance in hospitals.

2.1 Introduction

Maintenance Management (MM) is done to achieve specific goals in the best way and minimum costs. MM is a leadership group of engineers, technicians and specialists working together to get the main objective of the maintenance. Decision making for effective maintenance of large systems is complex because it depends on several independent sources of information (Ni and Jin, 2012).

Factors were reviewed, including age of building, height, method of construction, social status of estate, labor force (Horner and El-Haram, 2002; Holmes and Droop, 1982; Son and Yuen, 1993). Human factors play an important role in these operations of a service, include the systematic application of information about human characteristics and behavior to increase the safety of a process system with a significant proportion of human errors occur during the maintenance phase (Noroozi *et al.*, 2013). The differences in the type of maintenance are influenced by the social, cultural economic and environmental conditions factors (Meir, 2000) cited in (Almhafdy et al, 2013).

Through interviews with MOH expert, maintenance represents events of general plans, a set of actions which are intended to ensure operating and maintaining facilities and equipment available in good working condition for use and acceptable in achieving goals. because of this study represents many factors affecting on maintenance management in governmental hospitals in Gaza strip as it well known: built area, maintenance duration, funds, maintenance wastes, obstacles, quality, complexity, safety, culture, misuse of facilities, payment and assurance, damages for delay in maintenance project, reusing of martials, risks, borders and barriers, client's management, maintenance policy, communication, resources, priority maintenance agenda, complex services systems, access for maintenance, considerations of health and safety requirements, instrumentation, Installations to maintain, services to replace, testing and commissioning, comprehensive maintenance information, advice on maintenance planning, planning of maintenance, much or little technical information, formal routines, fault finding information, suitably trained maintenance professionals, allocation of resources, weather, crowded, current discontinuity ,etc. (MOH experts,2014).

Best productivity results when each worker has a definite job to do in a definite way and a definite time (Productivity Network, Inc.,2002).

The Maintenance Management (MM) with its all branches have a significant role in maintaining of buildings and medical devices, making it reserves the longest possible period in a good condition. Since the maintenance is increasing continuously due to the increased number of buildings in the hospitals; complexity, cost, it would require the existence of a special department for maintenance available by all necessary means. Maintenance expenditure is usually defined as all resources spent on maintaining the building at a desired standard both the direct costs of maintenance resources (e.g., material, labor and tools), as well as indirect costs (e.g., cost of management, administrative staff, and overhead costs) (Lee, 1987). During the past decade, continuous research efforts have been undertaken to develop methods for strategic-level decision making in facilities management (Shohet ,2006) .

2.2 Types of Maintenance in Hospitals

Maintenance definition: Oxford Dictionary defined the verb maintain' as cause to continue. Maintenance is physical assets continue to fulfill their intended functions (Lam, 2008). Maintenance is a combination of all a technical, administrative actions, including supervision, intended to retain an item, or restore it to a state in which it can perform a required function (Parida and Kumar, 2006).

Chanter and Swallow (2006) defined maintenance as a combination of any actions carried out to retain an item in, or restore it to an acceptable condition. Due to the large size of the maintenance work in hospitals, compared with the rest of the component parts within the MOH. It is the responsibility of the Facilities Manager to evaluate and implement a program so as to ensure maximum economy for the facility. Factor that related to the occupancy of patient beds hospitals/m² as in our hospitals 100patient beds hospitals need 5,000m². The occupancy of a hospital is defined as the number of patient beds per 1,000 m². (Shohet, 2006). Regular maintenance can detect potential problems and if resolved in time, can prevent more serious damage, both in terms of safety and cost for equipment repair (Balaras et al., 2007).

Classification Methods of maintenance vary from one department to another. Number of engineers and technicians in the maintenance department, type of medical services, research tasks undertaken by the hospital, management style in the selection of the appropriate classification, complexity of building design and intensity of engineering services in the building , use of specific technology, avoiding the use of special systems, labor and material, level of reliability, durability and availability, future changing needs, consequence of failure of services , cost of failure, frequency of maintenance operations in conjunction with maintainability, health and safety aspects, the acceptance of new design ideas with greater integration of building, maintenance with adequate access, obsolescence and quality of system/equipment to facilitate good use of building, Impact on the environment (MOH experts,2014).

2.3 The Nature of Maintenance

The nature of maintenance has unique characteristics and low volume work, which means doing facilities. The maintenance technician does longer cycle work while the production worker does shorter cycle work. Large maintenance jobs are divided into smaller work orders. Smaller work orders are easier to plan accurately and assess the most popular maintenance approaches (Al-Najjar and Alsyouf, 2003). A list to develop supplying materials was recommended of parts and quantities through experience, set up work order system with rounds lists as soon as possible, track all work and call outs, next prepare daily, weekly and monthly summaries of work accomplished, work planned, then track parts or materials and equipment used and all other costs ferociously (Dennis, 2009).

Facility maintenance and management (FMM) is the priority concern upon completion and effective can help managers to identify problems early and maintain (IFMA, 2004) cited in (Chen *et al.*, 2013). Facility Management (FM) is “A profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology” (Lavy and Shoheit, 2010). (FM) included the built space, services, technology, maintenance, modification, adaptation, function and use, security, comfort, environmental health, costs and benefits of occupancy. The British Institute of Facilities Management (BIFM, 2001) defined the term facilities management as “The integration of multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace”. The International Facilities Management Association (IFMA, 2001) described (FM) as the “Practice of coordinating the physical workplace with the people and work of the organization”. Barrett (1995) defined (FM) as “An integrated approach to maintaining, improving and adapting the buildings of an organization in order to create an environment that strongly supports the primary objectives of that organization” (Lavy and Shoheit, 2004). A conscious decision was made to involve service providers and hospitals in the cooperative framework of the project in order to ensure a practical (real world) orientation and satisfy the needs of industry and the clinical complexes (Lennerts *et al.*, 2005).

2.4 Performance Indicator (PI)

Building Performance Indicator BPI, Annual Maintenance Expenditure AME, and Normalized Annual Maintenance Expenditure NAME were developed to examine hospital building performance and budgeting of their maintenance activities. The BPI aims to compute the actual physical performance score for each system in a given building, for each building and for the entire facility; it provides the facility manager with a new perspective that creates a simultaneous link between the physical performance score and the financial aspects of building components (Lavy and Shohet, 2010). AME indicator is measured in $(\$/m^2)$, expresses the amount of resources spent on maintenance during a financial year, and combines expenditures on in-house personnel, outsourcing, materials, and spare parts (Shohet et al., 2003). This indicator may be used to compare the expenditures in a facility from one year to another, as well as to compare maintenance expenditures between different facilities. Therefore, breaking the AME into its sources of labor may provide significant information to decision-makers, as well as encourage effective labor distribution decisions. NAME indicator is defined as the AME divided by the facility coefficient. It eliminates the effects of actual building age, occupancy, environment, and design by normalizing the Annual Maintenance Expenditure into an indicator that can be compared with facilities at different age and under different service conditions (Lavy and Shohet, 2010). This parameter can be combined with the BPI as an indicator for the building performance to cost ratio (Lavy and Shohet, 2004).

Another indicator is called the Projected Performance (PP), which aimed to project the future level of performance for the different elements in a building (Lavy and Shohet, 2007). Likewise, the PP mechanism does not consider renovation or capital improvement projects that may be conducted in a building. Since these types of projects depend on the mission of the building, as well as on available resources, it is very difficult to plan for and incorporate them into the prediction model (Lavy and Shohet, 2009). Another indicator is called Building Risk Indicator (BRI), this indicator aimed to determine the risk level for each system in each of the buildings surveyed. Risk level is defined as an ordinal scale with five categories of risk: Highly, Critical, C Marginal, Low and Negligible (Lavy and Shohet, 2010).

2.5 Design of Maintenance Operations

The maintenance in hospitals vary from one hospital to another depending on the type maintenance, size of business used, degree of technology, and services offered as well as the practice of maintenance or the manner. Hospitals are large public buildings that have a significant impact on the environment and economy and have deferent users, so adopting sustainable, environmental friendly measures for daily management of the hospital, solar lighting systems, solar refrigeration systems, water harvesting and water recharging systems etc. (Samiti, 2006; Lam, 2007).

It is impossible to produce buildings which are maintenance free, but maintenance work can be minimized by good design and proper workmanship carried out by skilled experts or competent craftsmen using suitable codes of installation, requisite building materials and methods (Iyagba and Adenuga, 2003). The design in any hospital variants of shape, size, details and should be conceder of the enclosing walls of a courtyard varied among regions and functions (Almhafdy et al, 2013). Maintenance is related to the background of any project, unfortunately development plans and approved recurrent and capital estimates. Good design is in itself maintenance, and non-maintenance is a factor/product of good design (Adenuga, 2007; Lam, 2007).

Architectural design not means a geometric organization, but it influences users' sensory perceptions with a vision of the life cycle of the building, rather than considering it simply as a new building with all members. The team should have a clear policy to satisfy the requirements. Spatial architectural designs affect staff recruitment and retention (Mourshed and Zhao, 2012). Design considerations that determine the success in maintaining aseptic conditions and avoiding the transfer of bacteria (Balaras et al., 2007). The integrated Building process means achieving good design for long term sustainability. On the basis of the design guideline as building's basic performances, some indices related to users' or owners' decision on the maintenance strategy such as the economy, safety performance, serviceability performance, rationality of maintenance, and maintenance times, the computing procedure for optimization is applied to search for the optimal maintenance strategy for a target building (Chiu and Lin, 2014).

Design with the concept of green hospital planning should consider the easy and low maintenance aspects as well as the specification. (Setyowati *et al.*, 2013). Understanding the Green Maintenance GM requirements during operation phase of maintenance with mapped onto design characteristics at the design stage (Ajukumar and Gandhi, 2013). GM design should provide planning , shape, safety , cost , qualified human, equipment, buildings, and extensions, needs, period , priority, quality, supply of materials , qualified staff, creating mentoring programs, systems, communication, decision making, cooperative culture, maintenance model, principles, functional analysis, reliability, fault analysis, risk identification, optimizing operation, a combination of all maintenance techniques and systems which give structure and life to a community in the hospitals (Lee, 1995 ; LAM,2004). The geographical distance from the hospital to the most distant settlement constitutes the worst case travel time to the hospital (Stern *et al.*, 1996).

Design innovation is a physical adaptability and ability of a building to economically accommodate future changing requirements (Barlow *et al.*, 2008). Working in public sector is very sophisticated, highly complex operation, performance is generally hard to measure, services installations, technology, the built environment, the condition and quality of buildings, way of looking at sustainability, equipment available with the hospital (Samiti,2006). Each hospital is comprised of a services range and functional units as a complex system, movement of people and goods. (Carr, 2010).

Building maintenance management in hospital represents the most difficult group of largely public sector buildings to maintain, modern technology has resulted in modern hospitals being one of the most complex and criticality of mechanical and electrical systems, involving the interaction between the technical, social, legal and physical determinants that govern the use of buildings (Francis *et al.*, 2001; Shohet and Lavy, 2006; Zawawi *et al.*, 2010; Lam, 2004).

2.6 The Choice of Maintenance

The choice of maintenance depend on the type of work, items priority, efficiency of maintenance, performance level, method of implementation , timing, function of the effectiveness, number of maintenance personnel required for the implementation and the expected cost of the maintenance process. Maintenance prioritization is a crucial task especially when there are more maintenance work orders than available people or resources and the correct prioritization of executing maintenance work-orders is essential for improving the efficiency of maintenance operations (Ni and Jin, 2012).

Maintenance Efficiency Indicator MEI indicates the efficiency with which maintenance activities are implemented. The MEI calculation requires three other indicators: the Annual Maintenance Expenditure AME, the Building Performance Indicator BPI, and the Facility Coefficient FAC (Shohet *et al.*, 2003). No one person can reasonably have complete knowledge, which is why specialized consultants play an important role in hospital planning and design (Shohet, 2006; Carr, 2010).

The number of fixed employees that do the work in high quality with minimum time to decrease the cost of whole small maintenances outsourcing can serve as a source for the execution of seasonal maintenance works, as well as rehabilitation, renovation, and replacement works. Maintenance labor could contribute as high as 80% of the total maintenance cost. (Ni and Jin, 2012). The number of employees per 1,000 m² built area in healthcare facilities and the optimum crew size for a maintenance job is the smallest that can perform the work using a good method in a safe, efficient manner (Shohet, 2006). Males are more likely to be employed in the maintenance department rather than females.

Promote staff efficiency by minimizing distance of necessary travel between frequently used spaces Allow easy visual supervision of patients by limited staff Hospital (Carr, 2010). Maintenance manager should study the minimum number of staff employed to avoid overworked staff, which might affect the quality of the system (Zawawi and Kamaruzzaman, 2009).

Indicators of maintenance needs might be very usefully employed in maintenance departments to ensure that there are enough people to cater to all the maintenance needs (Shohet, 2003; Zawawi et al., 2010). A maintenance technician often does many different jobs in a single day unlike the production counterpart who does high volume work (Productivity Network Inc., 2002).

Technician and supervisors are among staffs with technical certificate and are considered as skilled staffs that fulfill the building maintenance requirements. Staff must be carefully selected for their knowledge and ability. Staff evaluation systems, staff motivation programme and staff trainings are an effective way to improve employees' maintenance skills and should be practiced more often to bring out the best out of them. Maintenance staff should be clearly briefed on the position, jobs, and responsibilities before any work can be executed (Zawawi and Kamaruzzaman, 2009).

Gradually change the mindset of your staff from an outside agency performing tasks to one of a specialized and highly trained organization facilitating production (Dennis, 2009). A multidisciplinary design team has professional responsibility to design out maintenance and/or make suitable provisions for maintenance (Lam, 2007). Participation of local staff the right of independence for performance and management has to be provided in order to boost performance (Samiti, 2006). The degree and duration of overheating, especially in hospital, will depend on geographical location, building design, ventilation strategy and internal gains (Giridharan *et al.*, 2013).

The maintenance and repair (M&R) requirements of healthcare facilities are more demanding than those of most other facilities. The high intensity of use, long operating hours (24-hours per day for most primary care hospitals) and specialized equipment all lead to a relatively high maintenance workload usually fulfilled by a staff of tradesmen and supervisors. (Lufkin, 1998).

2.7 Previous Studies

Table 2.1: Summary of related previous studies

Research Location	Main Objective	Year	Main Findings	References
Palestinian Gaza Strip	-To provide an overview of the overall condition of the estate, number, size and efficiency of the hospitals.	2010	-The physical condition of 8 hospitals was rated good & 4 hospitals was rated poor, as an average score.	WHO, UNDP, UNSCO & MOH (2010)
	- Assess the operational conditions Gaza hospital buildings. -Determine factors affecting maintenance management hospital buildings.	2013	-Good coordination of receiving the requests from the hospitals other departments. -There is no enough staff ,not adequate fund, poor contractors performance.	El Shorafa (2013)
	- To evaluate the effectiveness of the medical equipment management in Governmental Health Facilities. - To improvement of equipment management.	2010	-61.1% of respondents reported that there is no preventive maintenance system in their department. -83.7% of them reported that most of equipment that were malfunctioning were due to lack of spare parts	Murad (2010)
Occupied Palestinian Territories (Israel)	- To develop key performance indicator. - To quantify the effects of users, building parameters and systems on the performance and maintenance of hospital buildings	2003	-The (BPI) analysis resulted indicating that the (MEI) -The manpower source diagram -The managerial span of control	Shohet(2003) Shohet et al (2003) Lavy&Shohet (2004) Lavy&Shohet (2010) Lavy (2006) Lavy (2011)
Saudi Arabia	- To audit the existing maintenance situation in government and private hospitals in the Kingdom of Saudi Arabia	1999	-Maintenance staff has formal vocational qualifications and are provided training facilities. -The system preventive and breakdown maintenance and is fairly well developed. Maintenance facilities are of standard nature and various maintenance reports.	Ikhwan and Burney (1999)
Europe	-To define what hospitals actually do,	2003	All approaches to performance measurement	WHO (2003)

	and -To compare that with the original targets identify opportunities for improvement.		suffer from behavioural and technical problems	
Kenya	-Increased efficiency and more effective utilization of available resources. -To improve the existing facilities maintenance management for hospitals in Kenya	2012	-The public maintenance organization does not have proper management of the medical equipment. -The organization fails to assess the new technology when selecting new equipment thus compromising the healthcare and patient safe. -Scheduled preventive maintenance services on the medical equipment does not take priority over corrective repairs in most of the public hospitals compared to private hospitals.	Mutia et al. (2012)
	-To look into the relationship between maintenance strategies implemented in Healthcare facilities. -To provide an overview of types of maintenance strategy applied to Maintain facilities while satisfying the end user.	2014	-There is a relationship between types of maintenance strategy implemented and end user satisfaction	Rani et al.(2014)
Malaysia	-To develop maintenance achievement index (MAI) to benchmark the performance of building maintenance a KPIs.	2012	-Building maintenance practitioners believe quality, safety, time, cost, functionality, and environmental friendliness can be considered as KPIs.	Yahya and Ibrahim, (2012).
	Proposes a (PMS) for the enhancement of FM.	2011	-Common maintenance management systems applied for office building.	NikMat et al. (2011)
	Identifying factors causing poor maintenance in various types of buildings	2010	-Lighting, HVAC, telecommunications and sanitation are considered to need most maintenance attention	Zawawi et al. (2010).
	To determine and identify the factors contributing to rising maintenance costs.	2010	-Five of the most influential variables were expectation of tenants, building materials, services, building age and failure to execute maintenance at the right time.	Shah Ali et al. (2010)

	To identify the maturity level of the maintenance organization in a specific hospital with regard to the effectiveness of their management of facility engineering maintenance (FEM) services	2009	-The findings that the maintenance organization had not made much effort to accomplish their roles and responsibilities towards successful implementation of FEM services	Ali, and Mohamad (2009)
Ghana	To assess the current condition of public buildings, identify the underlying principal causes of poor maintenance of public buildings	2010	-The maintenance problems influenced by the age of the buildings, lack of policy, inadequate funds and, low capacity of staff, pressure from buildings number of users	Cobbinah (2010).
	To examine the labour composition for maintenance works in the public hospital buildings in South-West, Nigeria	2012	-The staff strength of the maintenance departments is inadequate and they are inexperienced on hospital maintenance management. -Majority of the users of public hospital buildings do not have access to any formal training on effective use of facilities.	Afolarin (2012).
Nigeria	To assess the operational state of public hospital buildings within the study area.	2007	-The factors responsible for poor maintenance management of public hospital buildings in Lagos State, -The maintenance staff held to their views that the users' attitude and misuse of those facilities by them is strongly responsible for poor maintenance management of public hospital buildings.	Adenuga et al. (2007)
	-Identifies the significant difference(s) in the operational state of Federal and State-owned public hospitals within the study area.	2006	-Maintenance departments need to adopt sound policies with respect to building services replacement. -Inefficiencies and inflexibility impediments to operational performance should be avoided in hospital environments due to the sensitivity of the services being rendered.	(Adenuga&Ibiyemi,2006)

2.8 Properties Affecting the Maintenance Work

There were the fault properties that affecting of the maintenance work as faults properties, properties of prevention and safety, cost properties and maintenance culture as follow:

2.8.1 Faults Properties

The analysis of the types of faults and rates and the causes to arrive of optimal times to maintenance possibilities provision of resources which include the average time elapsed until a failure occurs, average operating life of the piece or the effectiveness, the amount of the discovery of faults and study the inspection and replacement times or carry out maintenance and the possibility of reform.

2.8.2 Properties of Prevention and Safety

The best safety based on the impact of the fault or damage to the safety and limits safety system linked to high age or equipment to be maintained or their parts.

2.8.3 Cost Properties

Specify the properties of the cost to achieve the lowest possible cost without losing the level of maintenance, relies on repeat faults , times to stop , repair and labor needed. The cost of doing the maintenance includes fixed costs, variable costs of labor, spare parts, and services. Maintenance expenses depending on the type of industry, typically 15–40% of production costs (Al-Najjar, 2003). A successful implementation of healthcare FM as strategic planning, customer care, market testing, benchmarking, environmental management, and staff development implementation is service requirements management, planning, performance monitoring, supplier and contractor management, health and safety processes, risk management, and service coordination (Lavy and Shohet, 2010). Services are one of the faster developing forms of technology within hospital building. The cost of services can fall between 10% and 50% of the total construction cost. Services designer should have a higher professional responsibility to influence the remainder of the team in the decision making process in relation to the neglected maintenance of services after their physical installation (Lam, 2007).

2.8.4 Maintenance Culture

Factors found to be highly significant by the maintenance officers as attitude of users, misuse of facilities, and lack of discernible maintenance culture, inadequate training and reluctance of some establishment to support innovations (Adenuga *et al.*, 2007). The challenge is to have good self-motivation and start promoting a 'maintenance culture' (Zawawi *et al.*, 2010). The difficulties in measurement of performance are also complicated by the relatively weak influence that clients have. In for-profit organizations the recipients of services may generally go elsewhere, but in non-profit organizations (Turrell, 1997). Maintenance performance is generally hard to measure, as one should not only consider quantifiable parameters but also the quality of the performed maintenance and its organization (Zawawi and Kamaruzzaman, 2009).

The concept of sustainability or green building issues and better design for our buildings (Lam, 2007). The Built environment expresses in physical form the complex, social and economic factors, which give structure and life to a community stated by (Adenuga, 2007; El-Haram and Horner, 2002; Holmes and Droop, 1982; Son and Yuen, 1993) believes that Maintenance management of hospital buildings is one of the more complex subjects in the field of facilities management. Contributing to great complexity of healthcare facilities, the high criticality of mechanical and electrical systems, and the scarcity of maintenance resources (Lavy and Shohet 2006).

The Integrated Design Process (IDP) makes a sustainable, green and high performance building which are designed, constructed, and operated to make the world a better place by improving the environment through nurturing lives, restoring environmental assets, and offering inspiration by drawing on the collaborative experience of a multi-disciplinary team of professionals. The IDP generates sustainable concepts that aim to minimize the negative impacts of building on the global, regional and local environment (Setyowati *et al.*, 2013).

2.9 Classification of Maintenance

Classification of maintenance vary from one department to another, as a result of several factors which mentioned in chapter one.

In this section, the classifications depend on the previous studies and the MOH experts as follow:

2.9.1 Lind and Muyingo Classification

Lind and Muyingo (2012) said that maintenance can be divided maintenance into two specific types.

- **Maintenance Corrective:** Maintenance (Repairs/replacement) that intends to restore a function that unnoticeably has reached an unacceptable level Immediate, that needs to be carried out as soon as possible, Other corrective maintenance.
- **Planned Maintenance:** is planned in time, nature and scale .

2.9.2 Dennis Classification:

Dennis (2009) classified maintenance as follow:

- **Preventive is** Maintenance which is carried out to prevent an item failing or wearing out by providing systematic inspection, detection and prevention of incipient failure. Preventative maintenance is usually programmed.
- **Statutory Maintenance** is when plant such as lifts, fire systems, fume hoods and air conditioning systems are serviced and maintained in accordance with legislative requirements.
- **Corrective Maintenance** can be defined as maintenance that is required to bring an item back to working order when it has failed or worn out.
- **Backlog Maintenance** is maintenance that is necessary to prevent the deterioration of an asset or its function but which has not been carried out.

2.9.3 MOH Experts Classification

These classifications depend on the MOH experts as follow:

❖ First Classification

The classification describes the maintenance as:

First: Planned maintenance and unplanned maintenance.

Second: Interior and exterior maintenance.

Third: Maintenance in governmental and non-governmental institutions look at the figure (2.1).

▪ Planned Maintenance and Unplanned Maintenance

● Planned Maintenance

A regular maintenance associated with planning and programming of work for the building, plan is organized and implemented based on prior study, practical experience, statistical data and registration records elements and control, to achieve high levels of maintenance of buildings and machinery, economic, higher efficiency and reduce costly failures, the Planned maintenance is divided into:

- Preventive Maintenance (PM)

Made by the occurrence of defect, based on thinking, planning, examination, tests and determining the status of each element of the building. The main objectives of using (PM) are to reduce failures, their economic consequences by performing maintenance actions at a predetermined point of times, regardless of the condition of the equipment/component (Al-Najjar and Alsyouf, 2003).

Maintenance work requires preparing for emergencies before happen, this kind of maintenance carried out according to plan time to reduce the risk of failure, improve the performance of building elements. There are different approaches of setting PM schedules leading to performance, reliability and utilization levels.

Difficulties of PM as insufficient data, inaccuracy in assessing the time to action especially when the standard deviation is large (Al-Najjar and Alsyouf, 2003).

Three different PM scheduling and ordering methods are being considered Global Maintenance Order (GMO), Reliability Maintenance Order (RMO) and Value-Based Maintenance Order (VMO) (altuger and Chassapies, 2009). PM is better than breakdown maintenance (BM), so that PM plans and measures are demanded for critical equipment (Qingfeng et al., 2011).

Risk Management in Healthcare Facilities

‘Risk management’ an organization process adopts a proactive management approach of future uncertainty, identification of methods for handling risks which may endanger people, property, financial resources or credibility. High priority risk management for any healthcare facility, and it is achieved through a risk management program, risks are identified, analyzed, classified, and controlled. (Lavy and Shohet 2010).

Table 2.2: Risk Categories: three risk assessment factors.

Risk Categories	Risk Category I Functional Areas (A)	Risk Category II : Impact of Failure or (I)	Risk Category III Preventive Maintenance Frequency (F)
	Defines various environmental areas in which building is used in the facilit	Defines potential impact scenarios that may result due to failure or malfunction of the equipment.	Defines the level and frequency of preventive maintenance required.

- Conditional Maintenance

Identifying particular specifications of the components of the building, based on prior planning of the state of the building, and by monitoring the performance of the elements of the building over its life, determining measurements and special conditions of the elements of the building. Condition-based maintenance (CBM) strategy and in particular vibration-based maintenance (VBM) policy, as one of the policies included by CBM, is based on deterministic and probabilistic models. (Al-Najjar and Alsyouf, 2003).

- **Predictive Maintenance**

Is done through periodic monitoring of some of the key elements to note any change may cause a lack of efficiency of any element in order to address defects can show those elements. Predictive maintenance is based on the same principle as preventive maintenance, diagnostic is used to measure the physical condition of state such as temperature, vibration, lubrication and corrosion. Preventive and predictive maintenance provide the maintenance organization with a more predictable and manageable workload (Swanson, 2003).

- **Treatment Maintenance**

This maintenance follows the failure occurrence, or the appearance of defects in one building elements, this maintenance aims to maintain the building to reserve its function efficiently, and is a necessary maintenance needed for buildings, equipment, medical devices, while the stoppage of work for technical reasons, such as breaking or corrosion in one or some of its parts work. Moreover, system malfunction occurs sooner or later, so it is necessary to provide the necessary resources to repair the fault and materials at the moment it happens to provide the services at the Ministry of Health continuously. Failure based maintenance (FBM) is only performed when a failure or breakdown occurs, no action is taken to detect the onset of or to prevent failure (AlNajjar and Alsyouf, 2003). Types of treatment maintenance intervention levels depending on type and size of fault:

a- Partial Failure:

Damage in a specific part such as plumbing or drainage, and this kind spoil the continuity of service in the performance of their work.

b- Total Failure:

If the damage occurs in more than one part of the system, this type stops completely and become inoperable until after repairs. It can take two forms:

- **Reforming of Faults:** Do not come only in the presence of experts and specialists agents assigned to the diagnosis of the faults.
- **Maintenance:** Deploying a team at a specific time of the need to maintain faults leaves the field to restart the service again.

- **Unplanned Maintenance**

Unplanned Maintenance is made after defects appearance of the building without following the program for the implementation of business and in accordance with previous records for maintenance of the different elements of the building and through which the repair procedures immediately, without any prior plan, carry out their work without the availability or use of data, information on maintenance activity and procedures to avoid more problems. It has a part-time based on experience, the structure of the business during the emergency period of time and include the following activities:

- 1- **Emergency and Urgent:** Actions which are required to be completed according to needs and emergencies.
- 2- **Dealing with the Sudden:** Increase in maintenance is planned and produced by increasing the number of business activities of various kinds.
 - a- **Corrective Maintenance:** carried out of the building to return it to its original state before the advent of its flows has been defined in the types of planned maintenance that have already been reviewed.
 - b- **Emergency Maintenance:** defined as non-planned maintenance, which are in the event of serious damage to the building, are usually high costs and non-recurring, elements of the planning of the unknown. "A stitch in time saves nine". Noble (1980) described this as "the ideal maintenance situation in which the condition of the property is kept within predetermined limits by a pre-planned programme of preventive work, is never achieved in practice and is in fact unattainable except at an impossibly high cost".

- **Internal and External Maintenance:**

Several internal factors that add complexity for the overall organization have a similar effect on the maintenance function. The maintenance function may have to manage many different craft classifications as electricians, mechanics (Swanson, 2003).

The internal maintenance is made within the hospital, regardless of the persons who carried out the maintenance work, employees in the hospital or came from outside.

External maintenance take place outside the hospital, that depends on the nature of the work and the circumstances in addition to the conditions contained in the purchase of the size of work decades and machinery and equipment to be maintained and most importantly to the hospital speed to do maintenance, accuracy and pay acceptable costs for maintenance (NikMat et al, 2011).

Due to intensity and scale of development, Hospitals on most occasions form deep build environments and it can experience overheating during the summer, especially when the outdoor temperature is more than 20°C (Giridharan,2013).

▪ **Maintenance in Governmental and Non-governmental Institutions**

The reality of the situation shows the importance and the degree of attention of senior management in the maintenance of non-governmental institutions, much higher than those given by the senior management of the maintenance in government institutions, due to the ease of economies account and evaluate the performance of maintenance in productive enterprise systems (non-governmental) while it is difficult in institutions government, and because of the ease of maintenance economies in productive enterprises account the increase in spending is much higher than government institutions maintenance add to that the administrative unit for maintenance in government institutions be linked to the lowest administrative level, and this reduces the effectiveness despite its importance. Many government documents identify benchmarks for the HVAC design in Hospitals, according to the various hosted functions (Ascione et al., 2013).

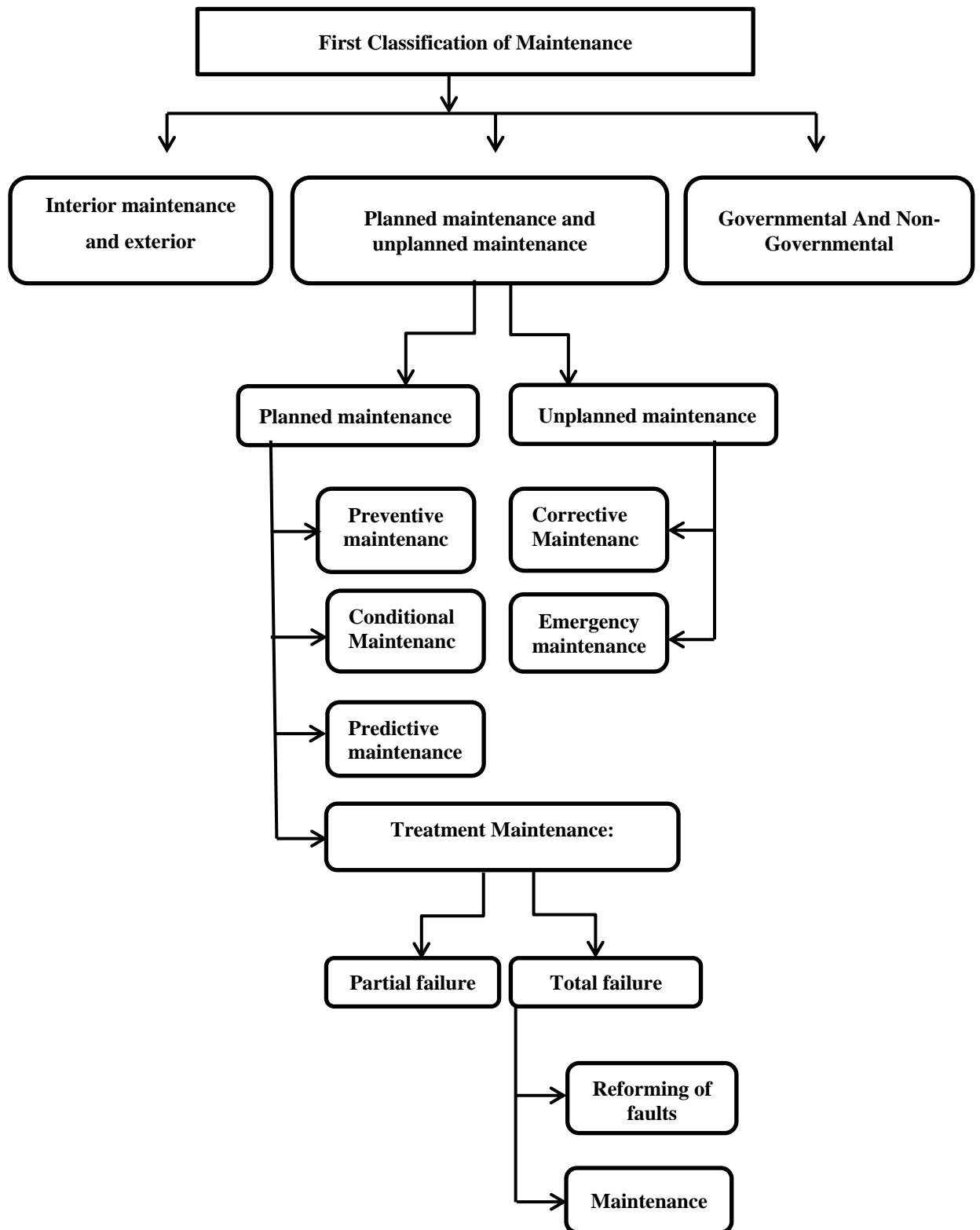


Figure 2.1: First classification of maintenance

❖ Second Classification

Maintenance includes radical change, organized prior and periodically and daily construction work as that means the maintenances divided as radical, regular and routine as shown in the Figure (2.2)

- **Radical Maintenance**

The Radical Maintenance includes radical change or necessary maintenance to restore one of the elements of the building to function or perform maintenance work for structural elements of the building such as the maintenance of a bishop or rebuilding damaged walls, some maintenance work.

- **Regular Maintenance**

The periodic maintenance is maintenance work that are organized prior and periodically and systematically to raise the efficiency of the building and functionally or aesthetically is the assignment of maintenance work to a group of contractors, including those actions,.

- **Routine or Daily Maintenance**

daily construction work on the follow-up and check the various elements of the building, and thus they are like preventive maintenance that address the flaws of the building before they appear. When the trade-offs between different types of maintenance must study the impact on the performance of the function of the building and the availability of materials and maintenance crews necessary for implementation with the expected for maintenance in mind the cost situation.

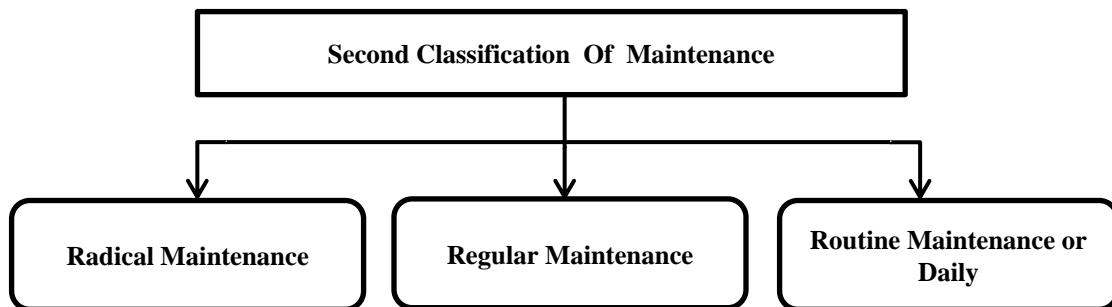


Figure 2.2: Second classification of maintenance

❖ **Third Classification**

Maintenance activities in the hospital is done according to the following categories as primary and secondary activities and this activates categories as specialization as shown in the Figure (2.3).

- **Primary and Secondary Activities**

It can be divided depending on the size, type of hospital, nature of maintenance:

- 1- Initial activities: is the operation of the equipment, facilities, buildings, inspection, calibration, electric power generation, distribution to the various sections according to their need.
- 2- Secondary Activities: includes: storage, all procedures related to storage, distribution, purchase, work of all protection systems, and systems of fire protection.

- **Activities According to Specialization:**

When the size of the maintenance at the hospital is very large, so it is necessary to classify this maintenance into groups, or which combines a set of properties and features.

- 1- Maintenance relating to the activities of civil engineering and architecture, work in the field as ventilation, sewer, water system, lighting, control of air, water pollutants, and other activities. From an engineering perspective, a conscious evaluation of the plants under the domain of the civil construction is based on objective and quantifiable parameters (Peruzzi et al., 2014).
- 2- maintenance relating to the activities of electrical and electronic engineering, mechanical and medical devices, elevators, air conditioners, water, generators and all extensions on this field.
- 3- As the mechanical and electrical services in a building are an asset, good management of building services should be provided, and the TQM system is a useful management framework for achieving high quality of maintenance (Lam 1990).
- 4- Maintenance of Administrative activities, such as planning, recruitment of technical staff, finding a private maintenance work, cost accounting records, storage business, purchasing, distribution and procurement.

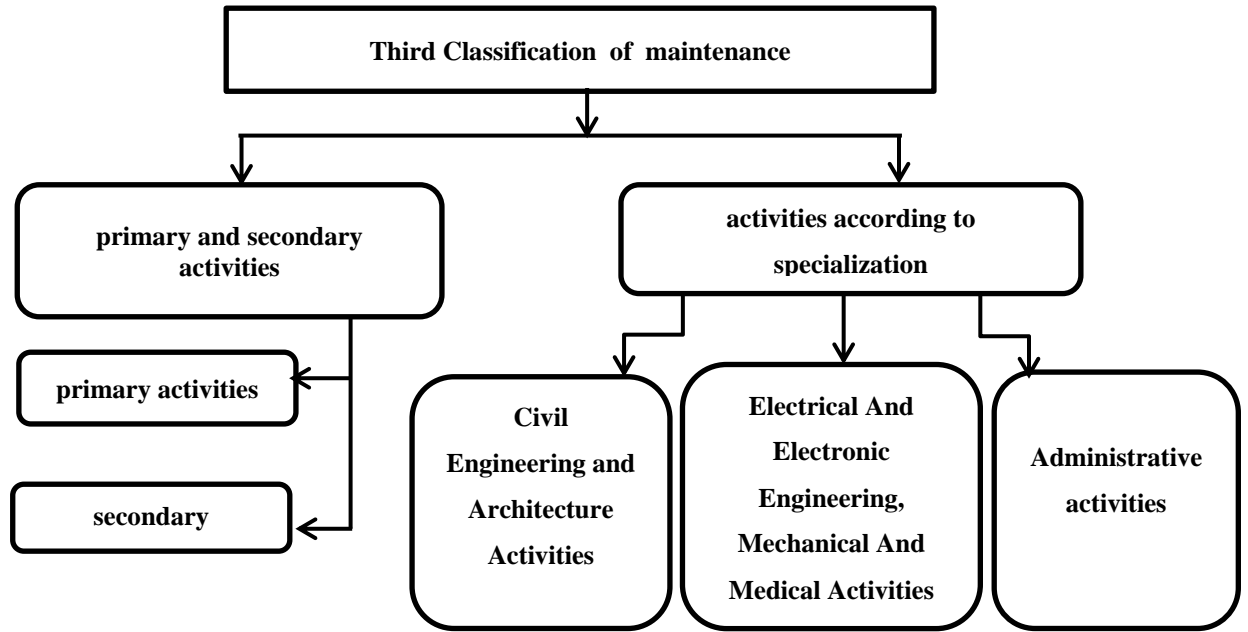


Figure 2.3: Third classification of maintenance

❖ **Forth Classification**

In this classification maintenance is classified into two categories depend on vacant place or size of hospitals as shown in the Figure (2.4).

- Classification depends on the working relationship maintenance vacant place: This Maintenance is directly related to the patient, such as medical equipment and maintenance have no direct relationship with the patient, such as maintenance of the building from the outside and the inside.
- Classification depends on hospital size: Maintenance is based primarily on hospital size and therefore the number of devices and staff at hospital.

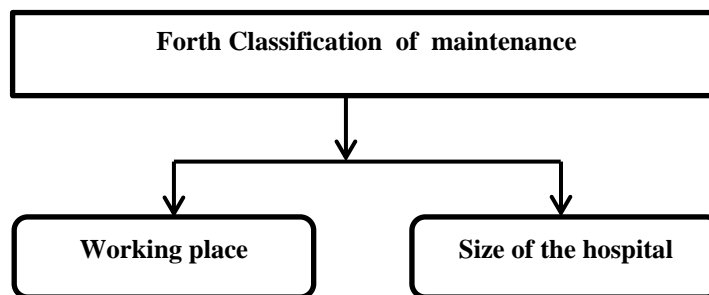


Figure 2.4 : Forth classification of maintenance

❖ Fifth classification

Maintenance in hospital can be divided into three categories in terms of the costs of maintenance: as shown in the Figure (2.5).

- Low value Maintenance: where no economic benefit from the work of maintenance and here only commissioned or replaced
- Highly cost maintenance: Maintenance and this is added the lowest possible cost.
- Expensive maintenance: must have an advanced maintenance system to determine the causes of failures, poor workmanship, bad quality materials and crashes unintended and here senior management should focus ,control failures ,non-use quality materials , low productivity, the alternative to the large maintenance replacement, taking into consideration the high cost of maintenance and the emergence of more sophisticated and increase the production technology, competition(Zawawi and Kamaruzzaman,2009).

Effective maintenance management minimized the cost associated with the non-availability of an engineering service (CIBSE, 2000). Problems of maintenance will result in high cost penalties including loss of service, high cost of repairs and, sometimes, unnecessary building damage.

It is important to consider the maintenance operational policy at an early stage in the design process to ensure that a maintainable building is possible. There are some hospitals do not follow any of the above categories, but depends on an entirely different classification depending on the nature of the departments used.

All classifications are agreed in that the work has complex parts, as well as the high cost of maintenance. Since any kind of maintenance requires the services performed by human beings, the human factor must be taken into account in program design and implementation.

Program implementation is always easier at a new facility than at one where the habits have been established and ingrained.

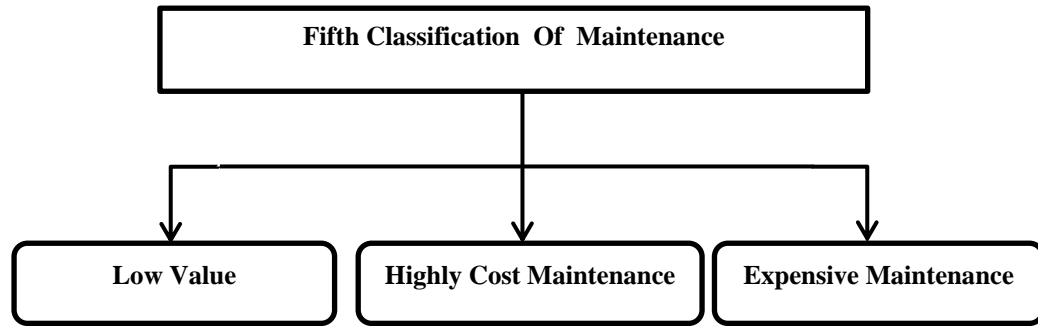


Figure 2.5: Fifth classification of maintenance

2.10 Ways of Implementing the Maintenance Work in Hospitals

There are three ways to carry out maintenance work can be summarized as follows:

1- Implementation of maintenance by a specialized departments in hospitals or outdoor center, specialist staff, follow to hospital as electromecanic, civil, medical, and so on . Speed of coordination to carry out various maintenance, either the most important drawbacks low completion rate and the difficulty of supervision and control. The construction is setting a timetable for the construction work such as maintenance plastering and re-paints the patient rooms and the restaurant every year in addition to various hospital facilities.

The washing and painting works for the offices of doctors is up every two or three years, and so on .The woodwork is up to every two years and re-paving lanes and streets in the hospital every four years and examines extensions of water and sewer every eight years. electrical and mechanical works and medical devices: In order to monitor all "checklist" In this area is the work of so-called checklist Electrical and mechanical works, so that the work of checking the connections and operating on a daily basis and oil testing, calibration and check wiring and electrical connections on a monthly basis and efficiency of the generator and appliances on an annual basis,

2- Implementation of Maintenance manner of contracting and this method is based on the delivery contractor all maintenance work in the hospital through contracts and agreements concluded between the hospital and the contractor and found the terms and conditions and maintenance requirements of both parties and this method cons of the

most important, high cost and low supervisory level and not get the job done the image desired by the hospital.

3- Hospital can be used more than one way to carry out maintenance work which according to the need and requirements of the reality of the case in order to achieve a better level of maintenance and avoid as much of the cons of each method.

2.11 The Benefit of Maintenance Classifications in Hospitals

This benefit facilitates the management of maintenance departments and dealing with a large number of activities at the hospital, finding several workshops according to the classification practice and depends on the follow:

- 1- Distribution of work, staff responsibilities, developing employees performance level by specialization in certain types of activities through specialized training,
- 2- Assistance in the completion of maintenance programs efficiently, specialization helps to speed the completion of maintenance operations.
- 3- Time is very important factor especially in the emergency maintenance to save the life of patients ,reduce downtime to a minimum, cost of buying, cost of maintenance of origin ,the service from abroad , reasonable maintenance cost, minimum running cost, high reliability of services good operational efficiency of building, quick response to maintenance problems if any (Lam 1990). development of systems time and programs to ensure the proper maintenance change damaged parts before the damage extends to other parts of the maintenance and insurance operations,
- 4- Maintenance contracts and agreements of procurement of international cooperation or the construction of hospitals through donors and the purchase of equipment in the short term to lack of the necessary financial allocations due to the blockade imposed on the Gaza Strip.
- 5- Determined the criteria, priority, needs of staff competency, maintenance asset records, maintenance schedule, and plan for maintenance operation and review of the process. These criteria are of the highest priority in improving the process in the management of building maintenance.

Working experience quality of maintenance system and the good design is in itself maintenance, and non-maintenance is a factor of good design.

The age of the facility, its state, state of its systems, these three parameters enable the identification of long-term and short-term need that significant to the maintenance of the facility (Shohet, 2006; LAM, 2007;Zawawi and Kamaruzzaman,2009).

2.12 Maintenance Management Responsibilities

The responsibilities of maintenance department at the hospital are protection and safety of all workers and patients, design of programs that reduce accidents, and solutions to those accidents and breakdowns based on standards. Maintenance manager should be able to manage the team as well as having sufficient knowledge of health and safety regulation, other requirements that are necessary to the departments. Manager responsibility brings a satisfaction condition not only for the occupants but also to the staffs for not burden on overworked. Small simple buildings and large complex buildings might require different amount of maintenance work. The ratio of average request for repair daily or weekly to the number of maintenance work force would help management to predict whether the maintenance team is able to run the maintenance system effectively or not.

A good arrangement of organization structure will help the maintenance department to manage the building without too much hassle (Zawawi and Kamaruzzaman, 2009). Bad management may be simply a reflection of idleness and waste among maintenance personnel, but there is usually much more to it than that. In order to have proper and smooth running of the maintenance works, the person in charge in the maintenance department must be competent in their roles and responsibilities (Zawawi et al., 2010).

Manager should know how to setup and run his maintenance department. Manual was developed to give a maintenance leader help in setting up his maintenance function, whether it is a small unit of a larger department or a complete but unorganized maintenance department (Bush, 2008). Management should prepare and explain the

responsibilities of the staff due to their position in the department. This is to avoid any disputes between the employees over the jobs assigned. Therefore, when there is a request for maintenance work at a certain area, the person in-charge of that area will immediately take up the job (Zawawi and Kamaruzzaman, 2009).

2.12.1 Manager Responsibility

Each maintenance personnel should know his or her responsibility in the department and description of the job responsibility will help each person perform work better. The degree of responsibility may be measured by the variation in the value of job outcomes over the feasible range of worker's effort. (Zawawi and Kamaruzzaman, 2009). Maintenance manager shall set departmental goals, plan, organize, and control the activities under his jurisdiction, and then all goals shall be specific, well defined, and quantifiable, with an estimated, time of achievement. The goal shall be communicated freely and clearly to all those involved. After that goals shall be reviewed regularly by the maintenance manager, maintenance supervisor, and operations representatives (Bush, 2008). To measure performance, set priorities, the organizational needs have to be considered i.e. the function and performance of buildings and their appropriate standards will be dependent on the user's perception and their primary needs (Chanter and Swallow, 1996). The senior management should focus, control failures, non-use quality materials, low productivity, the alternative to the large maintenance replacement or removal or replacement, taking into consideration the high cost of maintenance and the emergence of more sophisticated and increase the production technology, competition. Effective maintenance management minimized the cost associated with the non-availability of an engineering service (CIBSE, 2000; Zawawi and Kamaruzzaman, 2009).

2.12.2 Staff Responsibility

It is important for staffs to know their organization structure because it tells more about the responsibilities and provide staffs with the knowledge in seeking further assistance. A responsible worker is not closely monitored during the production process, but after the outcome of his work is evaluated, credits will be given for a well done job or blames if the job is poorly done. (Zawawi and Kamaruzzaman, 2009).

2.13 Maintenance Program

Any program should be planned and put on regular basis in accordance with known and accepted standards in the field of maintenance, these programs are necessary to be flexible, and be constantly evaluated taking into account the service variables and degree of quantity and quality) and the quality of materials used, and the standards and foundations must be taken into account when developing a program of maintenance at the hospital are:

- There is sufficient stock in the hospital covers the need during the holidays of different materials that can be continuously their need.
- Identify the tasks, duties and powers of each person within the prepared mind the need for hospital size and the size of the partitions and the quality and quantity of available machinery maintenance program.
- Find the command system or instruction within the maintenance department for each program so that this system includes how to prepare a request for essential maintenance and information that must be contained in this application and stages of the maintenance process until its completion with the knowledge that it is very necessary that each particular model hospital for maintenance well designed It contains all the necessary information that would be achieved, namely: to provide the means to cover the work and provide data on the costs and feedback about the repeated failures, as well as facilitate the scheduling of maintenance productivity and control work. Like any other service, maintenance is important to the success of any clinical engineering program, general, preventive maintenance (PM), breakdown maintenance (BD) and system of working. Maintenance problems factor: delays in obtaining spare parts, shortage of technical manpower, lack of training facilities, lack of funds, nonstandard spare parts, not enough technicians, poor communication amongst staff (Ikhwan and Burney,1999). A successful program include perform maintenance at a level that will keep the facility and equipment safe and in an acceptable condition, Inspect items which may impact adversely on the operation of the facility, promote the most effective and efficient use of resources, accurate means of estimating the number of operations and maintenance personnel needed staffed with sufficient number of individuals whose abilities and skill in the

various trades is appropriate, Staff who work in this manner will only lose faith in what maintenance can really do, The appropriate staff hours to accomplish each maintenance task will be defined in this document. This allows you to obtain the sum total of staff hours necessary to accomplish the required maintenance (Indian Health Service, 1997).

The preventive maintenance programs: program takes concenter the ideas and expertise of every member of the maintenance staff. When people become involved in change, they accept ownership for the rebuilding process. A program should include two main things:

- Building trust, providing recognition for improvements made, the opportunity to be creative, Being willing to listen, act on employee suggestions.
- The challenge to start or improve a planned maintenance program is no longer optional but essential. Everyone involved must believe in the program and the program must relate to the facility and to the maintenance department.

Establish a basis for determining budgetary requirements and long-range planning projections, provide a means of evaluating the maintenance effort and control of the standard of operation at each facility, a method for instruction and training in proper maintenance procedures by operators and users of equipment, establish the workload and schedule for an effective, components that require contractor performed maintenance due to lack of in-house expertise or staffing, prolong longer equipment life, reduce the number of repairs, equipment downtime, require less standby equipment. A written policy statement at the area level should clearly describe the importance of preventive maintenance to non-clinical personal property equipment, building service equipment and structures of the real property. The policies and procedures may be modified to adapt to each particular business need (Bush, 2008).

2.13.1 Planning

Jardine et al. (1997) said that maintenance management is one of the core domains of knowledge around which FM revolves. Applying program-planning frameworks (that often have a foundation in behavioral science theory), engaging the community in assessment and decision making (Sosnowy, 2013).

To plan the maintenance operation, and identify maintenance activities for all items in the records (Zawawi et al., 2010). A strategic facility plan SFP is a term often used to

describe the consolidation of FM activities. A long-term SFP is expected to forecast facility implications on future business scenarios then compare forecasts to existing resources and annually update the plan and budget to forecast potential improvements next support functions of long-term facility planning through long-range strategic facilities plans (Shohet, 2006). The main goal of planning are mentioned in the interviews as the planning activity aims to develop a plan for maintenance work to reduce crash rates, maintain the availability of equipment operation, and provide optimum and economic potential system.

The Factors affecting the maintenance plan are service request method (operating commands), the implementation of priority is operating ,providing materials, spare parts, labors , equipment maintenance ,implementation of maintenance places (site work or maintenance center) , the availability and accuracy of the information ,Records from work specifications.

planning steps are identify the work orders, then identify the needs of the work which include material, employment, and skills, next determine the time needed for implementation, where the record time for the command, after that set a timetable for the sequence of actions to accomplish of work that are operating priority status as a result of the need and availability of labor, materials and equipment. It will be succeed if we use a new technology in our plan such as Building management systems (BMS) to provide the most comprehensive means to control the OR operating conditions and these are more elaborate systems and are justifiable for large size facilities, especially when combined with other hospital controls (Balaras et al., 2007).

Types of Maintenance plans:

According to the maintenance manager (experts) in governmental hospital

- **Ongoing developmental plans:** are programs to estimate future needs and development include: Work plans, means to achieve
- **development plans** in the areas of technical
- **administrative maintenance plans**, specifications to develop working methods and the yield of the plan

- **Studies plans** (the efficiency of individuals and the level of service). It involves priority setting and using available manpower as efficiently as possible (Dekker & Scarfb, 1998).
- **Short-term plans:** is a short time programs include: Inspection service, planned reform programs, and preventive maintenance programs.
- **Long-term plans:** are the programs for maintenance activities include: Substitution and reconstruction programs, the reconstruction, and repair of the expectations of programs.

2.13.2 Organization

As a function located within the overall organization, the maintenance department is somewhat shielded from external, market-related factors that contribute to uncertainty (Swanson, 2003). User identification of the status in all content existing maintenance include determining the events and their locations using numbering, coding precision measurements, marking places for repair and maintenance, a comprehensive description of the work safety, operating instructions, definition of the site, the type of work, the priority, any additional explanatory notes, and illustrations.

Factors that related to the owner and affecting on the maintenance operations first factor that related to the maintenance organizational structure and its adaptation in this side. Grimshaw (2003) in the past decade, facilities management has in fact served as a principal means for the adaptation of the technological and cultural changes that organizations are undergoing in the postmodern society (Honnecker et al., 1999).

- **Technical record:**

a record which shows work information technical specifications, required allowance of operation, information about events, spare parts, replacements, and the basic performance according to the general and special conditions of maintenance projects limits.

Normally saves to record:

- private maintenance type cards in different colors
- card extraction method (signs or index cards)
- The use of computers now for registration and extraction of technical information.

- **Scheduling of maintenance work (how and when?) :**

A comprehensive list of the items for maintenance and events, based on the record events, condition, date, cost, inspection, repair and details of the steps technical executive.

- **Documents of the required specifications:**

A document that describes the operational procedures detailed, desired menu item quantities table, works that will be implemented and registered in cards specification working for work. Various FMM-related data, documents are digitized and stored in an integrated database in appropriate formats, all database are mapped as attributes of appropriate components in various scales for easy access (Chen et al., 2013).

- **Records:**

Updating maintenance asset records list all assets that need maintenance to make sure that they are in good working condition. Assets should be in different categories such as electrical, mechanical, structural or environmental, coded to easily identify their priority for maintenance. Effective records management programme will ensure that records are available for use when it needed (Zawawi et al, 2010).

Advantages of computerization of maintenance management for building records in the form of a property database, together with accounting, specifications and analysis of expenditure were recognized and recommended as the way forward. (Lennerts et al., 2005).

- **Maintenance plan:**

The action plan was developed through the agenda and timetable and specifications work out how to complete the work.

- **Maintenance schedule:**

Showing the type of maintenance appointed time, schemes, models program, which also includes planned maintenance, determine daily, weekly, monthly or annual maintenance work. This comprises the frequency for and all details of maintenance for each asset and The maintenance management decision diagram might be one of the options, The information gathered could be used in the future for any purpose, such as for setting monthly or annual budgets and weekly or monthly work schedules (Zawawi et al. , 2010).

- **Technical reports (Maintenance is it effective?)**

Reports give information on how to complete the work, effectiveness of performance, cost of maintenance, where decisions are taken on the amendment or change the maintenance plan, programs or change specifications and maintenance procedures and events and do substitution. A service file for all maintenance systems should be kept current and readily available, including operation, inspection and service instructions, records and reports of work performed, operating data and energy consumption, if possible(Balaras et al, 2007). Providing more relevant information about component condition increases maintenance ability (effectiveness) to avoid failures and makes use as much as possible of the equipment/component effective life due to performing replacements “just” before failure, i.e. improved policy’s accuracy(Al-Najjar and Alsyouf , 2003).

- **Report of work completion:**

The a document that describes the work carried out, the amount of effort, time, cost, new requirements to determine the causes of non-completion of work, the requirements of the

real maintenance work, production efficiency, events or spare parts storing, rates, method of operating availability.

- **Reports and Presentations**

Weekly, monthly reports summaries to plant manager, production manager, prepare draft presentation on proposal for formation of new maintenance responsibilities, submit to plant manager for comments, incorporate changes from first draft comments into second draft presentation, prepare slide presentation with verbal commentary of new unit proposal, then Rehearse and then give presentation to PM, finally incorporate changes, prepare, give presentation to plant manager and company headquarters (Bush, 2008).

2.13.3 Control

Method of work control to make optimal use of resources, by comparing the implementation period with the standard time to get to know the causes of deficiencies in the case of difference to one source. Hospitals, health care facilities are complex applications in the fields of microclimatic control (Ascione et al., 2013).

- **Control over the work:**

Management of maintenance comprise control activities associated with each item of maintenance project and addressed broadly under the headings of ‘technical’ and ‘control’ (BS 8210). Within local authorities there was a call for single control over the maintenance of buildings, and recognition of the link between maintenance and design (Kunibert et al., 2005).

- **Control of maintenance**

Good control systems and strategies also improve efficiency. There are various strategies, techniques and systems that can be used, each with a different complexity, cost and effectiveness (Balaras et al., 2007). A tendency to concentrate on the design at the expense of other considerations, especially maintenance as the last thing on the designer’s mind. Conceptual phase of a design is the single point in time at which there is

control over the future maintenance. The ability to control or modify maintenance diminishes from the earliest step in the design process (Lam, 2007). Maintenance control consists of comparing outcomes with plans, indicating to management where problems are (Dekker & Scarfb1998).

- **Control of implementing the maintenance**

The goal of control over the equipment is: the eradication of faults by changing the operating method or the development of specifications and minimization the impact of faults. Achieving more efficient maintenance depends on the capability of the implemented maintenance policy to provide and employ effectively the relevant information about the factors affecting the life of the component/equipment in question (Al-Najjar and Alsyouf, 2003). By amending the maintenance mode and access to an optimal plan and control method are as follows:

1- Gathering information: from work orders such as the time of the failure, its quality, spare parts, the quality of the stalled reform, time, and capacity to work (man / hour).

2- Failure Study: Analysis of the information collected in the past to study the causes of repeated failure, fault diagnosis, the amount of the costs of failure and maintenance: to identify the failure by a technical inspection team.

- **Scale maintenance work:**

Table 2.3: Scale maintenance work.

Scale maintenance work	The use of labor	Actual hours of work / standard work hours
	Work Orders	The number of executed orders / total no orders
	Delay in completion	Number of backlog / number of intake Business
	Hourly cost maintenance	College / maintenance cost of the total number of hours for maintenance
	Fault Repetition	Number of operating unit / number of hours Crash
	Maintenance operating ratio	Unity hours / total hours of maintenance operation

- **The administrative division of the Department of Engineering and Maintenance**

- Concepts and main characteristics of the organizational structure.
- Factors affecting the design of the organizational structure.
- The structure of the General Directorate of Engineering and Maintenance.
- The basic elements of the maintenance management.

- **Organizational structure:**

The maintenance department may have a tall organizational structure with several reporting levels (Swanson, 2003). The organizational structure is a framework that defines the various departments and interior sections of the maintenance management, and also shows the different administrative units that work together to achieve the goals of the institution and implement its operations through a specialized unit of maintenance to ensure service continuity which include qualified individuals through organizational structure represented by one of the following organizations Plant Maintenance, Engineering, operations and production must share responsibility in a coordinated effort to optimize facility performance.

Making decisions on the basis of the best available (both quantitative and qualitative research), using data and information systems systematically (Sosnowy, 2013), This term as a service function, has responsibility for safe, efficient, and technically sound execution of maintenance work. The Engineering in this term has responsibility for providing technical information, guidance, and support to operations and maintenance as part of the team effort. The operations and production, as equipment owners, have accountability for their maintenance costs. The maintenance department shall prepare, implement, promulgate, and maintain a clear set of departmental operating instructions (Bush, 2008).

- **Decentralized organizational structure:** The maintenance unit is represented within the department at the hospital, the similarity of works is taken into account in the sections and the technicians provide equipment that enable to perform the maintenance activity.
- **Centralized organizational structure:** The special section for maintenance workshop does all the work, where the maintenance of all sections of the hospital is done by the teams according to a program used in the case of small sections.
- **Decentralized organizational structure added to a centralized maintenance unit:** The maintenance unit is represented within the department at the hospital and do the maintenance work for the department which is added to a central unit for repair, production, storage of spare parts, specialized works, and to prepare guidelines and plans, this unit includes a central workshop for maintenance. This organizational structure is trying to combine the advantages of the last two structures, especially in the case of large-sized sections.

- **Factor affecting the design of the organizational structure:**

The organizational structure is influenced by several factors when designed and formulated to be comprehensive and appropriate the size of the organization reflect on the size of the organizational structure, if the institution is more small, its organizational structure is also small, but relatively large difficult to be in the division and identify the tasks and activities to be performed process, and if a large organization, the organizational structure be great activities and business and be more numerous and diverse, leading to easy in the division of labor.

2.13.4 Monitoring

In this area the work called prepare checklist of Electrical and mechanical works, checking the connections, operating a daily testing, calibration, check wiring, a monthly efficiency of assessment, appliances on an annual basis, the devices at

different times depending on the timeframe expected malfunctions. The hospital units of elevators need to be sustained and vigorous follow-up for continued suitability. To evaluate, review maintenance programme that has been implemented assessment to establish whether the target has been achieved, find out what could be done to solve remaining problems (Zawawi, 2010). New technologies, systems introduce a need for well-trained and qualified personnel, to monitor, operate and maintain them. Thus, keep updating with current advances and new technical information is essential (Balaras et al., 2007).

2.14 Obstacles of Maintenance

A lot of countries are trying to get rank of industrialized with respect of maintenance. National strategy for those countries, these Strategies must begin a rehabilitation program for building , machinery and equipment to adopt preventive maintenance. Many obstacles facing can be summarized which adversely affect the production of the following:

- Absence of a circle on the high level of maintenance in most health institutions in hospitals real field survey of information about the real situation of the reality of maintenance in many countries , non-clear plan for maintenance , no prioritization of work, wasted a lot of effort, time and money.
- There is no enough money to carry out maintenance work; productivity is low, low wages, salaries, and lack of incentives for workers.
- The absence of a specialized department for purchase, distribution, storage of assets for various building, equipment used in hospital, leading to a lack of specialists in the development of specifications, bidding, lack of a clear acceptable maintenance contracts with provide service companies, lack of knowledge, lack of experience.

2.15 Service Procurement:

The services provided to stakeholders services, require a high-tech medical devices, good environments, continuity of the effective requirements to use preventive or corrective maintenance. Service purchasing follows competition and governmental procurement system in which there are two methods certified to the system of

purchasing maintenance service, the first method is: purchasing of maintenance service through large tenders by authorized parties of donors and through the Administration of International Cooperation at MOH, The second method is: direct purchasing under the supervision of the procurement Administration at MOH. Correct decisions regarding location selection to reduce operational costs and increase profits but also enhance the competitive advantage of future growth (Chen et al., 2007).

2.15.1 Management Functions of the Maintenance Unit

There are a set of functions for maintenance unit, which is considered as an outline of the work at the hospital:

- Identify the different objectives, policies, and procedures to establish guidelines for all maintenance work.
- Identification of deviations in showing instructions and the actual reality of the work unit and maintenance technicians.
- identify the causes that led and lead to non-compliance with the guidance and the maintenance unit should have a knowledge of that of the main reasons behind the failure to train employees on the instructions properly and desire to implement what they know they are on their own in addition to the sometimes a narrow time.
- Identify and develop schedules and executive plans to make the correction operations and application and follow-up and continuity in the modernization of the instructions according to the findings of cutting-edge technology .

To make sure that the maintenance unit has made and is walking towards achieving its objectives, it is necessary to find a good regulatory system and a high level of efficiency and effectiveness, including the following:

- Monitoring of maintenance workers in the department's commitment and achievements and the work of control of the logical action and indicators of the workers within the guidelines lay down and control the loss or problems resulting from the disruption of service to buildings and machinery and equipment.

- The transfer of sufficient information on the case and all phases of maintenance and procedures and the economy at the time, since all maintenance work must be done according to a specific timetable and action plan are full and comprehensive coordination and cooperation between the various units in the hospital details in addition to the high flexibility.
- Sufficient number of teams or crews of human, plant and materials provide commensurate with the size of the hospital and the nature of the services provided therein.

2.15.2 Service Procurement by Large Tenders

The minister forms several competent committees to complete the process of purchasing the service through major tenders, when deciding about the offers, all incoming requests are sent from the hospitals to the Procurement Department (PD) at the MOH, PD make an inventory of all requests received from all hospitals and collect all of the service specifications, all information are gathered in a brochure which contains general specifications, special conditions, technical specifications, bill of quantities, drawings, department of request, and the distribution of brochures to the companies for some of money goes to the Ministry of Finance (MOF) directly, the procurement department announce the tender in two newspapers at least according to the system and receive all bids from companies and announce the time of bids opening, and then calling all the participated companies at a certain time, the committee shall open the envelopes and announce the rates presentations of each company, the technical committee of MOH sorts all bids submitted by the companies, the order of prices, matching budget, cooperate with consultants from the same ministry in the technical issues when needed, the committee is composed of at least three members in addition to the chairman, financial observer from the MOF, and an observer of the general inspection department, this committee awards one company to have service procurement from it according to the provisions of the Law and Regulations, the procurement department contacts with the MOF to send a letter to the amount of budget before awarding the certified companies, after completing the accreditation procedures for the MOF, the purchasing order is sent to a company that has been awarded by the offer, and ask the companies to make: a bank guarantee, an

enforceable contract, identify business and accessories, site preparation in case of that the business requires it, and a record of the reception of the location. After the completion of the procedures and implementation, the Exchange are down paid, the receiving of works are tested after the registration process, and the engineer or the committee do the necessary tests to make sure the safety of the service after executing supervision and can be used in the hospital , the observations are recorded within the model of service examination, if the service has a very small observations and can be easily repaired, these observations should be recorded in the model (PD in MOH, 2014).

- **Administration of cards working in the field of maintenance / hospital**

The human is the most important element in the maintenance unit at the hospital in addition to the equipment, machinery, materials and construction, so the focus was on manpower in terms of numbers, disciplines, creating systems of incentives, assign responsibilities, duties, and functions of each individual, as well as making sure that everyone on the knowledge and expertise of systems and methods of work in the hospital have worked hard and some hospitals in order to find a special guide working in the field of maintenance contains individuals this guide on basic things that are important to them which is about the tasks and duties in each unit of the maintenance department, the basic requirements to recruit and fill any vacancy in the departments of maintenance. Laws, regulations, and instructions of interest to individuals and employees and senior management statement expectations of workers in the departments (GDEM, 2014).

And the statement of the job description for all individuals and all sites within the department and the department of human cadres in the maintenance department does not need to be an effective supervisor the tasks assigned to it in terms of solving the problems of maintenance services and follow-up instructions and staff scheduling their works.

Coordination with other departments in the hospital and to prepare special programs to maintenance and to provide periodic reports to senior management for maintenance and follow-up of all things storage, procurement and Business and Administrative other in addition to other works of art cover, but the role of the supervisor in the maintenance beyond the circle even further so that the supervisor loop link between the two groups and the administration to meet the needs of technicians and motivate and lead them

instead of their management, in addition to the need to investigate and search for personal needs and his staff in order to provide appropriate incentives that meet their needs towards more tender and productivity and management personnel also must provide a training program and guiding them can technicians through these programs recognize and cope with all sections of maintenance department and learn the various aspects of the technology used in their field in addition to increasing their skills and the maintenance department to provide places of special training and the use of optimal training method as the case (GDEM, 2014).

- **Maintenance Orders of medical devices and procedures of out servicing**

- 1- Maintenance orders of medical devices.
- 2- procedures of out servicing

The database on the computer is considered as the backbone in the maintenance procedures of medical devices since it contains all the data and information of medical devices.

- **Maintenance Procedures**

Recording & testing: when a Failure in the medical devices is occurred, one of the users of the medical devices communicates by telephone with the reception center of medical breakdowns and informing them about the Failures or to bring the device to the workshop. Reception center then recording all the information about the device in the database. Then, the device is delivered to the competent technician who records the failures on a label on the device, this label remains on the device until repairing and handling over to the department. After that, the technician records all the repairing details of the device, then turning to the database after full repairs. In each section or department there is an area of reception and delivery of devices, between the user of the device and the competent engineer of repairing devices. The repairing details of the device must be recorded in the database, because this data can be used as reference when needed, and can be used in saving time and effort when repeating the same failures, and a useful reference for the manufacturing company. All examination tools that used in the

department should be appropriate for the use within the department and carry a calibration certificate (GDEM, 2014).

A table is allocated for each technician in the maintenance workshops, and each technician is responsible for his table. All medical devices must be isolated from each other during the repairing process, and the technicians must wear the appropriate clothes and gloves code must be recorded for each device during repairing within the database that describes the state of the device and what failures or that the device is expected to attend the agent ... etc. The state of the device can be known from its location clearly, there is a need for each user to write detailed reports about faults occurred in the device and entering in the database, because this leads to reserve the device, any negligence in recording of such failure lead to deterioration or damaging of the equipment (GDEM, 2014).

- **Implementing Repairing Process**

The device should not be used until it has a mark of good manner and has the technician signature, all details should be recorded in the database. The environmental impact of maintenance associated with equipment is primarily decided at the design stage and secondarily, by the policies and steps followed during the operation phase of maintenance (Ajukumar and Gandhi, 2013).

- **Preventive Maintenance for Medical Devices**

Preventive maintenance process is one of the medical engineering administration tasks, it is done by one of technicians of medical maintenance. If the competent technician could not implement the Preventive maintenance for any reason, the manager should use his experience and skills in identifying the Preventive maintenance, and then he should inform the user if the preventive maintenance for the device is not implemented. Gits (1992) stated that PM is work performed after a specified period of time or machine use, restores equipment condition in order to avoid more catastrophic failures that would cause more extended downtime(Swanson, 2003).

- **Transferring the Device for Repairing or Calibration**

Sometimes works are transferred to the company or agent for repairing or calibration or supplying. The secretary office record all information about the works in the data base and special forms which are confirmed by the administration and hospital managers signatures, this form contains the competent technician name, serial number, sending date, receiving date, reason for external maintenance, and name of external company. The implemented works are received by the engineer and committee. Classification of works in terms of risks the devices are classified in terms of risks to: High, Moderate, and Low (GDEM, 2014).

- **Types of maintenance in terms of dealing:**

- **Type one:** when the devices are repaired in the site by the technicians.
- **Type two:** when the devices are repaired at the workshop of medical devices by the technicians, time of repairing is less than two hours, according to the availability of spare parts, the devices are returned to the department within five days.
- **Type three:** when the devices are repaired externally or at the workshop of medical devices by the agent, time of repairing is less than two hours, according to the availability of spare parts at the company, the devices are returned to the department within five days (GDEM, 2014).

2.15.3 Maintenance Contracts

The manager will resort to the work of maintenance contracts with the agent when devices are high risk, there is no a specialist engineer in the maintenance of these devices, lack of such devices for the repair, or lack of calibration instruments (PD, 2014).

There is a special model evaluates medical maintenance contracts. This form contains the following:

- **The type of contract and the amount of coverage:**

a comprehensive or a preventive maintenance contract cost (cost per hour), and the information recorded in the model are taken from the original reference which is the database, any new information about the contract, date of the beginning, end of the

actual cost, are entered to the database. Details of agent contract, details of the user, the devices site, and the devices are still used or replaced by a new model? The replacement must be reported to the committee responsible for the device. The effective contract is consistent with the possibility of the user and provides good and appropriate services at an acceptable cost. If the device maintenance service is only available from the agent and the contract cost is too high and unacceptable, the medical engineering management and coordination with the purchasing department will make a decision to prevent the purchase of new equipment from this company because of the high maintenance cost, which exceeds the upper limit (GDEM, 2014).cv

- **Training:**

The general director of engineering and maintenance (GDEM) is considered as the responsible for identifying the training needs for all staff, and develops their abilities. This is done in coordination with all departments of personnel. Green maintenance enabled design of equipment and sustainable maintenance practices emerge as a solution to the problem (Ajukumar and Gandhi, 2013). Maintenance practices to "predict and prevent" is the advantage of the latter to perform a certain level of equipment deterioration that occurs on a specified period of time or usage (Veron et al, 2005). Engineering and management staff receives two types of training:

- **General training:**

It aims to develop the workers in engagement with their work environment, for example, training sessions are held in the areas of fire extinguishers, first aid, and the formation of working groups, etc.

- **Special training:**

It aims to develop staff skills in their field, e. g include courses held by the agents to train the users of devices so that they can use and maintenance as required. The maintenance department must be staffed with properly trained technical personnel. Training of staff, hiring qualified personnel or a contractor, is necessary pre-emptive actions (Balaras et al, 2007).

2.16 Concluding Remarks for Literature Review

This chapter reviews the literature that are related to the present study to achieve the four objectives listed in chapter one and to determine factors affecting maintenance management of public hospital buildings.

The first objective was to influence of decision making of maintenance management with reducing the overall costs of buildings maintenance in Gaza strip governmental hospitals as illustrated in the following:

- The maintenance department structure, responsibilities and what activities was illustrated.
- Deterioration, future needs and faulty of choice materials considered as factors influence maintenance in the design stage.
- Maintenance cost factors were mentioned as building materials, building services, building age and failure to execute maintenance at the right time.
- The poor maintenance of public buildings factors: the age of the buildings, lack of maintenance culture, inadequate funds and high maintenance cost, pressure on building facilities by number of users and poor construction work and maintenance work done by maintenance personnel of the institution.
- Hospital building characteristics and their effect on the privacy of interior preparation and medical installation that required special maintenance procedure was mentioned to have a good background on hospital`s behavior.
- There was dissatisfaction of the approach to maintenance factors: poor specification of initial requirements, unclear aims and objectives and inappropriate frameworks and the operational conditions carried out by maintenance departments in public hospital building didn`t cover all kind of maintenance.
- Maintenance daily work is important to determine the attitude of the maintenance departments or scheduled maintenance services provided to the end users of the building.

The second objective was to set the criteria of the maintenance project items according to the following:

- the complexity criteria is a lack consensus on what constitutes excellence in building assessment performance, covering the overlapping dimensions of social, economic, environment and technological factors.
- Maintenance projects, construction time, cost predictability (design and construction), time predictability, defects, client satisfaction with the product and client satisfaction with the service.
- Previous literature has listed more than one classification of maintenance: preventive maintenance, corrective maintenance and immediate maintenance etc.
- Building defects considered as essential resource for maintenance activities, understanding common building defects and their types were essential, defects in the building was analyzed and took an overview of common defects in buildings.

The third objective was to investigate the contradiction between the documents according to:

- Identifying all documents that related to maintenance projects.
- Choosing suitable standers documents for hospital building maintenance.
- Systems of before implementation in-house or outsourced.

The fourth objective was to Increase staff productivity to specify the minimum requirements for maintenance management:

- Detailed field Survey for each building in the hospital and determine the existing component of the building and their classifications.
- Prepare updated as built drawing for each component in the building and prepare Check list for inspection of building component.
- Maintenance was defined as combination of all the technical and administrative actions, including supervision, intended to retain an item, or restore it to a state in which it can perform a required function.
- Maintenance aspects like functional, technical and image of the building and their performance dimensions was discussed.

3. CHAPTER THREE: METHODOLOGY

This chapter describes the methodology that was used in this research. The adopted methodology to accomplish this study uses the following techniques: the information about the research design, research population, questionnaire design, statistical data analysis, content validity and pilot study.

3.1 Research Design

This chapter includes the main methodologies used in this research, pilot study and data collection of a structured questionnaire, and the research data. The research design is illustrated in six phases as follows:

The first phase of the research is identifying the problems and establishing objective of the study and developing a research plan.

The second phase of the research includes a summary of the comprehensive literature review. Literatures on Factors Affecting Maintenance Management in Gaza Strip Governmental Hospitals were reviewed.

The third phase of the research included a field survey which was conducted with the engineering, maintenance management in the governmental hospitals in Gaza Strip.

The fourth phase of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study. The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the study. The questionnaire was modified based on the results of the pilot study. **250** questionnaires were distributed to the research population and **226** questionnaires were received.

The fifth phase of the research focused on distributing questionnaire. This questionnaire was used to collect the required data in order to achieve the research objective.

The sixth phase of the research was data analysis and discussion. Statistical Package for the Social Sciences, (SPSS 22) was used to perform the required analysis. The final phase includes the conclusion and recommendations.

Figure (3.1) shows the methodology flowchart, which leads to achieve the research objective.

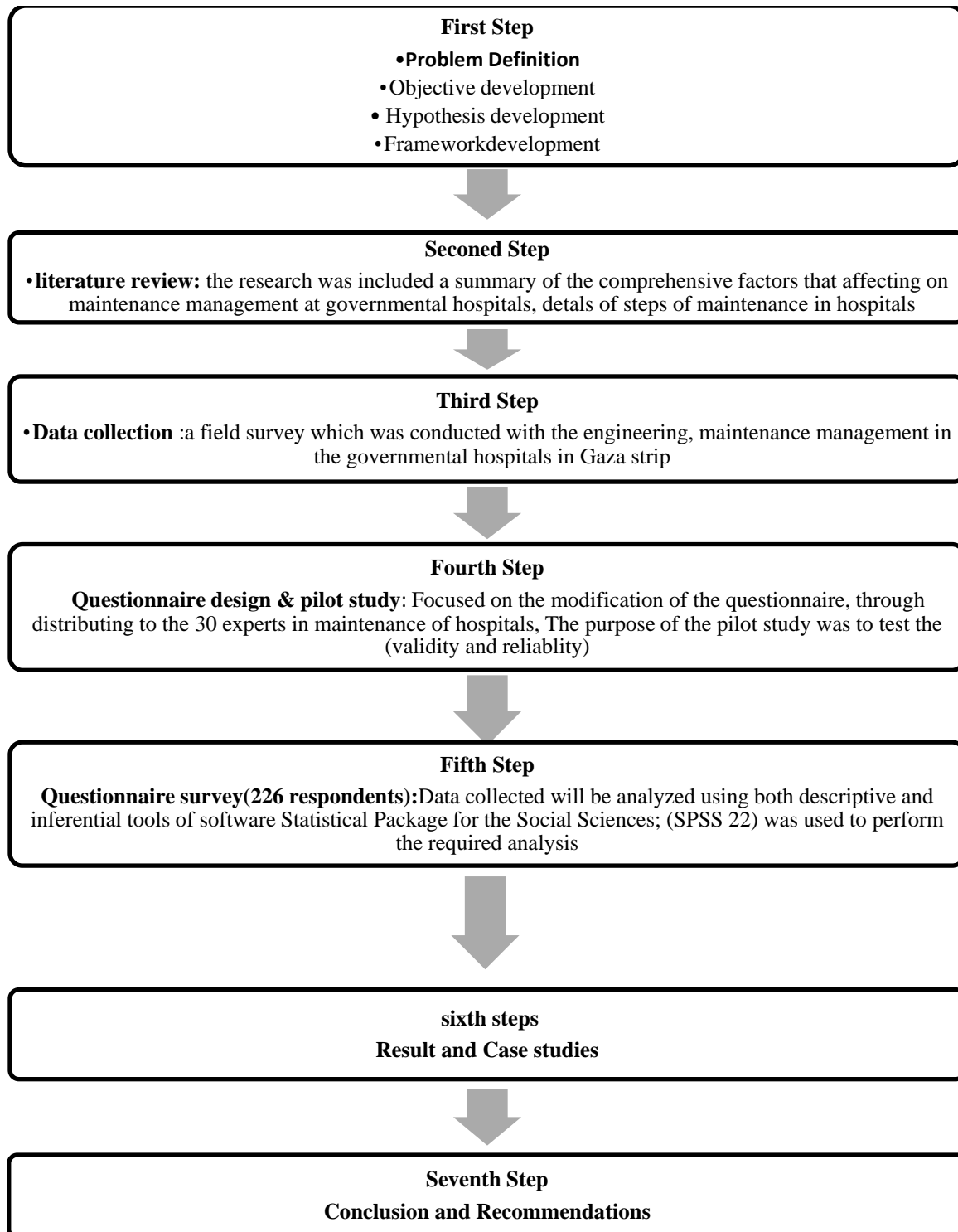


Figure 3.1: Framework of the research methodology

3.2 Data Collection Methodology

In order to collect the needed data for this research , the secondary resources in collecting data such as books, journals, statistics and web pages , in addition to preliminary resources that not available in secondary resources through distribute questionnaires on study population in order to get their opinions about factors affecting on maintenance management in Gaza Strip hospitals. Research methodology depends on the analysis of data on the use of descriptive analysis, which depends on the poll and use the main program (SPSS 22).

3.3 Population And Sample Size

The population included employees of administration of engineering and maintenance in the ministry of health MOH. The populations of study are the manager, engineers, technicians working in Gaza hospitals maintenance projects in Gaza Strip, we select exploratory sample with size of **30** , and 250 questionnaires were distributed randomly to the research sample and **226** questionnaires are received.

Sample size determination:

Here are the formulas used to determine the sample size:

$$\text{Sample Size } n = \left(\frac{z}{2m} \right)^2 \quad (3.1)$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level)

m = confidence interval (margin of error), expressed as decimal (e.g., .05 = ±5)

Correction for finite population:

$$n_{corrected} = \frac{nN}{N + n - 1} \quad (3.2)$$

Where: N = population size

Using Equation (3.1), the sample size is:

$$n = \left(\frac{1.96}{2 \times 0.05} \right)^2 = 384$$

The population size is 394, the corrected sample size using equation (3.2) is:

$$n_{corrected} = \frac{384 \times 394}{394 + 384 - 1} = 195 \quad (3.3)$$

Therefore, the minimum sample size required is at least 195

3.4 Pilot Study

A pilot study for the questionnaire was conducted before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of question, identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents.

3.5 Data Measurement

In order to be able to select the appropriate method of analysis, the level of measurement must be understood. For each type of measurement, there is/are an appropriate method/s that can be applied and not others. In this research, ordinal scales were used. Ordinal scale is a ranking or a rating data that normally uses integers in ascending or descending order. The numbers assigned to the important (1,2,3,4,5) do not indicate that the interval between scales are equal, nor do they indicate absolute quantities. They are merely numerical labels. Based on Likert scale as shown in table (3.1):

Table 3.1: Likert scale

Item	Very High.	High.	Mid.	Low	Very Low
Scale	5	4	3	2	1

3.6 Test of Normality for each field

Table (3.2) shows the results for Kolmogorov-Smirnov test of normality. From Table (3.2), the p-value for each field is greater than 0.05 level of significance, then the distribution for each field is normally distributed. Consequently, parametric tests will be used to perform the statistical data analysis.

Table 3.2: Kolmogorov-Smirnov test

Field	Kolmogorov-Smirnov	
	Statistic	P-value
Human Resources Factors	0.523	0.947
Maintenance Projects Factors	0.678	0.747
Effect of policy and vision of the organization on maintenance administration	0.515	0.954
Effect of internal and external environment of the organization on maintenance	0.618	0.840
Effect of Crisis policy outside the organization on maintenance administration	0.935	0.346
Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property	0.537	0.935
All paragraphs of the questionnaire	0.746	0.635

3.7 Statistical Analysis Tools

The researcher would use data analysis both qualitative and quantitative data analysis methods. The Data analysis was made utilizing (SPSS 22). The researcher would utilize the following statistical tools:

- Kolmogorov-Smirnov test of normality.
- Pearson correlation coefficient for Validity.
- Cronbach's Alpha for Reliability Statistics.
- Frequency and Descriptive analysis.
- Parametric Tests (One-sample T test).

T-test is used to determine if the mean of a paragraph is significantly different from a hypothesized value 3 (Middle value of Likert scale). If the P-value (Sig.) is smaller than or equal to the level of significance, $\alpha = 0.05$, then the mean of a paragraph is significantly different from a hypothesized value 3. The sign of the Test value indicates whether the mean is significantly greater or smaller than hypothesized value 3. On the other hand, if the P-value (Sig.) is greater than the level of significance $\alpha = 0.05$, then the mean an item is insignificantly different from a hypothesized value 3.

3.8 Validity of Questionnaire

Validity refers to the degree to which an instrument measures what it is supposed to be measuring. Validity has a number of different aspects and assessment approaches.

Statistical validity is used to evaluate instrument validity, which include internal validity and structure validity.

3.8.1 Internal Validity

Internal validity of the questionnaire is the first statistical test that used to test the validity of the questionnaire. It is measured by a scouting sample, which consisted of 30 questionnaires through measuring the correlation coefficients between each paragraph in one field and the whole field. Table (3.3) clarifies the correlation coefficient for each paragraph of the “Effecting of human resources factors on maintenance administration” and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.3: Correlation coefficient of human resources factors on maintenance administration

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Characterized by the institution size / No. of employees in the field of maintenance.	0.376	0.020*
2.	The staff have a good experience training in terms of efficiency	0.467	0.006*
3.	Employees have a competition in the field of maintenance.	0.564	0.001*
4.	A characterized of acceptable behavior for the employees compared to job satisfaction.	0.808	0.000*
5.	The culture to do the work and satisfaction.	0.710	0.000*
6.	The feeling of responsibility to complete works .	0.450	0.007*
7.	Work of employees and the reactions resulting from the performance feedback.	0.562	0.001*
8.	A social solidarity relationship between employees.	0.553	0.001*
9.	Supports the existence of the responsibility distribution of roles either positively or negatively.	0.530	0.001*
10.	Finding methods of reward and punishment of maintenance process according to planned vision.	0.386	0.018*
11.	Directing the staff to apply clear, serialized and written instructions in doing work.	0.587	0.000*
12.	Seeking clarity job description for maintenance workers to work distribution.	0.593	0.000*
13.	Presence of a strong relationship between the direct boss and workers to carry out business.	0.614	0.000*

* Correlation is significant at the 0.05 level

Table (3.4) clarifies the correlation coefficient for each paragraph of the “Effecting of maintenance projects factors on maintenance administration” and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are

significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.4: Correlation of maintenance projects factors on maintenance administration

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	The project size supports the speed and accuracy of implementation.	0.692	0.000*
2.	The administration have comprehensive maintenance for all project .	0.663	0.000*
3.	The period of completing the project in the specified time, cost and quality.	0.604	0.000*
4.	A specified time to start the project.	0.603	0.000*
5.	Finance the project (internally, externally)	0.575	0.000*
6.	Supports the division of work in phases according to the location or type of work	0.774	0.000*
7.	To specific criteria that differ in their characteristics from other projects.	0.701	0.000*
8.	Information about the complexity in the project	0.532	0.001*
9.	Encourages safety factors required in the project .	0.687	0.000*
10.	Takes decisions and implement rapidly from the supervision .	0.693	0.000*
11.	The administration follows true and planned steps in studying the tender documents and drawings of project before implementing the maintenance works.	0.594	0.000*
12.	The maintenance works can be affected by ambiguity, complexity and lack of a clear explanation of the bill of quantities in the project.	0.407	0.013*
13.	Provide the necessary materials for the maintenance work early	0.734	0.000*
14.	There is an advance to buy the needed materials for the maintenance project quickly	0.491	0.003*

* Correlation is significant at the 0.05 level

Effect of policy and vision of the organization on maintenance administration

Table (3.5) clarifies the correlation coefficient for each paragraph of the " Strategies of the organization according to plans " and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.5: Correlation coefficient of Strategies of the organization according to plans

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Standards of the organization to perform maintenance works	0.733	0.000*
2.	Enforce regulations, laws and mechanisms of the ministry for the implementation of special projects in maintenance work.	0.794	0.000*
3.	Priorities in choosing work implementation of scheduling and arranging of work.	0.777	0.000*
4.	There is the right man in the right place and make the right decision.	0.681	0.000*
5.	Action communication, cooperation and partnership with donors to provide funding for the completion of the work.	0.777	0.000*
6.	Capabilities according to prepared plans to complete the works as scheduled	0.669	0.000*
7.	Coordinates, provides facilities, and builds relationships with local and international institutions to overcome risks.	0.713	0.000*
8.	The administration provides a safe working environment and means of pre-emptive in the event of a risk because of the place.	0.746	0.000*
9.	Emit / qualify / train personnel administration, both abroad and at home to do the work.	0.634	0.000*
10.	The administration is characterized by planning, organizing, directing, monitoring and internal and external control to the success of the work.	0.798	0.000*
11.	The administration seeks to have a clear vision about the implemented maintenance projects and the projects to be implemented in the future and a mechanism to link these projects to each other.	0.739	0.000*

* Correlation is significant at the 0.05 level

Table (3.6) clarifies the correlation coefficient for each paragraph of the " Strategies of the organization In terms of economic issue " and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.6: Correlation coefficient of Strategies of the organization In terms of economic issue

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	High and low exchange rates	0.523	0.002*
2.	Delays / pays the payments in case of an external contractor or paid in a specific time.	0.840	0.000*
3.	Guarantees of a contractor	0.821	0.000*
4.	The administration fines / stimulates / deducts the maintenance workers in case of acceleration or delay	0.792	0.000*
5.	There are additional works in most of the maintenance	0.728	0.000*

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
	projects as a result of the ambiguity and lack of clarity in the size and type of maintenance.		

* Correlation is significant at the 0.05 level

Table (3.7) clarifies the correlation coefficient for each paragraph of the “Strategies of the organization In terms of technical issue ” and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.7: Correlation coefficient of Strategies of the organization In terms of technical issue

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Matching between the maintenance plan with the other plans (owner, contractor, consultant, donor, ..) and the nature of the relationship between them.	0.561	0.001*
2.	Quality services, quality of the used materials, and the attention to special maintenance works.	0.556	0.001*
3.	The necessary capabilities, resources, and facilities that will lead to the completion work.	0.704	0.000*
4.	Recycling and reuse of non-consuming material, which provides the organization and helps in new artwork, but the quality may be less.	0.594	0.000*
5.	Technical / engineering opinion in terms of flexibility / accuracy in decision-making.	0.836	0.000*
6.	Encourages independence /privacy in the success of non-subordination / failure of maintenance process technically	0.709	0.000*
7.	Supports the existence of a maintenance team during the receipt of the newly implemented projects for future follow-up maintenance	0.642	0.000*
8.	Coordinates between team supervisor on new projects and maintenance team in order to plan, have a clear vision,.	0.650	0.000*

* Correlation is significant at the 0.05 level

Table (3.8) clarifies the correlation coefficient for each paragraph of the " Strategies of the organization In terms of technological issue " and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.8: Correlation of Strategies of the organization In terms of technological issue

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	A unified computerized system to provide the tools and mechanisms of storing and dispensing like developed countries.	0.875	0.000*
2.	Schedules works in terms of priorities based on a program adopted by all the parties involved to accomplish.	0.820	0.000*
3.	The administration keeps pace with the development and transfer of technology from developed countries through the development of teams.	0.886	0.000*
4.	The sustainability systems projects in engineering design and insists to include these systems in the maintenance work.	0.837	0.000*
5.	A computerized system to document the performed work, as well as linking the request systems and stores.	0.891	0.000*
6.	The administration works to develop a modern control systems required for maintenance in all maintenance projects to be carried out and implemented, such as PLC / BMS	0.637	0.000*

* Correlation is significant at the 0.05 level

Effect of internal and external environment of the organization on maintenance administration.

Table (3.9) clarifies the correlation coefficient for each paragraph of the " Effect of internal environment of the organization on maintenance administration " and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.9: Effect of internal environment of the organization on maintenance administration

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	The administration seeks to provide a place for maintenance, such as (office rooms, nursing rooms, patient rooms, operation rooms, bathrooms) before starting maintenance	0.683	0.000*
2.	The information about the physical factors in terms of the appropriate place for maintenance work such as (ventilation / lighting / high or underground)	0.827	0.000*
3.	Information about the status of the place such as (vacant/ unoccupied /under warranty)	0.825	0.000*
4.	The specialization (type) in the work necessary for the maintenance of such (civil works/ mechanical/ electrical/medical)	0.789	0.000*
5.	The administration encourages to solve any problem necessary for maintenance work (emergency / scheduled / non-scheduled / planned / unplanned / preventive)	0.709	0.000*
6.	Characterized of degree difficulty to perform work (easy / vague / need to transfer out of place / difficult due to lack	0.772	0.000*

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
	of a suitable environment)		
7.	Information about the size of maintenance work (can be treated in the same place / large / small treatment cannot be in the same place)	0.810	0.000*
8.	The use of high quality materials and are available in stores or local markets	0.611	0.000*
9.	Non-specialized personnel (technically), doctors, nurses maintenance work for personal wishes	0.642	0.000*

* Correlation is significant at the 0.05 level

Table (3.10) clarifies the correlation coefficient for each paragraph of the "Effect of external environment of the organization on maintenance administration" and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.10: Effect of external environment of the organization on maintenance administration

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Weather changes such as (temperatures, winds, storms,)	0.785	0.000*
2.	Risks in the work, such as (pollution, noise, and congestion)	0.684	0.000*
3.	External constraints such as (intervention abroad / unplanned maintenance / works overlapping...)	0.722	0.000*
4.	Contracts with external parties, such as (experts in maintenance/ contractors / suppliers / donors	0.607	0.000*
5.	Characterized coordination (municipalities / Ministries Electricity Company and communications	0.673	0.000*

* Correlation is significant at the 0.05 level

Table (3.11) clarifies the correlation coefficient for each paragraph of the "Effect of Crisis policy outside the organization on maintenance administration" and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.11: Effect of Crisis policy outside the organization on maintenance administration

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Political instability resulting from the conflict/ reconciliation	0.509	0.002*
2.	The siege imposed on the Gaza Strip since 7 years	0.785	0.000*
3.	The challenges facing the health sector in the provision of the minimum requirements for the completion of works	0.723	0.000*
4.	Wars on Gaza strip in 2008, 2012, and 2014	0.810	0.000*
5.	Political conflicts which led to the conscientious and non-return of a large no. of employees to work and inequality among staff in terms of rights	0.717	0.000*
6.	Rapid crises as a result of lack of clear policy for donors / donor funding for projects the size and quality for maintenance	0.732	0.000*
7.	Using of collective punishment imposed by the Israeli occupation	0.622	0.000*
8.	Restrictions and conditions imposed by some donors to perform some maintenance work	0.577	0.000*
9.	No encourage for the investment in maintenance as a result of successive political upheavals	0.545	0.001*
10.	The lack of a comprehensive program to support the maintenance sector in all aspects	0.659	0.000*

* Correlation is significant at the 0.05 level

Table (3.12) clarifies the correlation coefficient for each paragraph of the " Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property " and the total of the field. The p-values (Sig.) are less than 0.05, so the correlation coefficients of this field are significant at $\alpha = 0.05$, so it can be said that the paragraphs of this field are consistent and valid to be measure what it was set for.

Table 3.12: Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
1.	Periodic meetings to resolve the problem on time	0.558	0.001*
2.	Setting a timetable for maintenance work in terms of priority	0.456	0.006*
3.	Review and audit requests for maintenance orders and do not recur	0.693	0.000*
4.	Regarding / responsibility in performing tasks by the team based on the maintenance operations	0.651	0.000*
5.	Provide moral and real incentives	0.755	0.000*
6.	Providing comfortable environment and appropriate place to work for the team of maintenance work	0.845	0.000*
7.	Provide adequate training to prepare staff for maintenance operations, whether internally or externally	0.741	0.000*
8.	Using of punishment methods , whether the warning or dismissal for those who work in disregarding	0.393	0.016*

No.	Paragraph	Pearson Correlation Coefficient	P-Value (Sig.)
9.	Speed and proficiency in the performance of work as required precision	0.607	0.000*
10.	Maintaining the use of high quality materials and are available in local markets	0.608	0.000*
11.	Operating the team on modern systems and variable periods	0.618	0.000*
12.	Applying the preventive maintenance program	0.833	0.000*
13.	Provision of spare parts and materials necessary for the implementation of all kinds of maintenance programs	0.756	0.000*
14.	Continuous coordination between Administrations and departments to perform maintenance quickly and accurately	0.677	0.000*
15.	The provision of a dedicated staff with efficiency and professionalism in terms of quantity and quality	0.787	0.000*
16.	Import modern technology and quality programs to keep pace compared with the developed countries	0.678	0.000*

* Correlation is significant at the 0.05 level

3.8.2 Structure Validity of the Questionnaire

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

As shown in Table (3.13) clarifies the correlation coefficient for each field and the whole questionnaire. The p-values (Sig.) are less than 0.05, so the correlation coefficients of all the fields are significant at $\alpha = 0.05$, so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study.

Table 3.13: Correlation coefficient of each field and the whole of questionnaire

No.	Field	Pearson Correlation Coefficient	P-Value (Sig.)
	Human Resources Factors	0.618	0.000*
	Maintenance Projects Factors	0.826	0.000*
1.	Strategies of the organization according to plans	0.918	0.000*
2.	Strategies of the organization In terms of economic issue	0.885	0.000*
3.	Strategies of the organization In terms of technical issue	0.770	0.000*
4.	Strategies of the organization In terms of technological issue	0.822	0.000*
	Effect of policy and vision of the organization on maintenance administration	0.802	0.000*
1.	Effect of internal environment of the organization on maintenance administration	0.840	0.000*
2.	Effect of external environment of the organization on	0.922	0.000*

No.	Field	Pearson Correlation Coefficient	P-Value (Sig.)
	maintenance administration		
	Effect of internal and external environment of the organization on maintenance	0.586	0.000*
	Effect of Crisis policy outside the organization on maintenance administration	0.431	0.009*
	Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property	0.533	0.001*

* Correlation is significant at the 0.05 level

3.9 Reliability of the Research

The reliability of an instrument is the degree of consistency which measures the attribute; it is supposed to be measuring. The less variation an instrument produces in repeated measurements of an attribute, the higher its reliability. Reliability can be equated with the stability, consistency, or dependability of a measuring tool. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient (George and Mallery, 2003). Period of two weeks to a month is recommended between two tests. Due to complicated conditions that the sample is facing at the time being, it was too difficult to ask them to responds to our questionnaire twice within short period. The statistician's explained that, overcoming the distribution of the questionnaire twice to measure the reliability can be achieved by using Cronbach Alpha coefficient through the SPSS 22 software.

3.10 Cronbach's Coefficient Alpha

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. The Cronbach's coefficient alpha was calculated for each field of the questionnaire.

Table (3.14) Shows the values of Cronbach's Alpha for each field of the questionnaire and the entire questionnaire. For the fields, values of Cronbach's Alpha were in the range from 0.775 and 0.941. This range is considered high; the result ensures the reliability of each field of the questionnaire. Cronbach's Alpha equals 0.959 for the entire questionnaire which indicates an excellent reliability of the entire questionnaire.

Table 3.14: Cronbach's Alpha for each field of the questionnaire

No.	Field	Cronbach's Alpha
1.	Human Resources Factors	0.775
2.	Maintenance Projects Factors	0.879
3.	Effect of policy and vision of the organization on maintenance administration	0.941
4.	Effect of internal and external environment of the organization on maintenance	0.854
5.	Effect of Crisis policy outside the organization on maintenance administration	0.858
6.	Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property	0.920
	All paragraphs of the questionnaire	0.959

Thereby, it can be said that the researcher proved that the questionnaire was valid, reliable, and ready for distribution for the population sample.

4. CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION

This chapter includes analysis and discussion of the result that have been collected from field surveys. A total of 226 from 250 completed copies had been received, representing valid response rate 90.4 %. Data were analyzed quantitatively using SPSS version 22 including descriptive and inferential statistical tools. This chapter included the respondent profiles and the way of implementing work, quantitative analysis of the questionnaire, and finally the summary framework of the results.

4.1 Personal Data

The target respondent of questionnaire survey were the professionals (administrators, managers, engineers, technicians and other workers.

Gender: Table No.(4.1) shows that 98.2% of the sample are Males and 1.8% of the sample are Females, this result indicates that males are more preferred than females to do maintenance as shown in the table (4.1).

Table 4.1: The respondent profile

General information about respondent	Categories	Frequency	Percentage
Gender	Male	222	98.2%
	Female	4	1.8%
Age	From 20-25yrs.	14	6.2%
	From 26-30yrs.	91	40.3%
	From 31-35yrs.	53	23.5%
Qualification	Master	16	7.1%
	Bachelor	77	34.1%
	Diploma	113	50.0%
	other	20	8.8%
Job in maintenance management	Director of Administration	1	0.45%
	Director of Department	6	2.65%
	Head of Department	25	11.1%
	other	194	85.9%
Years of Experience	1- 5 years	45	19.9%
	6- 10 years	100	44.2%
	11- 15 years	29	12.8%
	more than 15 years	52	23.0%

General information about respondent	Categories	Frequency	Percentage
Experience of your Maintenance Administration	1- 5 years	43	19.0%
	6- 10 years	89	39.4%
	11- 15 years	22	9.7%
	more than 15 years	72	31.9%
No. of permanent employees	1-5 Empl.	25	11.1%
	6-10 Empl.	73	32.3%
	11-15 Empl.	15	6.6%
	more than 15 Empl.	113	50.0%
Hospital Type	General	183	80.97%
	Specialist	42	18.58%
	Educational	1	0.45%
	Emergency	0	0.0%
Size of Hospital expands	50 Beds	41	18.1%
	51-150 Beds	97	42.9%
	151-600 Beds	61	27.0%
	more than 600 Beds	27	11.9%
Specializations	General	141	62.4%
	Specialist	58	25.7%
	Central	16	7.1%
	Major	11	4.9%
Departments administration	1-5 bul.	53	23.5%
	6-10 bul.	97	42.9%
	11-15 bul.	28	12.4%
	more than 15 bul.	48	21.2%
Area of Departments served	< 500m ²	22	9.7%
	500-<1000m ²	91	40.3%
	1000 - < 2000 m ²	34	15.0%
	more than 2000 m ²	79	35.0%
Age of building	1- < 5 years	13	5.8%
	5 - <10 years	91	40.3%
	10 - <20 years	48	21.2%
	more than 20 years	74	32.7%
No. of large systems	Single Sys	10	4.4%
	Double Sys	38	16.8%
	Multi Sys	125	55.3%
	Complex Sys	53	23.5%
No. of Medical devices need annual maintenance	< 10 devices	14	6.2%
	11 - <50 devices	79	35.0%
	51 - <100 devices	27	11.9%
	> 100 devices	106	46.9%
No. of specialized Companies that can buy the maintenance	< 5 comp	55	24.3%
	5 - <10 comp	91	40.3%
	10 - <20 comp	33	14.6%
	20 comp	47	20.8%

General information about respondent service	Categories	Frequency	Percentage
No. of general companies can do maintenance	< 5 comp	68	30.1%
	5 - <10 comp	88	38.9%
	10 - <20 comp	31	13.7%
	20 comp	39	17.3%

Age : Table (4.1) shows that 6.2% of the sample is from 20-25 years, 40.3% of the sample is from 26-30 years, which is a benefit that is the largest percent from youth, 23.5% of the sample are from 31-35 years, and 30.1% of the sample is more than 36years.

Qualification: Table (4.1) shows that 7.1% of the sample are " Master " holders, 34.1% of the sample are " Bachelor " holders, 50.0% are " Diploma " holders since almost of the maintenance workers are technicians, and 8.8% of the sample are other holder.

Job in maintenance management: Table (4.1) shows that 0.45% of the sample are " Director of Administration ", 2.65% of the sample are " Director of Department " , 11.1% are " Head of Department " since almost of the maintenance team from engineers , and 85.9% of the sample are other holder.

Years of Experience at Maintenance: Table (4.1) shows that 19.9 % of the sample have " 1-5" years of experience, 44.2 % of the sample have " 6-10" years of experience, 12.8 % have " 11-15" years of experience, and 23% of the sample have more than 15 years which include the experts of maintenance.

Experience of your Maintenance Administration: Table (4.1) shows that 19% of the Maintenance Administration have "1-5" years of experience, 39.4% of the sample have " 6-10" years of experience, 9.7 % have " 11-15" years of experience, and 31.9% of the sample have more than 15 years.

No. of permanent employees in your administration: Table (4.1) shows that more than 50% of Maintenance Administration have more than 15 employees, 11.1% from "1-5" empl. 32.3% from "6-10" empl. And 6.6 % from "11-15" empl.

Hospital according to type: Table (4.1) shows that 80.97% is general hospitals, 18.58% Specialist hosp.,0.45% educational hospitals and there is no emergency hospitals but there is an emergency department in every hospital.

The Size of Hospital expands to: Table (4.1) shows that 18.1% contain 50 bed, 42.9% contain from 15 to 150 beds, 27.0% from 151 to 600 beds and 11.9 more than 600 bed.

Specializations: The table (4.1) shows that more than 62% of the Hospitals are General, 25.7% Specialist, 7.1% central and 4.9% Major.

No. of Departments served by your administration: Table (4.1) shows that more than 42% of the Hospitals have 6 to10 buildings served by the maintenance administration, 23.5% served by from 1-6 buil., 12.4% served by from 11 to 15, more than 21% served by more than 15 buil.

Area of Departments served by your administration: Table (4.1) shows that more than 40% of the hospitals have area of 500 to 1000m² served by the maintenance administration, more than 9% of the hospitals have area of 500 to 1000m² served by the maintenance administration. exact 15% of the hospitals have area of 1001 to 2000m² served by the maintenance administration, exact 35% of the hospitals have area of more than 2000m² served by the maintenance administration.

Age of building needs maintenance: Table (4.1) shows that more than 40% of the hospitals having age of 5 to 10 years need maintenance, more than 5% of the hospitals having age of 6 to 10 years need maintenance, more than 21% of the hospitals having age of 11 to 20 years need maintenance, more than 32% of the hospitals having age more than 20 years need maintenance,.

No. of large systems need maintenance (Generators,): Table (4.1) shows that more than 55% of the hospitals need multi systems of maintenance, more than 4% of the hospitals need single systems of maintenance, more than 16% of the hospitals need double systems of maintenance, more than 23% of the hospitals need complex systems of maintenance,.

No. of Medical devices need annual maintenance: Table (4.1) shows that about 47% of the hospitals need annual maintenance less than 10 dev., exact 35% of the hospitals need annual maintenance from 11to 50 dev., about 12% of the hospitals need annual maintenance from 51to 100 dev., about 47% of the hospitals need annual maintenance more than 100 dev.

No. of specialized companies that can buy the maintenance service: Table (4.1) shows that about 40% of the existed medical companies can provide maintenance service for the hospitals less than 5 comp., about 24% of the existed medical companies can provide maintenance service for the hospitals from 6 to 10, more than 14% of the existed medical companies can provide maintenance service for the hospitals from 11to 20, and more than 20% of the existed medical companies can provide maintenance service for the hospitals more than 20 comp.

No. of general companies can do maintenance: Table (4.1) shows that about 30% of the existed general companies can do maintenance for the hospitals less than 5 comp., about 40% of the existed general companies can do maintenance for the hospitals from 5 to 10 comp., more than 13% of the existed general companies can do maintenance for the hospitals from 11 to 20 comp., more than 17% of the existed general companies can do maintenance for the hospitals more than 20 comp.

4.2 Analysis For Each Field

4.2.1 Effecting Of Human Resources Factors

Table (4.2) shows the following results:

- The mean of item #11 “The administration is directing the staff to apply clear, serialized and written instructions in doing work” equals 3.36 (67.26%), Test-value = 5.32, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.
- The mean of item #3 “Employees have the state of competition in the field of maintenance because they are paid incentives, either moral or physical” equals 2.11 (42.23%), Test-value = -12.08, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this paragraph.
- The mean of the field “Effecting of human resources factors on maintenance administration” equals 2.96 (59.15%), Test-value = -1.14, and P-value=0.128 which is greater than the level of significance $\alpha = 0.05$. The mean of this field is insignificantly different from the hypothesized value 3. We conclude that the respondents (Do not know, neutral) to field of “Effecting of human resources factors on maintenance administration”.
- item #11 indicates that a sequence and a clear instructions from the maintenance administration, also paragraph #3 indicates that there is no satisfaction in the competition due to two reasons lack of employees and political division.
Generally, the resources do not only affect on maintenance administration decisions.

Table 4.2: Effecting of human resources factors on maintenance administration

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Characterized size / No. of employees in the field of maintenance compared to the size of the work assigned to them.	2.47	49.33	-8.64	0.000*	12
2.	The staff have a good experience , adequate training in terms of efficiency	2.91	58.12	-1.44	0.075	10
3.	Employees have a competition in the field of because they are paid incentives, either moral.	2.11	42.23	-12.08	0.000*	13
4.	The administration accepted behavior for the employees compared to job satisfaction.	2.59	51.77	-5.77	0.000*	11
5.	The employees have the culture to do the acceptable work and satisfaction.	2.98	59.56	-0.36	0.361	8
6.	The employees are feeling responsibility towards the works to be completed	3.35	67.00	5.41	0.000*	2
7.	There is a follow-up to the work of employees and the reactions resulting from the performance of work and give feedback.	3.31	66.13	4.46	0.000*	3
8.	There is a social solidarity relationship between the employees .	3.26	65.24	3.65	0.000*	4
9.	The administration supports the existence of the Mandate / responsibility / distribution of roles/ and be developed to its extent, either positively or negatively.	3.09	61.78	1.21	0.115	6
10.	The administration seeks to find methods of reward and punishment that would regulate the maintenance process according to the planned vision.	3.09	61.87	1.25	0.107	5
11.	The administration is directing the staff to apply clear, serialized and written instructions in doing work.	3.36	67.26	5.32	0.000*	1
12.	The administration is seeking clarity of the job description for maintenance workers according to the work distribution.	2.98	59.56	-0.32	0.375	7
13.	The administration encourages the presence of a strong relationship between the direct boss and workers to carry out business.	2.93	58.67	-0.86	0.196	9
	All paragraphs of the field	2.96	59.15	-1.14	0.128	

* The mean is significantly different from 3

4.2.2 Maintenance Projects Factors

Table (4.3) shows the following results:

- The mean of item #6 “The administration supports the division of work in phases according to the location or type of work” equals 3.32 (66.33%), Test-value = 5.04 and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this item.
- The mean of item #1 “The project size (large / medium / small/ large divided into several small projects) large supports the speed and accuracy of implementation” equals 2.67 (53.42%), Test-value = -5.36, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this item is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this item.
- The mean of the field “Maintenance Projects Factors” equals 3.08 (61.61%), Test-value = 1.85, and P-value=0.033 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. We conclude that the respondents agree to field of “Maintenance Projects Factors ”.
- There is a strong approval of work division into stages in terms of location or type of work, on the other hand, the size of project does not affect on the maintenance project either the project is small or large. Generally, Maintenance Projects Factors should be applied.

Table 4.3: Means and Test values for “Maintenance Projects Factors”

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	The project size divided into small parts to implementation with speed, accuracy.	2.67	53.42	-5.36	0.000*	14
2.	A comprehensive maintenance for all project parts as (Electrical/ Mechanical/ Civil/ Medical Equipment).	3.02	60.36	0.25	0.400	9
3.	Period of completing the project in the specified time, cost and quality.	2.94	58.82	-0.72	0.237	11
4.	Project can be started directly after awarding the project.	2.98	59.64	-0.23	0.408	10
5.	The administration seeks to finance the project (internally, externally)	3.31	66.27	4.41	0.000*	2
6.	Division of work in phases according to the location or type of work.	3.32	66.33	5.04	0.000*	1
7.	The work is done with specific criteria that differ characteristics from other projects.	3.28	65.66	4.33	0.000*	3
8.	information about the complexity in the project precision and lot of details.	3.23	64.66	3.41	0.000*	5
9.	encourages safety factors required in the project and the response of workers.	3.17	63.33	2.39	0.009*	7
10.	The administration takes decisions and implement rapidly from the supervision according to technical/engineering opinion.	3.26	65.23	3.29	0.001*	4
11.	The administration follows true and planned steps in studying the tender documents and drawings of project before implementing the maintenance works.	3.20	63.96	2.65	0.004*	6
12.	The maintenance works can be affected by ambiguity, complexity and lack of a clear explanation of the bill of quantities in the project.	3.16	63.24	2.22	0.014*	8
13.	Provide the necessary materials for the maintenance work early	2.87	57.48	-1.64	0.051	12
14.	There is an advance to buy the needed materials for the maintenance project quickly	2.73	54.59	-3.36	0.000*	13
	All paragraphs of the field	3.08	61.61	1.85	0.033*	

* The mean is significantly different from 3

4.2.3 Policy And Vision Of The Organization

- **Strategies of the organization according to plans.**

Table (4.4) shows the following results:

- The mean of item #11 “The administration seeks to have a clear vision about the implemented maintenance projects and the projects to be implemented in the future and a mechanism to link these projects to each other” equals 3.17 (63.36%), Test-value = 2.29, and P-value = 0.011 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. It concludes that the respondents agree to this item.
- The mean of item #4 “There is the right man in the right place and make the right decision for the right time perform the work” equals 2.69 (53.87%), Test-value = -4.13, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. It concludes that the respondents disagree to this paragraph.
- The mean of the field “Strategies of the organization according to plans” equals 2.91 (58.20%), Test-value = -2.00, and P-value=0.023 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this field is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to field of “Strategies of the organization according to plans”.
- Any administration aims to have a clear vision, but the different persons and locations can effect on any procedure if there is no a clear plan that determine priorities and responsibilities.

Table 4.4: Means and Test values for “Strategies of the organization according to plans”

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Using standards of the organization to perform maintenance works	2.76	55.13	-3.81	0.000*	10
2.	enforce the regulations, laws , mechanisms of the ministry for the implementation of special projects in maintenance work.	2.92	58.50	-1.05	0.148	6
3.	The administration follows priorities in choosing work for the implementation in terms of scheduling and arranging of work.	2.76	55.18	-3.06	0.001*	9
4.	There is the right man in the right place and make the right decision for the right time perform the work.	2.69	53.87	-4.13	0.000*	11
5.	The administration takes action in the communication, cooperation and partnership with donors.	3.04	60.89	0.64	0.261	3
6.	The administration provides capabilities according to prepared plans to complete the works as scheduled	3.04	60.89	0.61	0.271	3
7.	The administration coordinates, provides facilities, and builds relationships with local and international institutions to overcome risks.	2.93	58.58	-1.00	0.160	5
8.	The administration provides a safe working environment and means of pre-emptive in the event of a risk because of the place.	2.79	55.82	-2.94	0.002*	7
9.	Emit / qualify / train personnel administration, both abroad and at home to do the work.	2.77	55.49	-3.20	0.001*	8
10.	The administration is characterized by planning, organizing, directing, monitoring and internal and external control to the success of the work.	3.13	62.58	1.83	0.034*	2
11.	The administration seeks to have a clear vision about the implemented maintenance projects and the projects to be implemented in the future and a mechanism to link these projects to each other.	3.17	63.36	2.29	0.011*	1
	All paragraphs of the field	2.91	58.20	-2.00	0.023*	

* The mean is significantly different from 3

- **Strategies of the organization In terms of economic issue**

Table (4.5) shows the following results:

- The mean of item #5 “There are additional works in most of the maintenance projects as a result of the ambiguity and lack of clarity in the size and type of maintenance” equals 3.33 (66.55%), Test-value = 4.51, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3 . We conclude that the respondents agree to this paragraph.
- The mean of item #1 “High and low exchange rates” equals 2.61 (52.15%), Test-value = -5.61, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3 . We conclude that the respondents disagree to this paragraph.
- The mean of the field “Strategies of the organization In terms of economic issue” equals 2.84 (56.80%), Test-value = -3.28, and P-value=0.001 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this field is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to field of “Strategies of the organization In terms of economic issue ”.
- Generally, all works are increased or decreased by time due to the existed commercial systems at countries, this is based on future ambiguity and unclearness, but not on changing of price materials, this imply that there is a weakness in economic and its relation with maintenance projects.

Table 4.5: Means and Test for “Strategies of the organization In terms of economic issue”

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	High and low exchange rates	2.61	52.15	-5.61	0.000*	5
2.	The administration accelerates / delays / pays the payments in case of an external contractor or paid in a specific time.	2.63	52.59	-4.95	0.000*	4
3.	The administration provides guarantees and collateral required to work in case of a contractor (ensure entry tender and good execution and maintenance)	2.83	56.64	-2.26	0.012*	2
4.	The administration fines / stimulates / deducts the maintenance workers in case of acceleration or delay	2.77	55.31	-3.23	0.001*	3
5.	There are additional works in most of the maintenance projects as a result of the ambiguity and lack of clarity in the size and type of maintenance.	3.33	66.55	4.51	0.000*	1
	All paragraphs of the field	2.84	56.80	-3.28	0.001*	

* The mean is significantly different from 3

- **Strategies of the organization In terms of technical issue**

Table (4.6) shows the following results:

- The mean of item #8 “The administration coordinates between the team supervisor on new projects and maintenance team in order to plan, have a clear vision, and include warranty periods” equals 3.26 (65.23%), Test-value = 3.40, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this item.
- The mean of item #1 “Matching between the maintenance plan with the other plans (owner, contractor, consultant, donor, ..) and the nature of the relationship between them” equals 2.53 (50.59%), Test-value = -7.98, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is

negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this item.

- The mean of the field “Strategies of the organization In terms of technical issue” equals 2.89 (57.74%), Test-value = -2.51, and P-value=0.006 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to field of “Strategies of the organization In terms of technical issue ”.
- The Coordination between the teams of the same administration is effective due to the interdependence and understanding in a central decision, but the ambiguity occurs by linking between plans to together all the parties of the different views from a technical point. Therefore, it is preferred for the maintenance work to be done by specialists for each department in the hospital staff.

Table 4.6: Means and Test for “Strategies of the organization In terms of technical issue”

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Matching between the maintenance plan with the other plans (owner, contractor, consultant, donor, ..) and the nature of the relationship between them.	2.53	50.59	-7.98	0.000*	8
2.	The administration seeks to provide quality services, quality of the used materials, and the attention to special maintenance works.	2.75	54.95	-3.88	0.000*	5
3.	The administration seeks to provide the necessary capabilities, resources, and facilities that will lead to the completion of the work.	2.70	54.05	-3.95	0.000*	6
4.	The administration perseveres in recycling and reuse of non-consuming material, which provides the organization and helps in new artwork, but the quality may be less.	2.67	53.39	-4.86	0.000*	7
5.	The administration have the technical / engineering opinion in terms of flexibility / accuracy in decision-making technically.	3.05	60.99	0.75	0.228	3
6.	The administration encourages independence /privacy in the success of non-subordination /	2.97	59.37	-0.48	0.315	4

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
	failure of maintenance process technically					
7.	The administration supports the existence of a maintenance team during the receipt of the newly implemented projects for future follow-up maintenance	3.16	63.24	2.12	0.017*	2
8.	The administration coordinates between the team supervisor on new projects and maintenance team in order to plan, have a clear vision, and include warranty periods.	3.26	65.23	3.40	0.000*	1
	All paragraphs of the field	2.89	57.74	-2.51	0.006*	

* The mean is significantly different from 3

- **Strategies of the organization in terms of technological issue**

Table (4.7) shows the following results:

- The mean of paragraph #5 “The administration seeks to have a computerized system to document the performed work, as well as linking the request systems and stores” equals 3.22 (64.32%), Test-value = 64.32, and P-value = 0.002 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.
- The mean of item #3 “The administration keeps pace with the development and transfer of technology from developed countries through the development of teams” equals 2.71 (54.30%), Test-value = -4.08, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this paragraph.
- The mean of the filed “Strategies of the organization In terms of technological issue” equals 2.99 (59.77%), Test-value = -0.22, and P-value=0.411 which is

greater than the level of significance $\alpha = 0.05$. The mean of this field is insignificantly different from the hypothesized value 3. We conclude that the respondents (Do not know, neutral) to field of “Strategies of the organization In terms of technological issue ”.

- Maintenance Management looks forward to the use of technological means in terms of documenting and implementing business using computing systems, with knowing that there are difficulties with the transfer of technology from country to country, but with some efforts we will have advancement.

Table 4.7: Means and Test for “Strategies of the organization In terms of technological issue”

	Item	Mean	Proportional mean	Test value	P-value (Sig.)	Rank
1.	Having a unified computerized system to provide tools and mechanisms of storing and dispensing like developed countries.	3.02	60.45	0.30	0.382	3
2.	Schedules the works with priorities based on a program involved to accomplish.	2.90	58.10	-1.46	0.073	4
3.	Keeps pace development and transfer of technology from developed countries through the development of teams.	2.71	54.30	-4.08	0.000*	6
4.	Sustainability systems projects in engineering design and insists to include these systems in the maintenance work.	2.87	57.47	-1.86	0.032*	5
5.	Have a computerized system to document the performed work, stores.	3.22	64.32	2.95	0.002*	1
6.	Develop a modern control systems required for maintenance to be carried out and implemented, such as PLC / BMS	3.20	63.98	2.53	0.006*	2
	All paragraphs of the field	2.99	59.77	-0.22	0.411	

* The mean is significantly different from 3

4.2.4 Effect Of Internal And External Environment

- **Effect of internal environment of the organization on maintenance administration**

Table (4.8) shows the following results:

- The mean of item #7 “The administration has information about the size of maintenance work (large / small can be treated in the same place / large / small treatment cannot be in the same place)” equals 3.24 (64.89%), Test-value = 3.50, and P-value = 0.002 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this item.
- The mean of item #1 “The administration seeks to provide a place for maintenance, such as (office rooms, nursing rooms, patient rooms, operation rooms, bathrooms) before starting maintenance” equals 2.49 (49.87%), Test-value = -7.19, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this paragraph.
- The mean of the filed “Effect of internal environment of the organization on maintenance administration” equals 2.96 (59.13%), Test-value = -1.02, and P-value=0.155 which is greater than the level of significance $\alpha = 0.05$. The mean of this field is insignificantly different from the hypothesized value 3. We conclude that the respondents (Do not know, neutral) to field of “Effect of internal environment of the organization on maintenance administration ”.
- Each department has known the size of works entrusted to it, whether small or large, regardless of the function and the importance of the place to have a

maintenance work or what his relation to the internal environment for maintenance projects.

Table 4.8: internal environment of the organization on maintenance administration

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Provide a place for maintenance, such as (office rooms, nursing rooms, patient rooms, operation rooms, bathrooms) before starting maintenance	2.49	49.87	-7.19	0.000*	9
2.	Has information about the physical factors in terms of the appropriate place for maintenance work such as (ventilation / lighting / high or underground)	2.62	52.36	-6.31	0.000*	8
3.	Has sufficient information about the status of the place such as (vacant/ unoccupied /under warranty)	2.78	55.64	-3.03	0.001*	7
4.	The specialization (type) in work necessary for the maintenance of such (civil works/ mechanical/ electrical/medical)	3.08	61.60	1.15	0.126	5
5.	Encourages to solve any problem necessary (emergency / scheduled / non-scheduled / planned / unplanned / preventive)	3.18	63.54	2.72	0.003*	3
6.	The administration is characterized by the information about the degree of difficulty to perform such work (easy / vague / need to transfer out of place / difficult due to lack of a suitable environment)	3.15	63.01	2.29	0.011*	4
7.	The administration has information about the size of maintenance work (large / small can be treated in the same place / large / small treatment cannot be in the same place)	3.24	64.89	3.50	0.000*	1
8.	The administration reserves the use of high quality materials and are available in stores or local markets	3.21	64.18	2.87	0.002*	2
9.	The intervention of some non-specialized personnel (technically), such as doctors, nurses and administrators in maintenance work for personal wishes	2.84	56.88	-1.85	0.033*	6
	All paragraphs of the field	2.96	59.13	-1.02	0.155	

* The mean is significantly different from 3

- **Effect Of External Environment Of The Organization On Maintenance Administration**

Table (4.9) shows the following results:

- The mean of item #5 “The administration is characterized by the coordination with other entities (municipalities / Ministries / Authority of Energy / Electricity Company and communications” equals 3.27 (65.49%), Test-value = 3.90, and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.
- The mean of item #4 “The administration contracts with external parties, such as (experts in maintenance/ contractors / suppliers / donors)” equals 2.87 (57.43%), Test-value = -1.89, and P-value = 0.030 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is negative, so the mean of this paragraph is significantly smaller than the hypothesized value 3. We conclude that the respondents disagree to this item.
- The mean of the filed “Effect of external environment of the organization on maintenance administration” equals 3.05 (60.91%), Test-value = 0.92, and P-value=0.180 which is greater than the level of significance $\alpha = 0.05$. The mean of this field is insignificantly different from the hypothesized value 3. It conclude that the respondents (Do not know, neutral) to field of “Effect of external environment of the organization on maintenance administration ”.
- Coordination with external institutions to facilitate the implementation and examination of some works would develop and advance the institution, regardless of the contract with other parties interested in taking advantage of the reputation or behind the external environment for the implementation of maintenance projects.

Table 4.9: External environment of the organization on maintenance administration

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Weather changes such as (low and high temperatures, winds, storms,)	2.96	59.20	-0.53	0.298	4
2.	There are risks in the work, such as (pollution, noise, and congestion	3.12	62.41	1.59	0.056	2
3.	There are external constraints such as (intervention from abroad / unplanned design for maintenance / works overlapping / invisible things	3.00	60.00	0.00	0.500	3
4.	The administration contracts with external parties, such as (experts in maintenance/ contractors / suppliers / donors	2.87	57.43	-1.89	0.030*	5
5.	The administration is characterized by the coordination with other entities (municipalities / Ministries / Authority of Energy / Electricity Company and communications	3.27	65.49	3.90	0.000*	1
	All paragraphs of the field	3.05	60.91	0.92	0.180	

* The mean is significantly different from 3

4.2.5 Effect Of Crisis Policy Outside The Organization

Table (4.10) shows the following results:

- The mean of item #7 “Using of collective punishment imposed by the Israeli occupation” equals 3.86 (77.21%), Test-value = 11.94 and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.
- The mean of item #1 “Political instability resulting from the conflict/reconciliation” equals 3.32 (66.43%), Test-value = 3.60 and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.

- The mean of the field “Effect of Crisis policy outside the organization on maintenance administration” equals 3.62 (72.31%), Test-value = 10.28, and P-value=0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. We conclude that the respondents agree to field of “Effect of Crisis policy outside the organization on maintenance administration ”.
- The Israeli siege applied on the Gaza Strip is the main reason for the crisis in maintenance projects because they need a permanent coordination with the Israeli side to enter the material and not the political differences that led to the political split in Gaza Strip.

Table 4.10: Crisis policy outside the organization on maintenance administration.

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Political instability resulting of conflict/reconciliation	3.32	66.43	3.60	0.000*	10
2.	The siege imposed on the Gaza Strip since 7 years	3.50	70.00	5.36	0.000*	8
3.	The challenges facing the health sector in the provision of the minimum requirements for the completion of works	3.39	67.75	4.20	0.000*	9
4.	Wars on Gaza strip in 2008, 2012, and 2014	3.59	71.80	6.44	0.000*	7
5.	Political conflicts which led to the conscientious and non-return of a large no. of employees to work and inequality among staff in terms of rights	3.79	75.77	11.06	0.000*	2
6.	crises as a result of lack of clear policy for donors / funding projects size and quality for maintenance	3.62	72.34	8.67	0.000*	6
7.	Using of collective punishment imposed by the Israeli occupation	3.86	77.21	11.94	0.000*	1
8.	Restrictions and conditions imposed by some donors to perform some maintenance work	3.66	73.24	9.10	0.000*	5
9.	No encourage for the investment in maintenance as a result of successive political upheavals	3.68	73.57	9.17	0.000*	4
10.	The lack of a comprehensive program to support the maintenance sector in all aspects	3.74	74.77	9.25	0.000*	3
	All paragraphs of the field	3.62	72.31	10.28	0.000*	

* The mean is significantly different from 3

4.2.6 Support Effective Methods Of Treatment To Reduce Maintenance Operations

Table (4.11) shows the following results:

- The mean of item #10 “Maintaining by using high quality materials and available in local markets” equals 3.39 (67.71%), Test-value = 5.25 and P-value = 0.000 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this paragraph is significantly greater than the hypothesized value 3. We conclude that the respondents agree to this paragraph.
- The mean of item #5 “Provide moral and real incentives” equals 2.87 (57.38%), Test-value = -1.47, and P-value = 0.071 which is greater than the level of significance $\alpha = 0.05$. Then the mean of this paragraph is insignificantly different from the hypothesized value 3. We conclude that the respondents (Do not know, neutral) to this item.
- The mean of the field “Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property” equals 3.13 (62.54%), Test-value = 2.60, and P-value=0.005 which is smaller than the level of significance $\alpha = 0.05$. The sign of the test is positive, so the mean of this field is significantly greater than the hypothesized value 3. We conclude that the respondents agreed to field of “Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property ”.
- Maintenance in the presence of high quality and availability of materials in the local market makes maintenance to have easy way to get to creative solutions regardless of loyalty and incentives.

Table 4.11: Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property.

	Item	Mean	Proportional mean (%)	Test value	P-value (Sig.)	Rank
1.	Periodic meetings to resolve the problem on time.	2.90	58.03	-1.36	0.088	15
2.	Setting a timetable for maintenance work in terms of priority	3.06	61.17	0.82	0.206	12
3.	Review for maintenance orders	3.07	61.35	0.82	0.207	11
4.	Responsibility in performing tasks by the team based on the maintenance operations	3.16	63.26	1.98	0.024*	6
5.	Provide moral and real incentives	2.87	57.38	-1.47	0.071	16
6.	Providing comfortable environment and place of a team work of maintenance work	3.02	60.36	0.22	0.414	14
7.	Provide adequate training staff for maintenance operations, whether internally or externally	3.05	61.08	0.69	0.244	13
8.	punishment methods , whether as warning for those who work in disregarding	3.34	66.79	4.55	0.000*	3
9.	Speed , proficiency in the performance of work as required precision	3.38	67.64	5.55	0.000*	2
10.	Using of high quality materials and available in local markets	3.39	67.71	5.25	0.000*	1
11.	Operating a modern systems and variable periods	3.11	62.23	1.53	0.064	8
12.	Applying preventive maintenance program.	3.08	61.52	0.96	0.169	10
13.	Spare parts , materials necessary for the implementation of maintenance programs	3.24	64.73	3.11	0.001*	4
14.	Coordination between Administrations and departments to perform maintenance quickly and accurately	3.17	63.48	2.22	0.014*	5
15.	The provision of a dedicated staff with efficiency and professionalism in terms of quantity and quality	3.14	62.77	1.80	0.037*	7
16.	Import modern technology and quality programs to keep pace compared with the developed countries	3.08	61.70	1.01	0.158	9
	All paragraphs of the field	3.13	62.54	2.60	0.005*	

* The mean is significantly different from 3

5. CHAPTER FIVE: CASE STUDIES

5.1 Introduction

This study started at the end of 2014, the aim of research was to study the factors affecting on maintenance managers to control the operation of hospital building maintenance in Gaza strip. This chapter includes the conclusion, recommendations to improve maintenance performance in the Gaza Strip hospitals. This research had four main objectives, which were achieved through the data collection using survey techniques and the detail analysis of the survey results. The first objective was to identify main factors that may influence of decision making and activities carried out by the maintenance departments of public hospital buildings in Gaza strip. The second objective was to determine criteria of the maintenance project items special the time and cost to do the maintenance. The third objective which was to investigate the conflict between the documents in the maintenance in governmental hospitals, and the last one to specify increasing staff productivity with life span of buildings in the hospital to minimize the private emergency in hospitals maintenance department include a program coordination for the department and coordinate with all other departments for the procurement, production equipment, utility services, and communication services, preparation of maintenance department budgets, preparation of maintenance budgets, preparation of project cost estimates, proposal, justification, maintenance of records of planned and current construction and maintenance contracts, review and filing of reports from inspectors and insurance carriers and preparation of status reports to appropriate management, planning and scheduling of work; provision of required parts, materials, and equipment; and maintenance of all equipment records, materials, and equipment for which the maintenance department is held responsible, , statistics, and recommendations on maintenance department activities, solicitation, preparation, and administration of appropriate service contracts, maintenance of appropriate records pertaining to labor under the jurisdiction of the maintenance department.

5.2 Objectives Of The Case Study

1. Illustrate the important role of maintenance management at hospitals in Gaza Strip.
2. Effectiveness of the maintenance management in achieving the objectives of reducing cost and external service.

Table 5.1: data of hospitals in Gaza Strip (2014)

No.	Hospital Name	Geographic Location	No. of Patients per year	No. of Beds	Hospital Area in sq. m.	Age (year)	Category	Type	No. of Maintenance Employees
1	Bait Hanon	North	4,775	45	2500	9	Small	General	8
2	Kaml Odwan Hospital	North	8,059	104	5000	13	Big	General	14
3	Al Naser for Pediatrics	Gaza	8,996	136	4400	53	Big	Specialized	12
4	Ophthalmic	Gaza	3,995	42	3600	50	Small	Specialized	8
5	Psychiatric hospital	Gaza	314	29	6000	35	Small	Specialized	8
6	Rantisi Specialized Pediatrics	Gaza	1,595	51	2500	10	Small	Specialized	8
7	Dorra	Gaza	4,819	91	1,600	15	Small	Specialized	10
8	AlShifa Hospital	Gaza	50,225	619	45,000	69	Complex	General	70
9	Al Aqsa	Middle	16,228	136	4,000	14	Big	General	25
10	Nasser	Khanyonis	39,480	322	5,000	57	Complex	General	59
11	European Gaza Hospital	Khanyonis	13,822	261	65,000	28	Big	General	35
12	Al Najjar Hospital	Rafah	3,957	80	4,000	15	Small	General	13
13	Emirates Crescent Hospital	Rafah	16,228	52	4,000	15	Small	Delivery (Maternity)	5
Total									

The fields of services as following:

- **Maintenance field**

Maintenance of all buildings of the MOH (Hospitals), Maintenance of devices and medical equipment, Maintenance of all types of furniture, Maintenance of electromechanical equipment

- **Maintenance of infrastructure**

Power networks, Communication networks, Water, fire and wastewater networks.

- **Maintenance staff in Gaza Strip governorates**

There are five main centers in the five governorates with total staff 366 employees for maintenance and 28 employees for the engineering office department.

Many factors are responsible for inadequate maintenance process as lack of maintenance staff, the Israeli restrictions on the movement of goods and people, made a poor internal organization of maintenance service (MOH report, 2010). A team of engineers and technicians supervise and support local maintenance units in the hospitals in the Strip through centered departments allocated in the five governments “North, Gaza, Middle, Khan Yonis and Rafah”.

There was shortage of raw materials for construction without cement and other building materials, a hospital cannot rehabilitate until the end of 2010. A confusion of tasks and responsibilities are not defined job descriptions , unclear leading to a waste of effort and resources, there is no clear separation of responsibility for maintenance work and supervision of local maintenance teams working in the hospitals (MOH report, 2010).

Old age buildings, some of them more than 65 years of the hospitals in Gaza, like Shifa hospital which results in an essential problem to building maintenance. The research problem appeared from the necessary need to maintain the old age hospital buildings specially the main hospitals in Gaza strip like Shifa hospital and to conserve the new hospital building arising since 2011. Lack of scheduled maintenance activities which may

lead in a huge failure in the hospital system at any time seems a big problem especially in the Gaza strip political status which makes it imperative to be ready at any moment.

5.3 First Case Study: Hospital Surgery Building In Shifa Hospital

Corrective Maintenance

5.3.1 Introduction

Al-Shifa hospital is considered secondary health care delivery system and provides some tertiary care services for population. It is the biggest medical institution in the Palestinian MoH and located in the west part of Gaza. The hospital was established in 1946 on an area of over 45.000m.sq. Many buildings were built like general surgery building, special surgery building, Internal medicine, burn department, oncology department. Till 2015 the hospital contained 746 hospitalization beds, distributed in internal medicine, general and specific surgeries, burn intensive care, obstetrics and gynecology and neonatal department. AL-Shifa hospital is subdivided into 3 hospitals as surgical hospital, medical hospital and obstetrics and gynecology hospital beside paramedical services such as Laboratory, Radiotherapy, Pharmacy, and Physiotherapy. Each hospital has its own administrative team and each manager refer to his general director of hospital (Ministry of health annual report, 2014).

Because of the siege on Gaza and the complicated political conditions in the last few years, the maintenance of buildings, medical equipment and machines has deteriorated. In light of pressures on the Gaza Strip, the health system is in a situation that is better described as a continuing Complex Emergency. As we mentioned, in our hospitals there are many type of maintenance as followed (emergency maintenance, periodic maintenance and comprehensive maintenance). In emergency maintenance that means repair the defect immediately, maintenance as fast as life cycle . In the periodic maintenance means the maintenance by periodic time (daily, weekly, monthly, every three month, and every six month, yearly).In the comprehensive maintenance we do the maintenance every (20 years for modern building , five year for old building).In this case we chose case to study what happened in the maintenance . We chose a general surgery

building as a case study in AlShifa hospital. Another name is recognized (8 building shape) to determine the most important factor that affecting on maintenance management.

Table 5.2: Hospital surgery building in Shifa hospital corrective maintenance.

Hospital Name		No. of Patients per year	No. of Beds	Built Area (m2)	Age (year)	No. of Maintenance Employees	Salaries of Maintenance Employees (\$/yr)	Annual Cost of corrective Maintenance (\$/yr)
AlShifa Hospital		50,225	585	21,500	69	90	450,000	79,500
Case study (8building shape)		No. of Patients per year	No. of Beds	Built Area (m2)	Age (year)			
No	General surgery building (structure)	12,556	150	1,400	26			
1	Basemen floor (departments)	Fluoroscopy		Ultrasound		X-ray	C.T	
2	Ground floor (departments)	I.C.U.				Emergency		
3	First floor (departments)	Women (Bon) surgery				Men (Bon) surgery		
4	Second flour (departments)	Operation Department						
5	Third floor (departments)	Women (general)surgery				Children surgery		
6	Fourth floor (departments)	Men (general)surgery				Specialists surgery		
7	Fifth floor (departments)	Mechanical services(chillers, elevator roos,etc...)						

5.3.2 Project Description

- Project Name: Maintenance of general surgery building (The surgery hospital) in Alshifa hospital complex.
- Location: Shifa hospital complex - Gaza city
- Area of floors :
- Project Value: \$ 1,750,000.000
- Owner: MOH
- Donor: Islamic Bank for development

5.3.3 Problem identification

General surgery building considered as one of the most buildings in Shifa complex for its daily importance for Palestinian people. More than 50,000 patients per year treat in the hospital; this number indicates the increase of demand on surgery medical services. MOH do a comprehensive maintenance every twenty years as we mentioned and that will illustrates wide range maintenance areas. Staff in engineering and maintenance department examined the place and found the main problems in hospital building:

Look at appendix C Figures (5.1 ~5.10).

Then staff in engineering and maintenance department discussed with the medical staff the process of building rehabilitation the following results appeared look at appendix C Figures (5.11, 5.12).

At the beginning it was looked for another place which appropriated to transport the person who needs the services. After discussing hospital management, a plan of work was put, and the place was the daily care department. It was started and cooperated with hospital manager to empty the men (general) surgery, Then it was started working in surgery building by removing and dismantling works as in the photos that explain the obstacles.

5.3.4 Corrective Maintenance Solution

Removing existing paint from walls, damaged ceiling areas, preparing walls and ceiling for new plaster and painting Preparing walls for maintenance. look at appendix C Figures (5.13, 5.14,5.15).

Add protection concrete around sleeves and pipes of electrical, sanitary and mechanical pipes and windows sills, external and internal lintels, parapets, canopies look at appendix C Figures (5.16).

All hardware for doors shall be Original Italian Wally type or equivalent approved type and ground Jacks for operations rooms. Doors should be fitted with handles; Steel frames should be filled with fine aggregate mortar concrete, for fixation. Price of doors should

include fixing two (Norista) kick plates and door stoppers. look at appendix C Figures (5.17).

Supply and install solid internal wooden double swing, The door is priming and painting with Anti-Bacteria Painting type or Formica face. look at appendix C Figures (5.18).

Repair any cracks using seca flex material, Paint bondrol primer coat and three coats poliside for the ceiling and internal walls height range (120 -220cm) for corridors, stairs and rooms including a pendrol layer, two layers of putty as minimum, one layer of primer undercoat and two layer of oil paint. look at appendix C Figures (5.19).

Change water network pipes with new pipes in the ceiling figure shows the changed pipes, changing water networks. Look at appendix C Figures (5.21).

Lay traflex PVC roll 2mm for corridors and rooms ,Anti-humidity and Anti-bacteria false ceiling (magnesium oxide silicate) 60x60cm for the rooms of operation and recovery. Look at appendix C Figures (5.22, 5.23).

Copper pipe for medical gases pipes ,the pipes shall be cleaned, flushed and two end capped including the risers and risers' duct covering with all connection and fittings. Look at appendix C Figures (5.24).

5.3.5 Concluding Remarks

Maintenance is an important department as main part of the body health services in MoH. The most common building defects results from insufficient water and sewage network and the high occupancy of the building. After the building is maintained many advantages have resulted: provide health their place for patients, change many rooms' functions for better use and increasing of the capacity of building to receive more patients. Corrective maintenance in general surgery hospital in Shifa complex was outsourced funding with local experience supervision from MoH. Mainly the project is implemented depending on the available outsourced fund not on scheduled maintenance program. Look at appendix C Figures (5.25).

5.4 Second Case Study: Al Najjar Hospital Buildings Corrective Maintenance

5.4.1 Introduction

Al Najjar Hospital is a general hospital is typically the major health care facility in its region, with large numbers of beds for intensive care and long-term care; and specialized facilities for surgery, laboratories, and so forth. Al Najjar Hospital in Gaza strip is considered the second biggest medical institution in Rafah, located in Rafah city that considers secondary health care delivery system. The construction work of Rafah Medical hospital began at the year 2000 MOH Administration on Rafah city on area around 4,000m.sq. The service started on 2001 limited with 80 Inpatient beds (MOH reports, 2014). Al Najjar buildings was a clinic before becoming a hospital ,the age of a hospital has exceeded 15 years old which result many sequences on the structural elements, lack of preventive maintenance , in sufficient maintenance ways in the last few years. In the last year in the War 2014 teams of the International Committee of Red Cross (ICRC) suggest to operate the hospital by downer with coordinate for fund to repair four hospitals through war.

5.4.2 Project Description

- Project Name: Maintenance & rehabilitation of Al Najjar hospital buildings
- Location: Rafah city
- Project Value: USD \$ 356,000
- Owner: MOH
- Donor: ICRC
- Supervision: MOH

5.4.3 Problem Identification

Most of a hospital subjected to destroy because of the last war 2014 on Gaza strip. The problem started in the war 2014 which firstly appeared as destroy walls, leakages from floors, expansion joints, poor drainage, and lack of isolation. Make alerts for the maintenance and engineering staff to make intervention. A comprehensive examination of buildings at Al Najjar Hospital. Staff in engineering and maintenance department

examined the place and found the main problems in hospital buildings and suggests stopping to introduce some service in War 2014, transfer services to other hospitals.

The buildings age is more than 20 years, insufficient of operating room in hospital, Leakage from water lines, Lack of maintenance team ,examination the building system as causes of moisture, sewer and water lines ,examine all the accessories on the building (roof, insulation work), Coordinate with all departments to do the maintenance not more two month .Addressing periodic and continuous maintenance for any appearing moisture and cracks in other parts of the building.

5.4.4 Corrective Maintenance Solution

Maintenance started at the last year in November 2014 and it was outsourcing funded (ICRC) and the total budget was \$356,000 for all maintenance work in the hospital, the procedure for the maintenance was as follow:

- Remove some existing walls, plaster and painting from walls even internal or externals, some defect doors and windows. Look at appendix C Figures (5.26).
- The plumping networks system, Remove some of the existing electrical connections, and remove some of the existing tiles in the bathrooms and marble in the kitchens, Do the connections before the finishing. Look at appendix C Figures (5.27).
- Maintain the plastering and painting, HVAC, doors, windows, dooms, isolation work as boiled, falsecilling, PVC, Laying the tiles of the floors and walls, Supplying and Install the electrics and mechanics works, some of machine and accessories. Look at appendix C Figures (5.28).
- Supplying and Install the electrics and mechanics works, some of machine and accessories, Changing operation lams and their arms, Maintain the wood protection, polish and Clean the site and cart away the garbage. Look at appendix C Figures (5.29).

5.4.5 Concluding Remarks

This case study illustrated how the factor of maintenance affecting on maintenance manager in hospitals as facility age, lack of periodic maintenance water, sewage system that produced a big problem in the hospitals. Engineers have made their investigation and approved that there are many solutions for the most maintenances but the best one is make program for maintenance consist preventive maintenance. They should be considering astatic in time beter than nine.

5.5 Conclusion

Research describes and evaluates the factor affecting on maintenance management departments and the hospitals buildings in the Gaza Strip hospitals. Main factors were defined which affect the maintenance management and applying main factor selected to be suitable for the Gaza Strip governmental hospitals. Corrective maintenance in general surgery building in Shifa complex was outsourced funding with local experience supervision from MoH and EMCC. Mainly the project is implemented depending on the available outsourced fund not on scheduled maintenance program. The case study in Al Najjar hospital was outsourced funding with local experience supervision from MoH outsourced fund not on scheduled maintenance program. Mainly the projects is implemented depending on the available resources .In both projects we illustrated how the facility age, an lack of periodic maintenance for the water and sewage system produced big problem in the overall work in hospital .

In conclusion the corrective maintenance is the main type of the maintenance projects in MoH hospitals buildings.

Concluding of Objective one

The most important results were to influence of decision making of maintenance with reducing the overall costs of buildings maintenance in Gaza strip governmental hospitals. The main problems for building maintenance management were focused on the following:

- Building design inefficiencies
- Not adequate fund.
- Misunderstanding, misusing of cleaning attitudes.
- Plumping, water supply and waste disposal network problems.
- Poor contractor's performance.
- Staff has a good experience but inadequate training,
- no enough staff, low motivation ,no bonus for good work, punishment is applicable.
- Lack of opportunities for training/development,
- Unhealthy working condition.
- No existence of planed schedule which contain a checklist makes the work out of order.

Concluding of Objective two

To determine the criteria of the maintenance project items according to:

- Maintenance is done according to specific criteria that differ characteristics from other projects.
- The consideration size of maintenance supports by speed and accuracy of standard implementation.
- The maintenance departments took few hours to respond to maintenance requests, which represents a good coordination of receiving the requests from the hospitals other departments
- The building conditions in the hospital maintenance improved from year to year and the final situation of the maintained building is getting better.
- There are some problems for the hospital users to identify the right item to be maintained, there is difference from the actual damage to maintain and the requested maintenance.

The criteria of the major cause of non-maintenance of public building which was as following priority:

- Lack of clarity of size, type of maintenance.
- Lack of maintenance culture
- Inadequate funds
- Lack coordinates between the team supervisor
- Blockade on Gaza Strip and restriction on the movement of goods
- Poor work done on building.
- Non response to some maintenance request

Concluding of Objective three

To investigate the conflict between the documents according to the following steps:

- Identifying all documents (drawing, BOQ, specification, accurate calculations sheets).
- Choosing the suitable documents for hospital building maintenance standards
- Revise all documents of various building systems before implementation.
- Take accredit to all documents from the maintenance departments and their needs.
- Applying the maintenance and share departments through the implementations.

Concluding of Objective four

To increase staff productivity, to specify the minimum requirements for the management of maintenance:

- Preventive maintenance application considered as success factor which can be used as building performance maintenance.
- Analyze the current situation and Prerequisites stage.

- Detailed field Survey for each building in the hospital and determine the existing component of the building maintenance and their classifications.
- Prepare updated as built drawing for each component in the building and prepare Check list for inspection of building components.
- Gather all the needed data and the missing values then the implementation.

5.6 Recommendations For Case Studies

Recommendation for objective one

Decision making of maintenance with reducing the overall costs of buildings

maintenance in Gaza strip governmental hospitals according to:

- Define the current human resources and determining the detailed responsibilities for each employee in the maintenance m in MOH.
- Develop a team vision for hospital maintenance department and estimating an average or the minimum financial budget which can be available from the financial unit and design the maintenance plan.
- Changes the work culture towards a culture of maintenance require a full commitment from all parties.

Recommendation for objective two

The criteria of the maintenance project items

- Setting the priorities and what the stores needs of raw materials and spare parts
- Maintenance should be carried out by the maintenance departments of public hospital buildings in Gaza strip with changing the work style (rearrange the human resources, set new standards to receive the maintenance requests).
- Use preventive maintenance to make a survey for assets of the hospitals, convert maps to database with priority for important item.

Recommendation for objective three

Investigate the conflict between the documents according

- Identifying all documents as standard work and plan it to carry out with steps.
- Make certified periodic maintenance checklists and revise all documents which able to be updated.
- Develop adequate standard documents for the maintenance departments.

Recommendation for objective four

Increase staff productivity, to specify the minimum requirements for the management of maintenance:

- Outline comprehensive maintenance team training schedule, administrative staff, and management to be aware of the facility management principles.
- Classify all the types of maintenance done or its just fixing what is damaged.
- Set a detailed survey for buildings, evolving high level of management of the importance of starting of defining the priorities.
- Start a preventive maintenance which will be the lead in getting better building conditions, evolve the medical staff with the plans done and the trainings.

6. CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

- It is a lack of human resources that means acceptable behavior for the employees compared to job satisfaction and their culture to do the acceptable work without look to the no. of employees, the size of work, the experiences, and responsibility according to questionnaire.
- 1- Decisions making of maintenance with reducing the overall costs of buildings maintenance in Gaza strip governmental hospitals depend on the team and their ability to do the work.
 - 2- The main problems for building maintenance management were focused on the not adequate team, misunderstanding, misusing of the tools of work.
 - 3- Staff has a good experience but inadequate training due to unhealthy working condition.
- Maintenance projects in MOH include good comprehensive plans, accurate, specified time, criteria, high quality, low cost, complexity, clear maintenance policy, fund communications facilitates, but there is ambiguity in some of BOQs and procurement system according to interviews and expert in MOH.
- 1- Specific criteria that differ characteristics from other projects, the size of maintenance supports by speed and accuracy of standard implementation.
 - 2- Problems for the hospital users to identify the right item to be maintained, there is difference from the actual damage to maintain and the requested maintenance.
 - 3- The criteria of maintenance building followed by priority of the item of emergency.
- The conflict between the documents reversed to the strategies of the organization plans that consist good standards, priorities, right decision, cooperation, a clear vision, exchange rates, guarantees, technical engineering opinion in terms of flexibility, computerized system, programs, primary ideas about sustainability systems, modern control systems by the literature review as to the interviews.

- 1- Identifying all documents, choosing the suitable documents for hospital building maintenance and revise all documents of various building.
 - 2- Applying the maintenance by deferent ways that was planned and share departments through the implementations.
 - 3- There were no direct clearness of documentation because it appears as variation orders , addition or deleted items that defer between documents.
- Increase staff productivity, to specify the minimum requirements for the management of maintenance it will be a good internal and external environment of the organization, good coordination according to the expert.
- 1- Using preventive maintenance application considered as success factor which can be used as building performance maintenance.
 - 2- Detailed field survey for each building in the hospital and determine the existing component of the building maintenance and their classifications.
 - 3- Updated as built drawing for each component in the building, check list for inspection of building components and gather all the needed data and the missing values then the implementation.
- The Crisis policy outside of the maintenance organization exhibit means inadequate resources, maintenance of services has still not integrated into the design and installation, complex services systems with low reliability, insufficient instrumentation for monitoring, difficult Installations ,Lack trained maintenance professionals, inadequate evaluation and according to the questioner .
 - Political instability, siege, challenges, wars, crises, punishment imposed by the Israeli occupation, restrictions and conditions imposed by some donors, lack of investment in maintenance, lack of a comprehensive program all of these factors may be change the situation in MOH according to the questioner .

6.2 Recommendations

- MOH should review the allocation of maintenance employees among the hospitals and use modern training programs with periodic meetings and provide areal moral incentives.
 - 1- Define the current human resources and detailed responsibilities for each employee in the maintenance of MOH, develop a team vision for hospital maintenance department and estimate the minimum financial budget which can be available from the financial unit and design the maintenance plan.
 - 2- Changes the work culture towards a culture of maintenance require a full commitment from all parties.
- The design of new buildings shall be based on construction standards and consider environmental aspects to minimize maintenance costs.
 - 1- Set the priorities, what the stores needs of raw materials?, spare parts maintenance should be carried out by the maintenance departments of public hospital buildings in Gaza strip with changing the work style (rearrange the human resources, set new standards to receive the maintenance requests).
 - 2- Use preventive maintenance to make a survey for assets of the hospitals, convert maps to database with priority for important item to improve the design with better building conditions, evolve the medical staff with the plans done and the trainings
 - 3- Government should provide adequate fund and look for new downers' to specialized fund to support maintenance projects program in hospitals.
- Maintenance project managers should look for an intelligent maintenance method as preventive maintenance program by using sensors cameras before increasing the risks, use a proactive measure to reduce the occurrence of accidents and defects by using protection maintenance scenario.
 - 1- Identify all documents (standard) work, plan it to carry out with steps, make certified periodic maintenance checklists and revise all documents which able to be updated.
 - 2- Develop adequate standard documents for the maintenance departments.

- MOH should import modern technology and quality programs to compared with the developed countries with continuous coordination between Administrations and department's needs.
- 1- Outline comprehensive maintenance team training schedule, administrative staff, and management to be aware of the facility management principles.
- 2- Classify all the types of maintenance done or its just fixing what is damaged, set a detailed survey for buildings, evolving high level of management of the importance of starting of defining the priorities.
- WHO and other agencies should be helped to forbidden the siege, settlement or neutralizing the MOH about the political issues.

REFERENCES

Adenuga, A., Odusami T., Faremi, O. (2007), “Assessment of Factors Affecting Maintenance Management of Public Hospital Buildings in Lagos State, Nigeria” The construction and building research conference of the Royal Institution of Chartered Surveyors, Available from: http://www.rics.org/site/download_feed.aspx?fileID=3339...PDFSimilar[Accessed on 3/2/2012]..

Adenuga O., (2010), “Labour composition for maintenance works in public hospital built environment in south west, Nigeria”, *Journal of Building Performance*, Vol. 1, No.1, pp.83-97.

Afolarin A., (2012), “Maintenance managements practices in public hospital built environment Nigeria case study”, *Journal of Sustainable Development in Africa*, Vol. 14, No.1, pp.185-201.

Ahzahar, N., Karim, N., Hassan, S. and Eman, J. (2011), “A study of contribution factors to building failures and defects in construction industry”, *Procedia Engineering*, Vol. 20, pp. 249 – 255.

Ajukumar, V., Gandhi, O.,(2013) “Evaluation of green maintenance initiatives in design and development of mechanical systems using an integrated approach” *Journal of Cleaner Production* Vol. 51, PP. 34-46

Al Bashir, A., Al Rawashdeh, M., Al Hadithi, R., Al Ghandoor, A. and Barghash, M. ,(2012) , “Building medical devices maintenance system through quality function deployment, *Jordan Journal of Mechanical and Industrial Engineering*, Vol.6, No.1, pp.25-36.

Al Zubaidi, H. (1997), “Assessing the demand for building maintenance in a major hospital complex”, *Property Management*, Vol.15, No. 3, pp. 173–183.

Alexander, K. (2011), “Building control and performance: as if people and the planet matter”, *Procedia Engineering*, Vol. 20, pp. 1-11.

Ali, M. and Mohamad, W. , (2009), “ Audit assessment of the facilities maintenance management in a public hospital in Malaysia”, *Journal of Facilities Management*, Vol. 7, No.2 , pp. 142 – 158.

Al-Khatam, J. (2003) , “ Unpublished (MSc) thesis, King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia.

Almhafdy, A., Ibrahim, N., Ahmad ,S., Yahya , J.,(2013), “Analysis of the Courtyard Functions and its Design Variants in the Malaysian Hospitals” AicE-Bs2013London Asia Pacific International Conference on Environment-Behavior Studies University of Westminster, London, UK, 6-8 September 2013 "From Research to Practice". *Procedia - Social and Behavioral Sciences* Vol.105, PP. 171 – 182

Al-Najjar, B., Alsyouf I. (2003), “Selecting the most efficient maintenance approach using fuzzy multiple criteria decision making” *Int. J. Production Economics*”, Vol. 84, PP. 85–100.

ALwaer, H. and Croome, D. (2010), “Key performance indicators (KPIs) and priority setting in using the multi-attribute approach for assessing sustainable intelligent buildings”, *Building and Environment*, Vol. 45, pp. 799–807.

Amaral, T. and Costa, A. (2014) “Improving decision-making and management of hospital resources: An application of the PROMETHEE II method in an Emergency Department” *Operations Research for Health Care* Vol.3, PP.1–6.

Balaras, C., Dascalaki, E. and Gaglia , A. (2007), “HVAC and indoor thermal conditions in hospital operating rooms”, *Energy and Buildings*, Vol.39, PP.454–470.

Bank, M. and Kelsey, C. (1995), “Radiation information for hospital personnel, Published for the American Association of Physicists in Medicine, Available from: http://www.aapm.org/pubs/reports/rpt_53.pdf.

[Accessed on 1/8/2012].

Barlow, J., Gaiser, M.(2008), “The private finance initiative, project form and design innovation The UK’s hospitals programme”, Vol.37, PP. 1392–1402

Bin Hashem, A., (2006), “Maintenance management and services case study Perkeso building`s in Penisular of Malaysia”, Unpublished MSc. thesis, University Technology of Malaysia.

Carr, F. (2010), “Hospital (NIKA Technologies, Inc.for VA Office of Construction & “Facility Management (CFM) ” , Revised by the WBDG Health Care Subcommittee.

Cardoen, B., Demeulemeester, E. and Beliën, J. (2010), “Operating room planning and scheduling: a literature review”, *European Journal of Operational Research*, Vol. 201, pp.921–932.

Chanter, B. and Swallow, P. (2006), “Building maintenance management”, Blackwell Publishing Ltd., UK.

Chen, H., Hou, C., Wang, Y. (2013), “A 3D visualized expert system for maintenance and management of existing building facilities using reliability-based method” *Journal of Expert Systems with Applications* Vol. 40, PP.287–299.

Journal homepage: www.elsevier.com/locate/eswa

Ching , H., Shen-Wen, C., Chien-Hung, L., Po-Ta, H., Yi-Ting, S. and Huei-Ru, S. (2011), “A Study for the evacuation of hospital on fire during construction”, *Procedia Engineering*, Vol.11 ,pp.139–146.

Chiu, C., Lin, Y. (2013), “Automation in Construction Multi-objective decision-making supporting system of maintenance strategies for deteriorating reinforced concrete buildings”

available at Science Direct <http://dx.doi.org/10.1016/j.autcon.2013.11.005>.

Chotipanich, S. (2004), “Positioning facility management”, *Facilities*, Vol. 22, No. 13, pp. 364 – 372.

Chow, T. and Yang, X. (2003), “ Performance of ventilation system in a nonstandard operating room”, *Building and Environment*, Vol.38, pp. 1401 -1411.

Cobbinah, P. (2010), Maintenance of buildings of public institutions in Ghana case study of selected institutions in the Ahanti region of Ghana” , Unpublished (MSc) thesis, Kwame Nkrumah University of Science and Technology, Kumasi. Available from: <http://dspace.knust.edu.gh:8080/jspui/bitstream/123456789/190/1/Prince%20Jude%20Cobbinah%20Thesis.pdf> [Accessed on 1/8/2012].

Cooper, J. and Jones, K. (2008), “ Sustainable social housing maintenance”, University of Greenwich. Available from: <http://www.serg.soton.ac.uk/idcop/outcomes/IDCOP%20WP%202.1%20Questionnaire-Analysis.pdf> [Accessed on 1/9/2012].

Cruz, A. and Rincon, A. (2012), “Medical device maintenance outsourcing: have operation management research and management theories forgotten the medical engineering community? a mapping review”, *European Journal of Operational Research*, Vol.221, pp.186-197.

Dennis, G. (2009) “Assets maintenance policy, The university of Queensland”, Available from: <http://www.pf.uq.edu.au/pdf/MaintenancePolicy.pdf> [Accessed on 10/10/2012].

Department of veterans (2008) Radiology service design guide, available from: <http://www.wbdg.org/ccb/VA/VADEGUID/radio.pdf> [Accessed on 1/8/2012].

Department of veterans, (2008) Radiology service design guide, available from: <http://www.wbdg.org/ccb/VA/VADEGUID/radio.pdf>.

Dhillon, B. (2002) Engineering maintenance: a modern approach, CRC Press LLC, United States of America, available from: http://site.iugaza.edu.ps/sabdelall/files/2010/02/Engineering_Maintenance_a_modern_approach.pdf [Accessed on 15/7/2012].

Fixit Institute, (2010), “Understanding common building defects”, Solutions and maintenance management Rebuild, Vol.2, No.4, pp.5-12.

Garvin, D. A. (1998), “Building a learning organization”. J. Appl. Manuf. Syst, pp(15:27).

Garip, E. (2011), “Environmental cues that affect knowing: a case study in a public hospital building”, Procedia Social and Behavioral Sciences, Vol. 30, pp. 1770 – 1776.

Giff, G. and Cromptoets, J. (2008), “Performance indicators: a tool to support spatial data infrastructure assessment”, Computers Environment and Urban Systems, Vol.32, pp. 365-376.

George, D. and Mallery P. (2003), “SPSS for Windows Step by Step. A Simple Guide and Reference”, p- 231, USA.

Guimarães, C. M. and Carvalho, J. C. ISCTE, IUL, (2010), ”Outsourcing in Health Care Sector” , A State of the Art Review RIRL, Lisbon University Institute.

The 8th International Conference on Logistics and SCM Research BEM Bordeaux Management School, September (29, 30) and October (1) 2010.

Hicks, L.M. (2004). Manager, Plant Hospital Maintenance, University of Michigan Hospital And Health Centers (UMHHC), “ Hospital Maintenance Strategic Plan at the University of Michigan”, Hospital and Health Centers.

“How to Use Work Measurement for High-Productivity Maintenance Operations Productivity Network, Inc. (1031) Revere Court Lombard, IL (60148). tawest@pninc.com.

Highley, D. (2009), “Medical gases: their storage and delivery”, Anesthesia and Intensive care Medicine, Vol.10 No.11, pp. 523-527.

Horner, R., El-Haram, M. and Munns, A. (1997) ”Building maintenance strategy: a new management approach”, Journal of Quality in Maintenance Engineering, Vol. 3 No. 4, pp. 273-280.

IBM asset management solutions (2007). White paper, “Using IBM Maximo Asset Management to manage all assets for hospitals and healthcare organizations” ,Produced in the United IBM, representative or IBM Business Partner, or visit [ibm.com/tivoliStates of America](http://ibm.com/tivoliStatesofAmerica) (9-07).

Indian Health Service division Of Facilities And Environmental Engineering facilities Engineering Operations Manual, (Part 4) - “Preventive Maintenance” (1997).

Ikhwan, M. and Burney, F. (1999), “Maintenance in hospitals of Saudi Arabia”, Industrial Engineering Department, Faculty of Engineering, King Abdulaziz University, Jeddah, Saudi Arabia, Engineering Science, Vol. 11, No. 2, pp. 61-68.

Jardali, F., Saleh, S., Ataya, N. and Jamal, D. (2011), “Design, implementation and scaling up of the balanced scorecard for hospitals in Lebanon: policy coherence and

application lessons for low and middle income countries”, Health Policy ,Vol.103, pp.305– 314.

Jardine, A.K.S. and Banjevic, D. and Montgomery, and N. Pak, A. (2005)“Repairable system reliability”: recent developments in CBM optimization , Department of Mechanical and Industrial Engineering, University of Toronto, Canada.

Janowitz, I. L. and Gillenb, M. and Ryanc, G. and Rempela, D. and Trupinc, L. And Swigc, L. and Mullenb, K. and Ruguliesd, R. and Blancc, P. D. (2005).“Measuring the physical demands of work in hospital settings”: Design and implementation of an ergonomics assessment, National Institute of Occupational Health, Copenhagen, Denmark.

Kagioglou, M., Cooper, R. and Aouad, G. (2001) Performance management in construction: a conceptual framework, Research Institute for Design and Manufacture, University of Salford, Centenary Building.

Kennett, M. (2006) Hospital design considerations, Fema, Available from <http://www.fema.gov/library/file?type...file...> [Accessed on 20/5/2012].

Key performance indicators, (2012) Wikipedia, Available from: http://en.wikipedia.org/wiki/Key_performance_indicators [Accessed on 8/11/2012].

Kothari, C. (2004), “Research Methodology: methods and techniques”, New Age International Ltd.

Kutucuoglu, K., Hamali, J., Irani, Z. and Sharp, J. (2001), “A framework for managing maintenance using performance measurement systems”, International Journal of Operations and Production Management, Vol. 21, No.1, pp. 173 – 195.

Lam, E., Chan, A. and Chan, D. (2010), “Qualitative survey on managing building maintenance projects”, World Academy of Science Engineering and Technology, Vol.65, pp.232-236.

Lam, E., Chan, A. and Chan, D. (2010) Qualitative survey on managing building maintenance projects, World Academy of Science Engineering and Technology, Vol.65, pp.232-236.

Lam, k. (2008) Design for maintenance from the viewpoint of sustainable hospital buildings, Available from: <http://mail.airah.org.au/downloads/2007-12-02.pdf> [Accessed on 14/2/2012].

Lavy, S. (2006) Integrated facility management and its implementation to hospitals in Israel, Haifa Israel, Unpublished PhD thesis, Technion Occupied Palestinian Territories (Israel)Institute of Technology.

Lavy, S. and Shohet, I. (2004) Integrated maintenance management of hospital buildings: a case study, Construction Management and Economics, Vol.22, pp. 25–34.

Lavy, S. and Shohet, I. (2010) Performance based facility management: an integrated approach, International Journal of Facility Management, Vol.1, No.1, pp.1-14.

Lennerts, K. and Abel, J. and Pfmnder, U. (2005) “Step-by-step process analysis f or hospital f facility management An insight into the OPIK research project Facilities”,vol. 23 PP. 161-175. emerald group publishing limited.

Lind, H. and Muyingo, H. (2012), “Building maintenance strategies: planning under uncertainty”, Property Management, Vol. 30 No. 1, pp. 14-28.

Lourenco, P., Luso, E. and Almeida, M. (2006), “Defects and moisture problems in buildings from historical city centers a case study in Portugal”, *Building and Environment*, Vol. 41, pp.223–234.

Lomas, K., Giridharan, R. (2012), “Thermal comfort standards, measured internal temperatures and thermal Resilience to climate change of free-running buildings: A case-study of hospital wards” ,

available at SciVerse ScienceDirect ,*Building and Environment*
journal homepage: www.elsevier.com/locate/buildenv

Lufkin, P. (1998), “Estimating the Size and Composition of the Hospital Maintenance Staff”.

Marinie, E. and Zawawi, A. (2009), ”Personnel Characteristics of Maintenance Practice :A Case of High-Rise Office Buildings in Malaysia” , *journal of sustainable development*, 2(1).

McClay, G. (2009) Hospital maintenance mechanic, Available from:
<http://www.co.monterey.ca.us/personnel/documents/specifications/72C19.pdf>
[Accessed on 1/11/2012].

Ministry of Health, PHIC, Health Status in Palestine 2011, May 2012, Ministry of Health –Palestine -Ramallah.

Ministry of Health-Gaza strip (2010) Hospital annual report 2010, Palestinian Health Information Center (PHIC), Ministry of Health -Palestine- Gaza strip .

Ministry of Health-Gaza strip (2011) Hospital annual report 2011, Palestinian Health Information Center (PHIC), Ministry of Health -Palestine- Gaza strip .

Mourshed, M., Zhao, Y. (2012), “Healthcare providers’ perception of design factors related to physical environments in hospitals” *Journal of Environmental Psychology*,

Lough borough LE11 3TU, United Kingdom

Moy Jr, F., (1995), "Facility wellness health facilities management", *Facilities*, Vol. 13, No. 9, pp.45 – 48.

Murad, A., (2010), "Evaluation of medical equipment management in governmental health facilities in Gaza Governorates", Gaza strip-Palestine, Unpublished MSc thesis, Al Quds University.

Mutia, D., Kihui, J. and Maranga, S., (2012), "Maintenance management of medical equipment in hospitals", *Industrial Engineering Letters*, Vol. 2. No. 3, pp. 9-20.

Ni, J., Jin X., (2012), "Decision support systems for effective maintenance operations" Available from : <http://dx.doi.org/10.1016/j.cirp.2012.03.065>.

Nik-Mat, N., Kamaruzzaman, S. and Pitt, M., (2011), "Assessing the maintenance aspect of facilities management through a performance measurement system a Malaysian case study", *Procedia Engineering*, Vol. 20, pp. 329 – 338.

Noroozi, A., Khakzad, N., FaisalKhan, MacKinnon S., Abbassi, R. (2013), "The role of human error in risk analysis: Application to pre- and post-maintenance procedures of process facilities", *Journal of Reliability Engineering and System Safety* Vol.119, PP. 251–258.

Nudurupati, S., Arshad, T. and Turner, T., (2007), "Performance measurement in the construction industry: an action case investigating manufacturing methodologies", *Computers in Industry*, Vol. 58, pp. 667–676.

OLA., (2000), "A best practice preview preventive maintenance for local government buildings", 6th Report of Office of the Legislative Auditor, St. Paul, Minnesota, U.S.A.

Olajide, F. and Afolarin, A., (2012), "Evaluation of maintenance management practice in banking industry in Lagos state Nigeria", *International Journal of Sustainable Construction Engineering and Technology*, Vol.3, No. 1, pp.45-53.

Palestinian Central Bureau of Statistics, 15 January, 2012, < <http://www.pcbs.gov.ps/>>.

Parida, A. and Kumar, U., (2006), "Maintenance performance measurement (MPM) issues and challenges", *Journal of Quality in Maintenance Engineering*, Vol. 12, No. 3 pp. 239 – 251.

Popova, V. and Sharpanskykh, A., (2010), "Modeling organizational performance indicators", *Information Systems*, Vol. 35, pp. 505-527.

Qingfeng W., Wenbin L., Xin Z., Jianfeng Y., Qingbin Y., (2011), "Development and application of equipment maintenance and safety integrity management system", *Journal of Loss Prevention in the Process Industries* 24 (2011) 321e332

Queensland Department of Public Works (2011), Maintenance management framework Policy for the maintenance of Queensland Government buildings, Available from: http://www.works.qld.gov.au/downloads/bpu/mmf_policy.pdf [Accessed on 15/3/2012].

Reymondon, F., Pelletc, B. and Marcon, E., (2008), "Optimization of hospital sterilization costs proposing new grouping choices of medical devices into packages", *Production Economics*, Vol.112, pp. 326–335.

Shah Ali, A., Kamaruzzaman, S., Sulaiman, R. and Peng, Y., (2010), "Factors affecting housing maintenance cost in Malaysia", *Journal of Facilities Management*, Vol. 8 No. 4, pp. 285 – 298.

Shohet, I.M, (2003), “Key performance Indicators for Maintenance of Health Care Facilities”, Vol.21, No.1/2, pp (5-12).

Shohet, I. M. and Lavy, S., (2004). “Healthcare facilities management: State of the art review Facilities, 22(7/8), pp(210-220).

Shohet, I. M. (2006). “Key Performance Indicators for strategic healthcare facilities maintenance”, ASCE Journal of Construction Engineering and Management, 132(4), pp(345-352).

Shohet, I. M. and Lavy, S. “Development Of A Facility Coefficient: Quantifying The Effect Of Service Life Conditions On Maintenance”.

Shohet, I. M. and Sarel, L. “Community Clinics - Hard Facilities Management and Performance Management in hospitals”.

Sarel, L. and Shohet, M.I. (2010), “Performance-Based Facility Management An Integrated Approach”, International journal of facility management, 1(1)(2010).

Sarel, L. and Shohet, M.I. (2008). “Integrated healthcare facilities maintenance management model: case studies” Department of Construction Science, College of Architecture, Healthcare Facilities management.

Setyowati, E., Harani, A., Falaha, Y., (2013), “Green Building Design Concepts of Healthcare Facilities on the Orthopedic Hospital in the Tropics”, AMER International Conference on Quality of Life Holiday Villa Beach Resort & Spa, Langkawi, Malaysia, 6-7 April 2013, "Quality of Life in the Built and Natural Environment", Procedia - Social and Behavioral Sciences Vol.101 PP. 189 – 199.

Silva, J. and Falorca, J. (2009), “A model plan for buildings maintenance with application in the performance analysis of a composite facade cover”, *Construction and Building Materials*, Vol.23 , pp.3248–3257.

Silva, N., Dulaimi, M., Ling, F., and Ofori, G. (2004) Improving the maintainability of buildings in Singapore, *Building and Environment*, Vol.39, pp. 1243 – 1251

Takim, R. and Akintoye, A., (2002), “Performance indicators for successful construction project performance”, 18th Annual ARCOM Conference, Association of Researchers in Construction Management, Vol. 2, pp.545-55.

Takim, R., Akintoye, A. and Kelly, J., (2003), “Performance measurement systems in construction”, 19th Annual ARCOM Conference, Association of Researchers in Construction Management, Vol. 1, pp.423-432.

The World Bank, (2008), “West Bank and Gaza health policy report performing prudently under pressure health financing reform and the rationalization of public sector health expenditures”, The world bank, Human Development Sector, Middle East and North Africa Region

Toor, S. and Ogunlana, S., (2010), “Beyond the ‘iron triangle’: stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects”, *International Journal of Project Management*, Vol.28, pp. 228–236.

Tsang, A., (1998), “A strategic approach to managing maintenance performance”, *Journal of Quality in Maintenance Engineering*, Vol. 4, No.2, pp. 87 – 94

Turrell, P., (1997). “Small is Different: A Strategy of Effective Management of Maintenance in Nonprofit- making Organization”, *The Royal Institution of Chartered Surveyors*, 1(3).

Veerabadran, S. and Parkinson, I., (2010), “Cleaning disinfection and sterilization of equipment”, *Anaesthesia and intensive care medicine*, Vol.11, pp.451-454.

Weber, A. and Thomas, R. (2005) Key performance indicators measuring and managing the maintenance function, Available from:<http://www.plantmaintenance.com/articles/KPIs.pdf> [Accessed on 5/2/2012]

World health organization, united nation development programme, and United nations educational scientific and cultural organization and Ministry of health report (2010), Assessment of public health estate in Gaza, World health organization draft report.

Wilson, A. and Ridgway, G., (2006), “Reducing hospital-acquired infection by design: the new University College London Hospital”, *Journal of Hospital Infection*, Vol. 62, pp.264–269.

Yahya, M. and Ibrahim, M., (2012), “Building maintenance achievement in high rise commercial building: a study in Klang valley Malaysia”, *International Journal of Sustainable Development*, Vol.04, No. 6, pp.41-46.

Yam, R., Yuen, P., Yung, R. and Choy, T., (2011), “Rethinking hospital general ward ventilation design using computational fluid dynamics”, *Journal of Hospital Infection*, Vol. 77, pp. 31-36.

Zawawi, E. and Kamaruzzaman, S., (2009), “Personnel characteristics of maintenance practice a case of high rise office Buildings in Malaysia”, *Journal of Sustainable Development*, Vol. 2, No. 1, pp.111-116.

Zawawi, E., Kamaruzzaman, S., Ali, A. and Sulaiman, R., (2010), “Assessment of building maintenance management in Malaysia: resolving using a solution diagram”, *Journal of Retail and Leisure Property*, Vol. 9, No. 4, pp. 349–356.

Zawawi, E., Kamaruzzaman, S., Ithnin, Z. and Zulkarnain, S. (2011) A conceptual framework for describing CSF of building maintenance management, Procedia Engineering, Vol.20, pp.110 – 117.

Appendixes:

Appendix A:



الجامعة الإسلامية - غزة
عمادة الدراسات العليا
قسم الهندسة المدنية
إدارة المشروعات الهندسية

استبانة حول

"العوامل المؤثرة على ادارة الصيانة في المستشفيات الحكومية بقطاع غزة"

الباحث/ م. إسماعيل عبدربه الهسي

المشرف/ د. خالد عبدالرؤوف الحلاق

2014م / 1435هـ

الاستبانة

يرجى وضع علامة (√) عند الإجابة المناسبة

القسم الأول / معلومات عامة

1. الجنس

ذكر أنثى

2. العمر

من 20-25 سنة من 26-30 سنة من 31-35 سنة 36 سنة فأكثر

3. المؤهل العلمي

ماجستير بكالوريوس دبلوم أخرى.....

4. المسمى الوظيفي

مدير إدارة مدير دائرة رئيس قسم أخرى , وضح

5. خبرتك في مجال الصيانة

من 1-5 سنوات من 6-10 سنوات

من 11-15 سنة 15 سنة فأكثر

6. العمر الزمني لإدارة الصيانة التي تعمل بها

من 1-5 سنوات من 6-10 سنوات

من 11-15 سنة فأكثر 15 سنة

7. عدد العاملين الثابتين في الإدارة التي تعمل بها

من 1-5 أفراد من 6-10 أفراد

من 11-15 فرد 16 فرد فأكثر

8. اسم المستشفى التي تعمل بها (إختياري) - - - - -

9. نوع المستشفى التي تعمل بها من حيث:

أ- النوعية

عامة متخصصة تعليمية طوارئ

ب- الحجم (يسع)

50 سرير من 51-150 سرير من 151-600 600 سرير فأكثر

ج- التخصصات

عامة تخصصية مركزية كبرى

10. عدد الأقسام التي تقوم ادارتك بعمل صيانة لها
 من 1-5 مباني من 6-10 مباني
 من 11-15 مبني 16مبني فأكثر
11. مساحة الأقسام التي تقوم بصيانتها
 أقل من 500م2 من 501-1000م2
 من 1001-2000م2 2001م فأكثر
12. عمر المبنى المقترح صيانتته
 أقل من 5سنوات من 5-10 سنوات
 من 11-20سنة 20 سنة فأكثر
13. عدد الأنظمة الكبيرة التي تقوم إدارتك بصيانتها(مولدات/أنظمة مركزية/محطات /غازات طبية)
 نظام واحد نظام مزدوج
 أنظمة متعددة أنظمة مركبة
14. عدد الأجهزة الطبية التي تقوم ادارتك بصيانتها كل سنة
 أقل من 10 أجهزة من 11-50 أجهزة
 من 51-100 جهاز 100 جهاز فأكثر
15. عدد الشركات المتخصصة التي يمكن شراء خدمة الصيانة منها
 أقل من 5شركات من 6-10 شركات
 من 11-20شركة 20 شركة فأكثر
16. عدد الشركات العامة التي يمكن إجراء خدمة الصيانة من خلالها
 أقل من 5شركات من 6-10 شركات
 من 11-20 شركة 20 شركة فأكثر

القسم الثاني / إلى أي مدى تؤثر العوامل المتعلقة بالموارد البشرية على إدارة الصيانة داخل المؤسسة

يرجى وضع علامة (√) عند المقياس المناسب.

5	4	3	2	1	الرقم	العوامل المتعلقة بالموارد البشرية
بشكل مرتفع جدا	بشكل مرتفع	بشكل متوسط	بشكل منخفض	بشكل منخفض جداً		
					1.	تمتاز المؤسسة بوجود حجم الطاقم / عدد الأفراد العاملين في مجال الصيانة مقارنة بحجم العمل المنوط بهم.
					2.	يملك العاملون خبرات في هذا المجال كافية لأداء الصيانة.
					3.	تتوافر لدى الكوادر الموجودة في الإدارة التأهيل والتدريب الكافي من ناحية الكفاءة.
					4.	يملك العاملون حالة من التنافس في مجال الصيانة لأنهم يتقاضون حوافز تشجيعية سواء معنوية أو مادية.
					5.	تمتاز الإدارة بسلوك لدى كثير من العاملين مقبول مقارنة بالرضا الوظيفي من حيث الأداء.
					6.	تتوفر في العاملين ثقافة لأداء العمل والرضا المقبول لديهم.
					7.	يشعر العاملون بالمسؤولية تجاه الأعمال المراد إنجازها.
					8.	توجد متابعة لأعمال العاملين وردود الأفعال الناتجة عن تأدية العمل وإعطاء التغذية الراجعة.
					9.	توجد علاقة تكافل اجتماعي بين العاملين تحظى بهم من حيث الاهتمام.
					10.	تدعم الإدارة وجود الانتداب /التفويض /المسؤولية/توزيع الأدوار و تكون بالقدر التي وضعت من أجله سواء بالسلب أو الإيجاب.
					11.	توفر العاملين على بند مشاريع التشغيل المؤقت من شأنها حل بعض المشاكل لنقص العاملين في الصيانة.
					12.	يوجد سوء أو سوء استخدام من قبل العاملين نتيجة الغموض والتعقيد في عمل الصيانة.
					13.	تسعى الإدارة إلى إيجاد أساليب الثواب والعقاب الذي من شأنه أن ينظم عملية الصيانة وفق الرؤية المخططة.
					14.	توجه العاملين بتطبيق التعليمات الواضحة والمكتوبة والمتسلسلة في تنفيذ الأعمال.

					15. تسعى الإدارة وضوح الوصف الوظيفي للعاملين بالصيانة حسب توزيع الأعمال
					16. تشجع الإدارة وجود علاقة قوية بين العاملين بالرئيس المباشر لتنفيذ الأعمال

القسم الثالث / إلى أي مدى تؤثر العوامل المتعلقة بمشاريع الصيانة على إدارة الصيانة داخل المؤسسة

يرجى وضع علامة (√) عند المقياس المناسب.

5	4	3	2	1	الرقم
بشكل مرتفع جدا	بشكل مرتفع	بشكل متوسط	بشكل منخفض	بشكل منخفض جداً	
العوامل التي تتعلق بخصائص المشروع المقترح صيانتها					
					1. يدعم حجم المشروع كبير/متوسط/صغير /مشروع كبير متفرع لعدة مشاريع صغيرة السرعة والدقة للتنفيذ .
					2. تمتلك الإدارة شمولية الصيانة لكامل المشروع/جزء من المشروع (كهرباء، ميكانيك، مدني، اجهزة طبية)
					3. تسعى الإدارة لوجود مدة انجاز المشروع في الوقت والتكلفة والجودة المحددة
					4. توجد اوقات محدد للبدء بالمشروع او يمكن البدء بالمشروع بعد الترسية بصورة مباشرة
					5. تسعى الإدارة الى تمويل المشروع (داخليا ، خارجيا)
					6. تدعم الإدارة تقسيم للأعمال على مراحل حسب المكان أو نوع العمل
					7. يسير العمل في المشاريع وفق معايير محددة تختلف في خصائصها عن المشاريع الأخرى.
					8. تمتلك الإدارة معلومات عن التعقيد من حيث الحجم و الدقة والتفاصيل الكثيرة في المشروع
					9. تشجع الإدارة عوامل الأمان المطلوبة في المشروع ومدى استجابة العاملين لتطبيقها .
					10. تتخذ الإدارة القرارات وتنفذها بشكل سريع من الناحية الإشرافية حسب الرأي الفني/الهندسي.
					11. تتبع الإدارة خطوات سليمة ومخططة في دراسة وثائق عطاء مشروع ومخططاته قبل التنفيذ لأعمال مشروع الصيانة .
					12. يؤثر الغموض والتعقيد وعدم تفسير واضح لجدول الكميات في المشروع على أعمال الصيانة .

					13. توفر المواد اللازمة بشكل مسبق لعملية الصيانة
					14. توجد سلفة لشراء ما يلزم من مواد للمشروع المقترح صيانتها بشكل عاجل

القسم الرابع / إلى أي مدى تؤثر سياسة المؤسسة ورؤيتها على إدارة الصيانة داخل المؤسسة

يرجى وضع علامة (√) عند المقياس المناسب.

5	4	3	2	1	الرقم
بشكل مرتفع جدا	بشكل مرتفع	بشكل متوسط	بشكل منخفض	بشكل منخفض جداً	
المجموعة رقم (1) استراتيجيات المؤسسة من حيث الخطط					
					1. تتبع الإدارة المعايير التي تتخذها المؤسسة لأداء أعمال الصيانة
					2. تسعى الإدارة لتطبيق اللوائح والقوانين والآليات التابعة لدى الوزارة لتنفيذ مشاريع خاصة بأعمال الصيانة
					3. تتبع الإدارة أولويات اختيار العمل للتنفيذ من حيث جدولة الأعمال وترتيبها
					4. يوجد الرجل المناسب في المكان المناسب ويتخذ القرار المناسب بالوقت المناسب لأداء الأعمال
					5. تتخذ الإدارة الإجراءات في الاتصالات والتعاون والشراكة مع الجهات المانحة لعمل برامج ضرورية لتوفير التمويل لإنجاز الأعمال
					6. توفر الإدارة الإمكانات حسب الخطط المعدة لإنجاز الأعمال حسب جدولتها
					7. تنسق الإدارة وتقدم التسهيلات وبناء علاقات محلية ودولية مع المؤسسات الأخرى لتذليل العقبات
					8. توفر الإدارة بيئة عمل آمنة ووسائل وقائية في حال وجود مخاطر بسبب المكان
					9. تبتعث / توهل / تدرب الإدارة العاملين سواء بالخارج والداخل لإنجاز العمل
					10. تمتاز الإدارة بالتخطيط والتنظيم والتوجيه والمتابعة والرقابة الداخلية والخارجية لنجاح الأعمال
					11. تسعى الإدارة لوجود رؤية واضحة بخصوص مشاريع الصيانة المنفذة والمشاريع المراد تنفيذها مستقبلاً والية ربطها ببعضها البعض
المجموعة رقم (2) استراتيجيات المؤسسة من الناحية الاقتصادية					
					1. ارتفاع وانخفاض أسعار العملات

					2. تقديم /تأخير/صرف الدفعات في حال وجود مقاول خارجي أو دفعها في وقتها المحدد .
					3. توفر الادارة الكفالات والضمانات المطلوبة للعمل في حال وجود مقاول(ضمان دخول المناقصة و حسن التنفيذ والصيانة)
					4. تغرم/تحفز/ تخصم/تعاقب الادارة القائمين بأعمال الصيانة في حال التسريع او التأخير
					5. تقدم الادارة دفعات قبل البدء بالعمل كحافز لأداء العمل بالسرعة والوقت المحدد لإنجاز العمل.
					6. تحث الادارة على صرف الرواتب بموعدها وغير ذلك يؤدي إلى عدم التزام العاملين لأداء الصيانة بالوقت المحدد لها نظرا للقيام بإجازات لأنها حقهم الطبيعي وفق القانون .
					7. توجد أعمال إضافية في اغلب مشاريع الصيانة وبشكل كبير نتيجة الغموض وعدم الوضوح في حجم ونوع الصيانة
المجموعة رقم (3) استراتيجيات المؤسسة من الناحية الفنية					
					1. تلائم خطة الصيانة مع خطة الأطراف الأخرى(المالك, مقاول, استشاري, متبرع,..) وطبيعة العلاقة الموجودة بينهم
					2. تسعى الادارة لتقديم خدمات نوعية وجودة المواد المستخدمة والاهتمام بالأعمال الخاصة بعملية الصيانة
					3. تسعى الادارة لتوفير الإمكانيات من الموارد اللازمة وتقديم جميع التسهيلات التي من شأنها أن تؤدي لإتمام العمل.
					4. تجتهد الادارة في التدوير وإعادة استخدام المواد الغير مستهلكة مما يوفر على المؤسسة ويساعد في أعمال فنية جديدة ولكن بجودة ربما
					5. تمتلك الادارة الرأي الفني/ الهندسي من حيث المرونة /الدقة في اتخاذ القرار من الناحية
					6. تشجع الادارة الاستقلالية //الخصوصية في نجاح عدم التبعية /فشل عملية الصيانة من الناحية الفنية
					7. تدعم الادارة وجود طاقم من الصيانة اثناء استلام المشاريع المنفذة حديثا لمتابعة صيانتها
					8. تنسق الادارة بين الطاقم المشرف على المشاريع الجديدة وطاقم الصيانة من باب التخطيط ووضوح الرؤية بما فيها فترات
المجموعة رقم (4) استراتيجيات المؤسسة من الناحية التكنولوجية					
					1. تتطلع الادارة إلى وجود نظام موحد محوسب لتوفير الأدوات والية لتخزينها وطريقة صرفها مثل الدول المتقدمة.

					2. جدول الادارة الاعمال حسب الأولويات من خلال برنامج تعتمد جميع الأطراف المعنية
					3. تواكب الادارة التطور ونقل التكنولوجيا من الدول المتقدمة عن طريق تطوير الكوادر
					4. تتبع الادارة أنظمة مشاريع الاستدامة في التصميم الهندسي والإصرار على إدخال هذه الأنظمة في أعمال الصيانة .
					5. تسعى الادارة إلى وجود نظام محوسب لتوثيق الأعمال المنفذة وكذلك ربطه على أنظمة الصرف والمخازن.
					6. تعمل الادارة لاستحداث أنظمة التحكم الحديثة اللازمة للصيانة في كل مشاريع الصيانة المنفذة والمراد تنفيذها مثل PLC/BMS

القسم الخامس / إلى أي مدى تؤثر العوامل المتعلقة بالبيئة الداخلية والخارجية على إدارة الصيانة داخل المؤسسة

يرجى وضع علامة (√) عند المقياس المناسب.

الرقم	1	2	3	4	5
	بشكل منخفض جداً	بشكل منخفض	بشكل متوسط	بشكل مرتفع	بشكل مرتفع جداً
المجموعة رقم (1) العوامل المؤثرة على الصيانة وتتعلق بالبيئة الداخلية					
1.					
					تسعى الادارة لتوفير مكان الصيانة مثل (غرف المكاتب والتمريض والمرضى والعمليات والدورات) قبل البدء بالصيانة
2.					
					تتوفر للإدارة معلومات عن العوامل الفيزيائية من حيث مناسبة المكان لعمل الصيانة مثل (التهوية/الإضاءة/الارتفاع او تحت الأرض /
3.					
					تمتلك الادارة المعلومات الكافية عن حالة المكان مثل (شاغر او مأهول او قيد الضمان)
4.					
					تدعم الادارة التخصص (النوع) في العمل اللازم للصيانة مثل (أعمال مدنية أو ميكانيكية وكهربائية أو طبية)
5.					
					تشجع الادارة بحل المشكلة أي كان نوع الصيانة اللازمة للعمل (طارئة/مجدولة/غير مجدولة/مخططة/غير مخططة/وقائية)
6.					
					تمتاز الادارة بمعلومات عن درجة الصعوبة لتأدية العمل مثل (سهلة/غامضة/تحتاج للنقل خارج المكان/صعبة لعدم توفر بيئة مناسبة)
7.					
					تمتلك الادارة معلومات عن حجم عمل الصيانة (كبير/صغير يمكن علاجه بنفس المكان/كبير /صغير لايمكن العلاج بنفس المكان....)

					8. تحتفظ الإدارة على استخدام مواد ذات جودة عالية ومتوفرة في المخازن/ الأسواق المحلية
					9. تدخل بعض الطواقم الغير متخصصة (فنيا)مثل الأطباء والمرضى والإداريين في أعمال الصيانة لرغبات شخصية
المجموعة رقم (2) العوامل المؤثرة على الصيانة وتعلق بالبيئة الخارجية					
					1. تغير المناخ مثل (درجات الحرارة المنخفضة والمرتفعة والعواصف والرياح....)
					2. يوجد مخاطر العمل من حيث (الثلوث و الضوضاء والضجيج والازدحام.....)
					3. يوجد معوقات خارجية مثل (تدخل من الخارج/ تصميم غير مخطط للصيانة/تداخل اعمال/اشياء غير مرئية.....)
					4. تتعاقد الإدارة مع جهات خارجية مثل (خبراء صيانة-مقاولين/موردين/مانحين.....)
					5. تمتاز الإدارة بالتنسيق مع جهات اخرى (بلديات/وزارات /سلطة الطاقة /شركة الكهرباء والاتصالات

القسم السادس / إلى أي مدى تؤثر الأزمات المتعلقة بالسياسة خارج المؤسسة بإدارة الصيانة داخلها .

يرجى وضع علامة (√) عند المقياس المناسب.

الرقم	1	2	3	4	5
	بشكل منخفض جداً	بشكل منخفض	بشكل متوسط	بشكل مرتفع	بشكل مرتفع جداً
1.					
2.					
3.					
4.					
5.					
6.					
7.					

					8. القيود والشروط المفروضة من بعض المانحين لأداء بعض أعمال الصيانة
					9. عدم تشجيع الاستثمارات في قطاع الصيانة نتيجة التقلبات السياسية المتعاقبة
					10. عدم وجود برنامج شامل لدعم قطاع الصيانة في جميع جوانبه

القسم السابع / مدى تأييد وجود

طرق للمعالجة الفعالة لتقليل عمليات الصيانة والحفاظ مدة أطول بالامتلاكات بالمستشفيات

يرجى وضع علامة (√) عند المقياس المناسب.

الرقم	1	2	3	4	5
	بشكل منخفض جداً	بشكل منخفض	بشكل متوسط	بشكل مرتفع	بشكل مرتفع جداً
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					

					التنسيق المستمر بين الدوائر والإدارات لأداء الصيانة بشكل سريع ودقيق	.14
					تفجير كادر متخصص ذو كفاءة وحرفية من حيث الكم والكيف	.15
					استيراد التكنولوجيا الحديثة والبرامج النوعية لمواكبة التطور مقارنة بالدول المتقدمة	.16

شكر التعاون معنا

Appendix B:



**Islamic University- Gaza
Deanery of Higher Education
Faculty of Engineering
Engineering Projects Management**

A questionnaire About:

**Factors affecting on Maintenance Administration at
Governmental Hospitals in Gaza Strip.**

Researcher : Eng. Ismail El-Hissy

Advisor: Dr. Khaled Al-Halaq

2014

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Dear Sir/ Madam

The employees in sector of maintenance projects at the governmental Hospitals in Gaza Strip.

Title: Factors affecting on Maintenance Administration at Governmental Hospitals in Gaza Strip.

One of the main duties at hospitals is performing maintenance, since it is very important. Maintenance in Hospitals is done 24hr per day, all parts of maintenance administration have an important role in preparing plans and the performance required in terms of quantity and quality. Therefore, the follow-up teams work day and night, even in the days of official holidays, so we chose this title to complete what were done by others from previous studies on that subject, and to address some errors caused during maintenance work and to propose new solutions necessary to participate with others, thus, demonstrating effective results to measure the factors affecting on maintenance administration at governmental hospitals in Gaza strip.

This questionnaire is divided into these parts:

Part One: General information.

Part Two: Effecting of human resources factors on maintenance administration

Part Three: Effecting of maintenance projects factors on maintenance administration

Part Four: effect of policy and vision of the organization on maintenance administration.

Part Five: effect of internal and external environment of the organization on maintenance administration.

Part Six: effect of Crisis policy outside the organization on maintenance administration.

Part Seven: Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property.

So we hope you could cooperate with us for the success of this research by your participation in filling this questionnaire transparency and honesty, note that this information will be preserved, and will be solely for the purpose of scientific research.

Thanks for Your Cooperation

Eng. Ismail El-Hissy

Part One: General information.

Please put (√) at the appropriate scale

1- Gender:

Male Female

2- Age

from 20-25yr. from 26-30yr. from 31-35yr. more than 36yr.

3- Qualifications:

Master Bachelor Diploma other.....

4- Job in maintenance management

5- Director of Administration Director of Department Head of Department

other.....

6- Your Experience at Maintenance

1- 5 years. 6- 10 years. 11- 15 years. more than 15 years.

7- Experience of your Maintenance Administration

1- 5 years. 6- 10 years. 11- 15 years. more than 15 years.

8- No. of permanent employees in your administration

1-5 Empl. 6-10 Empl. 11-15 Empl. more than 15 Empl.

9- Name of the Hospital in which you are working (optional):.....

10- Type of your Hospital according to:

a- Type:

General. Specialist. Educational. Emergency.

b- The Size of Hospital expands to:

50 Beds 51-150 Beds 151-600 Beds more than 600 Beds

c- Specializations:

General. Specialist. Central. Major.

11- No. of Departments served by your administration.

1-5 bul. 6-10 bul. 11-15 bul. more than 15 bul.

12- Area of Departments served by your administration.

< 500m². 500-<1000m². 1000 - < 2000 m². more than 2000 m².

13- Age of building needs maintenance

1- < 5 years 5 - <10 years 10 - <20 years more than 20 years

14- No. of large systems need maintenance (Generators, Central Systems, Stations, Medical Gases).

Single Sys. Double Sys M ulti Sys. Complex Sys.

15- No. of Medical devices need annual maintenance

< 5 devices 5 - <10 devices 10 - <20 devices > 20 devices

16- No. of specialized companies that can buy the maintenance service

< 5 comp. 5 - <10 comp. 10 - <20 comp. > 20 comp.

17- No. of general companies can do maintenance.

< 5 comp. 5 - <10 comp. 10 - <20 comp. > 20 comp.

Part Two: Effecting of human resources factors on maintenance administration

Please put (√) at the appropriate scale

No.	Human Resources Factors	1 Very Low	2 Low	3 Mid.	4 High.	5 Very High.
1.	Characterized by the institution size / No. of employees in the field of maintenance compared to the size of the work assigned to them.					
3.	The staff of administration have a good experience and adequate training in terms of efficiency					
4.	Employees have the state of competition in the field of maintenance because they are paid incentives, either moral or physical.					
5.	The administration is characterized by an acceptable behavior for the employees compared to job satisfaction in terms of performance.					
6.	The employees have the culture to do the acceptable work and satisfaction.					
7.	The employees are feeling responsibility towards the works to be completed					
8.	There is a follow-up to the work of employees and the reactions resulting from the performance of work and give feedback.					
9.	There is a social solidarity relationship between the employees .					
10.	The administration supports the existence of the Mandate / responsibility / distribution of roles/ and be developed to its extent, either positively or negatively.					
13.	The administration seeks to find methods of reward and punishment that would regulate the maintenance process according to the planned vision.					
14.	The administration is directing the staff to					

	apply clear, serialized and written instructions in doing work.					
15.	The administration is seeking clarity of the job description for maintenance workers according to the work distribution.					
16.	The administration encourages the presence of a strong relationship between the direct boss and workers to carry out business.					

Part Three: Effecting of maintenance projects factors on maintenance administration

Please put (√) at the appropriate scale

No.	Maintenance Projects Factors	1 Very Low	2 Low	3 Mid.	4 High.	5 Very High.
1.	The project size (large / medium / small/ large divided into several small projects) large supports the speed and accuracy of implementation.					
2.	The administration have comprehensive maintenance for all project /parts of project (Electrical/ Mechanical/ Civil/ Medical Equipment).					
3.	The administration seeks to let the period of completing the project in the specified time, cost and quality.					
4.	There is a specified time to start the project, or the project can be started directly after awarding the project.					
5.	The administration seeks to finance the project (internally, externally)					
6.	The administration supports the division of work in phases according to the location or type of work					
7.	The work in projects is done according to specific criteria that differ in their characteristics from other projects.					
8.	The administration have information about the complexity in the project in terms of size, precision and lot of details.					
9.	The administration encourages safety factors required in the project and the response of workers to be applied.					
10.	The administration takes decisions and					

	implement rapidly from the supervision according to technical/engineering opinion.					
11.	The administration follows true and planned steps in studying the tender documents and drawings of project before implementing the maintenance works.					
12.	The maintenance works can be affected by ambiguity, complexity and lack of a clear explanation of the bill of quantities in the project.					
13.	Provide the necessary materials for the maintenance work early					
14.	There is an advance to buy the needed materials for the maintenance project quickly					

Part Four: Effect of policy and vision of the organization on maintenance administration.

Please put (√) at the appropriate scale

No.		1 Very Low	2 Low	3 Mid.	4 High.	5 Very High.
Group no.1:Strategies of the organization according to plans						
1.	The administration follows the standards of the organization to perform maintenance works					
2.	The administration seeks to enforce the regulations, laws and mechanisms of the ministry for the implementation of special projects in maintenance work.					
3.	The administration follows priorities in choosing work for the implementation in terms of scheduling and arranging of work.					
4.	There is the right man in the right place and make the right decision for the right time perform the work.					
5.	The administration takes action in the communication, cooperation and partnership with donors to do necessary programs to provide funding for the completion of the work.					

6.	The administration provides capabilities according to prepared plans to complete the works as scheduled					
7.	The administration coordinates, provides facilities, and builds relationships with local and international institutions to overcome risks.					
8.	The administration provides a safe working environment and means of pre-emptive in the event of a risk because of the place.					
9.	Emit / qualify / train personnel administration, both abroad and at home to do the work.					
10.	The administration is characterized by planning, organizing, directing, monitoring and internal and external control to the success of the work.					
11.	The administration seeks to have a clear vision about the implemented maintenance projects and the projects to be implemented in the future and a mechanism to link these projects to each other.					
Group no.2: Strategies of the organization In terms of economic issue						
1.	High and low exchange rates					
2.	The administration accelerates / delays / pays the payments in case of an external contractor or paid in a specific time.					
3.	The administration provides guarantees and collateral required to work in case of a contractor (ensure entry tender and good execution and maintenance)					
4.	The administration fines / stimulates / deducts the maintenance workers in case of acceleration or delay					
7.	There are additional works in most of the maintenance projects as a result of the ambiguity and lack of clarity in the size and type of maintenance.					
Group no.3: Strategies of the organization In terms of technical issue						
1.	Matching between the maintenance plan with the other plans (owner, contractor, consultant, donor, ..) and the nature of the relationship between them.					
2.	The administration seeks to provide quality services, quality of the used materials, and					

	the attention to special maintenance works.					
3.	The administration seeks to provide the necessary capabilities, resources, and facilities that will lead to the completion of the work.					
4.	The administration perseveres in recycling and reuse of non-consuming material, which provides the organization and helps in new artwork, but the quality may be less.					
5.	The administration have the technical / engineering opinion in terms of flexibility / accuracy in decision-making technically.					
6.	The administration encourages independence /privacy in the success of non-subordination / failure of maintenance process technically					
7.	The administration supports the existence of a maintenance team during the receipt of the newly implemented projects for future follow-up maintenance					
8.	The administration coordinates between the team supervisor on new projects and maintenance team in order to plan, have a clear vision, and include warranty periods.					
Group no.4: Strategies of the organization In terms of technological issue						
1.	The administration looks forward to having a unified computerized system to provide the tools and mechanisms of storing and dispensing like developed countries.					
2.	The administration schedules the works in terms of priorities based on a program adopted by all the parties involved to accomplish.					
3.	The administration keeps pace with the development and transfer of technology from developed countries through the development of teams.					
4.	The administration follows the sustainability systems projects in engineering design and insists to include these systems in the maintenance work.					
5.	The administration seeks to have a computerized system to document the performed work, as well as linking the request systems and stores.					
6.	The administration works to develop a					

	modern control systems required for maintenance in all maintenance projects to be carried out and implemented, such as PLC / BMS					
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Part Five: effect of internal and external environment of the organization on maintenance administration.

Please put (√) at the appropriate scale

No.		1 Very Low	2 Low	3 Mid.	4 High.	5 Very High.
Group no.1: Effect of internal environment of the organization on maintenance administration.						
1.	The administration seeks to provide a place for maintenance, such as (office rooms, nursing rooms, patient rooms, operation rooms, bathrooms) before starting maintenance					
2.	The administration has information about the physical factors in terms of the appropriate place for maintenance work such as (ventilation / lighting / high or underground)					
3.	The administration has sufficient information about the status of the place such as (vacant/ unoccupied /under warranty)					
4.	The administration supports the specialization (type) in the work necessary for the maintenance of such (civil works/ mechanical/ electrical/medical)					
5.	The administration encourages to solve any problem necessary for maintenance work (emergency / scheduled / non-scheduled / planned / unplanned / preventive)					
6.	The administration is characterized by the information about the degree of difficulty to perform such work (easy / vague / need to transfer out of place / difficult due to lack of					

	a suitable environment)					
7.	The administration has information about the size of maintenance work (large / small can be treated in the same place / large / small treatment cannot be in the same place)					
8.	The administration reserves the use of high quality materials and are available in stores or local markets					
9.	The intervention of some non-specialized personnel (technically), such as doctors, nurses and administrators in maintenance work for personal wishes					
Group no.2: Effect of external environment of the organization on maintenance administration.						
1.	Weather changes such as (low and high temperatures, winds, storms,)					
2.	There are risks in the work, such as (pollution, noise, and congestion)					
3.	There are external constraints such as (intervention from abroad / unplanned design for maintenance / works overlapping / invisible things)					
4.	The administration contracts with external parties, such as (experts in maintenance/ contractors / suppliers / donors)					
5.	The administration is characterized by the coordination with other entities (municipalities / Ministries / Authority of Energy / Electricity Company and communications					

Part Six: effect of Crisis policy outside the organization on maintenance administration.

Please put (√) at the appropriate scale

No.		1	2	3	4	5
		Very Low	Low	Mid.	High.	Very High.
1.	Political instability resulting from the conflict/ reconciliation					
2.	The siege imposed on the Gaza Strip since 7 years					
3.	The challenges facing the health sector in					

	the provision of the minimum requirements for the completion of works					
4.	Wars on Gaza strip in 2008, 2012, and 2014					
5.	Political conflicts which led to the conscientious and non-return of a large no. of employees to work and inequality among staff in terms of rights					
6.	Rapid crises as a result of lack of clear policy for donors / donor funding for projects the size and quality for maintenance					
7.	Using of collective punishment imposed by the Israeli occupation					
8.	Restrictions and conditions imposed by some donors to perform some maintenance work					
9.	No encourage for the investment in maintenance as a result of successive political upheavals					
10.	The lack of a comprehensive program to support the maintenance sector in all aspects					

Part Seven: Supporting of the existence of effective methods of treatment to reduce maintenance operations and maintain a longer duration of hospital property.

Please put (√) at the appropriate scale

No.		1	2	3	4	5
		Very Low	Low	Mid.	High.	Very High.
1.	Periodic meetings to resolve the problem on time					
2.	Setting a timetable for maintenance work in terms of priority					
3.	Review and audit requests for maintenance orders and do not recur					
4.	Regarding / responsibility in performing tasks by the team based on the maintenance operations					
5.	Provide moral and real incentives					
6.	Providing comfortable environment and appropriate place to work for the team of maintenance work					

7.	Provide adequate training to prepare staff for maintenance operations, whether internally or externally					
8.	Using of punishment methods , whether the warning or dismissal for those who work in disregarding					
9.	Speed and proficiency in the performance of work as required precision					
10.	Maintaining the use of high quality materials and are available in local markets					
11.	Operating the team on modern systems and variable periods					
12.	Applying the preventive maintenance program					
13.	Provision of spare parts and materials necessary for the implementation of all kinds of maintenance programs					
14.	Continuous coordination between Administrations and departments to perform maintenance quickly and accurately					
15.	The provision of a dedicated staff with efficiency and professionalism in terms of quantity and quality					
16.	Import modern technology and quality programs to keep pace compared with the developed countries					

Thanks for Your Cooperation

Appendix C:

- Old age,



Figure 6.1: Old age of building

- Number of toilets per floor.



Figure 6.2: toilets per floor

- Tile de bonding, Staining of tiles,



Figure 6.3: Tile de bonding, Staining of tiles

- Staining of ceiling boards,



Figure 6.4: Staining of ceiling boards

- Water leakages through cracks,



Figure 6.5: Staining of ceiling boards

- Water leakages through pipe penetration,



Figure 6.6: Water leakages through pipe penetration

- Water leakages through joints



Figure 6.7: Water leakages through joints

- Corrosion of exposed drainage pipes,



Figure 6.8: Corrosion of exposed drainage pipes

- Paint peeling,



Figure 6.9: Corrosion of exposed drainage pipes

- Bad plumping



Figure 6.10: Corrosion of exposed drainage pipes

- Repair all damaged area



Figure 6.11: Corrosion of exposed drainage pipes

- Change functions of certain sections of the floors



Figure 6.12: Corrosion of exposed drainage pipes



Figure 6.13: Removing existing plaster & paint from walls

- Enlarging existing doors and windows openings



Figure 6.14: Enlarging existing doors and windows openings

- Removing existing tiles ,skirting, cement and sand layers



Figure 6.15: Removing existing tiles, skirting, cement and sand layers



Figure 6.16: Protection concrete around sleeves and pipes



Figure 6.17: Doors shall be Italian accessories, Steel frames filled concrete



Figure 6.18: Internal wooden ,priming and painting type or Formica face



Figure 6.19: Repair any cracks and painting

- Install non slip porsolan floor tiles



Figure 6.20: Install non slip porsolan floor tiles



Figure 6.21: Change water network pipes with new pipes

- lay traflex PVC roll 2mm for corridors and rooms



Figure 6.22: lay traflex PVC roll 2mm for corridors and rooms



Figure 6.23: Anti-humidity and Anti-bacteria false ceiling



Figure 6.24: Copper pipe for medical gases pipes



Figure 6.25: The last finish of building



Figure 6.26: Remove plaster and painting



Figure 6.27: Remove electrical connections, connections before the finishing



Figure 6.28: Maintain plastering and painting, HVAC, doors, windows, dooms, isolation work .



Figure 6.29: Install accessories, arms, wood protection, polish and Clean the site.