An-Najah National University

Faculty of Graduate Studies

Assessing Innovation Practices in Project Management: The case of Palestinian Construction Projects

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Dedication

To my mother and father

Rawan

Acknowledgement

First of all , I praise God, the Almighty, for providing me this opportunity and granting me the capability to proceed successfully.

My deepest gratitude to Dr. Ayham Jaaron, my supervisor, for his support, constructive comments, quick responses, valuable guidance and assistance throughout this research.

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At the end, I would like to thank all those people who made this thesis possible and an enjoyable experience for me.

الإقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Assessing Innovation Practices in Project Management: The case of Palestinian Construction Projects

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

Declaration

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

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Date : التاريخ: ١٧/٥/٢٠١٥م

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List of Abbreviations

ANOVA	Analysis of Variance
BIM	Building Information Modeling
CAD	Computer Aided Design
DCI	Dimensions Construction Innovation
GDP	Gross Domestic Product
Ho	Null hypotheses
IVC	Innovation Value Chain
NASA	National Aeronautics and Space Administration
PCBS	Palestinian Central Bureau of Statistics
PCU	Palestinian Contractors Union
PECDAR	Palestinian Economic Council for Development and Reconstruction
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PPP	Public Private Partnerships
P-value	Probability Value
R	Rank
R&D	Research and Development
RII	Relative Importance Index
SPSS	Statistical Package for the Social Sciences
SWOT	Strengths, Weaknesses, Opportunities and Threats
U.S. Navy	United States Navy
UK	United Kingdom
USAID	United States Agency for International Development
WB	West Bank
WW II	World War II
BIM	Building Information Modeling
PPP	Public Private Partnerships
AEC	Architecture Engineering Construction
CERF	Civil Engineering Research Foundation

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Abstract

Project management is one of the most important tools that have been used to maximize the probability of having a successful construction project. A successful project management requires effective controlling and alignment with innovation. Thus, the study takes the approach that project management can be improved if the construction industry is more innovative. From this point forth, this study is concerned with two topics and the interplay between them, namely "**Innovation**" and "**Project Management**".

The study relies on the exploratory research inquiry of structured questionnaires with interviews to achieve the objectives of the study, as it consists of two parts: The first part is prepared to present a clear picture of the relative importance of the key drivers, barriers, enablers and impacts of innovation in construction, the second one is prepared to explore the best innovation practices in construction project management.

A survey for the questionnaire has been submitted to 365 consulting and contracting firms that reside at WB- Palestine, where the SPSS statistical program has been used for the data analysis. The data was analyzed through two phases of analysis: descriptive analysis and hypotheses testing.

The results of the descriptive analysis showed that the main driver of innovation is “reducing the costs”, the main enabler of innovation is “the rewards system”, the main barrier of innovation is “lack of effective management” and the main impact of innovation is “getting a competitive advantage”. Furthermore, the results of hypotheses testing showed that there is a statistically significant relationship at a significant level ($\alpha \leq 0.05$) among five practices: (1) Strategic Management, (2) Internal Innovative Working Environment, (3) External Innovative Working Environment, (4) Stakeholders’ Management, and (5) Project Management. The focal point of this research is to assess the extent of applying these five practices in West-Bank Palestine. The total average response is (3.60) out of (5.00) which is considered high.

Based on the findings of the research, the researcher devised a framework that is intended to be an effective management tool for supporting construction project management. It is recommended for the organizations to apply such framework and to be aware about the positive impacts of innovation and participate actively to implement it rather than to resist it. Finally, the findings of this research are expected to provide useful information for future research directions, especially as an indicator for the development of frameworks for innovative project management.

Chapter One

Introduction

1.1 Chapter Overview

This chapter sets the background to the research and discusses the problem of the study. It also states the aim, objectives, questions and hypotheses of the research. Finally, the structure of the thesis is outlined.

1.2 Background

Construction is a powerful sector that provides jobs and stimulates growth for other construction-related economic activities. It plays a significant role in the Palestine's economy. According to PCBS (2014), it contributes to around 15.4% of Palestine GDP and 14.9% of its workforce.

The desire for innovation in the construction sector has been recognized by different authors (e.g. Barrett et al., 2001; Eaton, 2001; Gann, 2000). Barrett et al. (2001) remark that successful innovation enables construction firms to better satisfy the aspirations and needs of society and clients. Eaton (2001) declares, without innovation a business does not have a rational source of competitive advantage in construction. In addition, Gann (2000) states that construction firms need to improve their capabilities of managing innovation if they are to build reputations for technical excellence that set them apart from more traditional players.

According to Blayse and Manley (2004), organizations need to innovate to win projects. However, a major dilemma is how to stimulate innovation in the construction sector! Kavanagh and Naughton (2009) argue that project management can drive a nation's capability of innovation. Project management is one of the most important tools that have been used to maximize the probability of having a successful construction project. It plays an important role in planning, coordination, control and execution of construction projects and has provided efficient tools and many techniques for engineering and construction firms, such as work breakdown structure, Gantt chart and critical path method.

In response to development and change in construction environment, organizations need to challenge conventional construction project management applications and look for modern applications to improve their competencies. Organizations need to integrate project management with innovation to increase their effectiveness and gain a competitive advantage. Tushman and Nadler (1986) stressed that organizations can gain competitive advantage only by managing effectively for today while simultaneously creating innovation for tomorrow. Moreover, Hamel (2006) stated, while not every management innovation will result in competitive advantage, it is not an excuse not to innovate because the more you are innovative, the greater the chance of reaping a huge return.

1.3 The Research Problem

The local construction industry is one of the main economic engine sectors that supports the Palestinian national economy. Nevertheless, the construction project management has long been suffering from its lack of innovation, that leads to negative effects on capability of the organizations and creativity of the employees. Thus, there is really need to embrace innovation throughout the life cycle of construction projects. Moreover, the construction industry consistently had a poor score against evaluation practices of innovation. Such evaluation is very important to assist firms to understand their strengths and weaknesses, and so to enhance their ability to move from survival strategies to innovative culture with long- term sustainability.

1.4 Aim and Objectives of the Research

From a construction industry perspective, it is widely believed that due to the continuous changing conditions, construction innovation may become a fourth performance dimension in the future in addition to the traditional dimensions of cost, quality and time (Newton, 1999). Thus, this study aims to explore the best innovation practices that are suitable for the construction industry and then to assess the extent of applying these practices in WB-Palestine in construction and engineering firms. The primary aim, the two main objectives and the expected outcomes of this thesis are shown in Figure (1.1).

1.5 Research Questions and Hypotheses

The research project consists of two phases of analysis: The first phase is an exploratory research question, and the second is hypothesis testing.

Phase One: To consider objective one, to identify the shape of innovation value chain in the construction industry, the research questions are:

- *What are the key drivers of innovation in the construction projects?*
- *What are the key enablers of innovation in the construction projects?*
- *What are the key barriers of innovation in the construction projects?*
- *What are the key impacts of innovation in the construction projects?*

Phase Two: To consider objective two, to investigate the innovation practices; the research is based on the hypothesis that project management, when integrated with innovation, can offer potential solutions to PM problems, satisfy the needs of clients, enable organizations to get a competitive advantage and can, at the end, lead to real successful construction projects, from the point view of all the stakeholders involved to complete a specific project.

Primary Aim

Assessing Innovation Practices in Project Management: the case of Palestinian Construction Projects

Objective 1

Present a clear picture of the relative importance of the key drivers, barriers, enablers and impacts of innovation along the construction innovation value chain.

Objective 2

Investigate the best innovative practices that must be integrated with project management applications in order to enhance project management competencies.

Expected Outcomes

- Provide a useful framework that allows companies to learn about innovation PM best practices that offer a roadmap for sustainable competitive advantage.
- Assist companies in understanding their current level of innovation to help them in identifying their strengths and weakness.
- Spread the innovation culture in the organizations to maximize innovation success.

Figure (1.1): Aim, Objectives & Expected Outcomes of the Research

Based on the above, there were ten research hypotheses that were developed to explore the relationships among the innovation practices and project management, but the research main hypothesis is:

"Innovation correlates positively with Project Management"

1.6 Thesis Structure

The thesis is organized into six chapters as shown in Figure (1.2).

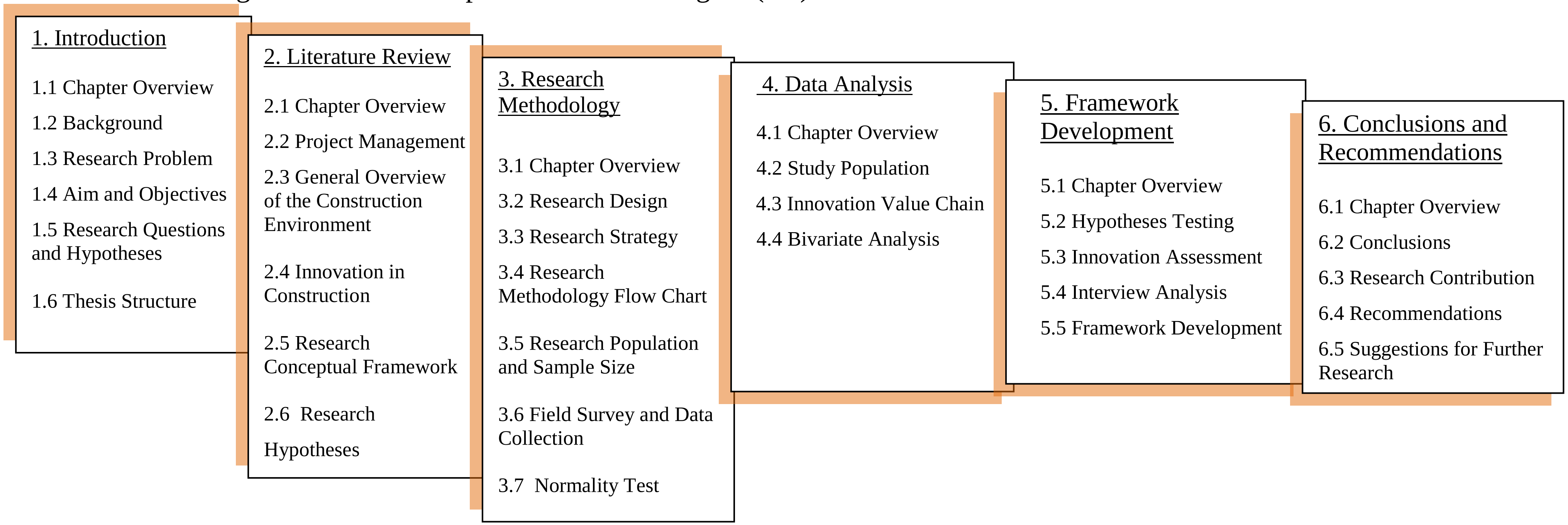


Figure (1.2): Thesis Structure

Chapter Two

Literature Review

2.1 Chapter Overview

Solid academic work cannot be created without a thorough investigation of the existing body of knowledge in the area of the chosen studies (Stadnick, 2007). Thus, this chapter will discuss some of the previous studies in the field of project management, construction environment and innovation in construction, which are the main three topics of this particular research. It also states the research conceptual model and research hypotheses.

2.2 Project Management

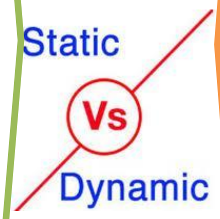
2.2.1 Project Definition

According to Lockyer and Gordon (1996), a project is a unique process, consisting of a set of coordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements including constraints of time, cost and resources. In general, projects can be characterized by several attributes. These attributes can be divided into two categories: static and dynamic (Adeli and Karim, 2001), as shown in Figure (2.1).

2.2.2 Project Management Definition

The beginning of project management can be traced back to a report published by the UK Institution of Civil Engineers on post WWII national development. The document pointed out the need for a ‘systemic approach’ with a planned break down of activities to achieve a fixed objective (Wideman, 1995). To answer to that demand, construction projects such as the Polaris program by the U.S. Navy and the Apollo Program by NASA were initiated (Stadnick, 2007).

Static Attributes are those that typically do not change during the execution of the project. These attributes are derived from the project specifications. Examples of static attributes include project goal, cost, duration, and number of tasks.



Dynamic Attributes are those that change during the execution of the project. As such, they define the current state of the project. Examples of dynamic attributes include resources utilized, time elapsed, and number of tasks completed.

Figure (2.1): Projects Attributes; Adapted from (Adeli and Karim, 2001)

Project management today is a matter of survival for many organizations. Today, organizations do not have the option whether or not to adapt to project management, but on how well project management is implemented (Levi, 2009). Project management is the work methods that are used to control and manage activities in a project. It involves the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholders' needs and expectations from a project. Generally, managing a project includes: identifying requirements, establishing clear and achievable objectives, balancing the competing demands for quality, scope, time and cost; adapting specifications, plans, and approach to the different concerns and expectations of the various stakeholders (PMBOK, 2004). According to Hendrickson (1998), the Project Management Institute focuses on nine distinct areas requiring project manager knowledge and attention: (1) *Project integration management* to ensure that the various project elements are effectively coordinated, (2) *Project scope management* to ensure that all the work required (and only the required work) is included, (3) *Project time management* to provide an effective project schedule, (4) *Project cost management* to identify needed resources and maintain budget control, (5) *Project quality management* to ensure functional requirements are met, (6) *Project human resource management* to develop and employ project personnel, (7) *Project communications management* to ensure effective internal and external communications, (8) *Project risk management* to analyze and mitigate potential risks, and (9) *Project procurement management* to obtain necessary resources from external sources. The summary of the nine areas from the basis of the Project Management Institute is shown in Figure (2.2).

1. Integration Management 1.1 Project Plan Development 1.2 Project Plan Execution 1.3 Integrated Change Control	**2. Scope Management** 2.1 Initiation 2.2 Scope Planning 2.3 Scope Definition 2.4 Scope Verification	**3. Time Management** 3.1 Activity Definition 3.2 Activity Sequencing 3.3 Activity Duration Estimating 3.4 Schedule Development 3.5 Schedule Control
4. Cost Management 4.1 Resource Planning 4.2 Cost Estimating 4.3 Cost Budgeting 4.4 Cost Control	**5. Quality Management** 5.1 Quality Planning 5.2 Quality Assurance 5.3 Quality Control	**6. HR Management** 6.1 Organizational Planning 6.2 Staff Acquisition 6.3 Team Development
7. Communications Management 7.1 Communications Planning 7.2 Information Distribution 7.3 Performance Reporting 7.4 Administrative	**8. Risk Management** 8.1 Risk Identification 8.2 Quantitative Risk Analysis 8.3 Risk Response Planning 8.4 Risk Monitoring and Control	**9. Procurement Management** 9.1 Procurement Planning 9.2 Solicitation Planning 9.3 Solicitation 9.4 Source Selection 9.5 Contract Administration 9.6 Contract Closeout

Figure (2.2): PMI's Nine Project Management knowledge Areas

2.3 General Overview of the Construction Environment

2.3.1 Construction Environment

The construction industry has been built on the needs of the world's inhabitants to provide shelter, harness energy, and create public access (Kadjr, 2006). The construction industry is that part of the economy that deals with the design, construction, maintenance, utilization, modulation, modification and demolition or deconstruction of constructs (Rußig et al., 1996). Construction is a powerful sector that provides jobs and stimulates growth for other construction-related economic activities. It provides job opportunity for large number of skilled as well as unskilled workforce (Devi and Kiran, 2013). Moreover, it is directly linked to many economic activities, such as: stone saws, factories of ready mix concrete, brick, aluminum, paint, tiles and other factories, as well as establishments of Blacksmithing, carpentry, aluminum and others (GIZ, 2011). Construction is a unique environment and by definition is a creative industry (Dale, 2007). It plays a central role in the nation's welfare, including the development of residential housing, office buildings and industrial plants, and the restoration of the nation's infrastructure and other public facilities (Hendrickson, 1998). In one word, construction plays a unique role in economic growth and is often a key parameter of economic conditions (Sun et al., 2013).

On the other hand, construction is a tough business with a very demanding and stressful process (Lingard and Sublet, 2002). It is often viewed as being stubborn, risk averse and old-fashioned (Barthorpe et al., 2000). It is characterized by continual changes and poor working conditions that is generally thought to stem from the nature of the work, which is often described as dirty, difficult and dangerous (Geneva, 2001). It is also characterized by the presence of multi players of different disciplines, who are brought together at various stages throughout a single project (Forese, 1997). Moreover, construction is ultimately a very complex and multi-disciplinary activity (Cushman et al., 2002). Compared to most other industries, construction projects involve relatively intensive labor use, and consume large amounts of materials and physical tools (Jekale, 2004). They are also subject to a variety of laws and regulations that aim to ensure public safety and minimal environmental impacts (Bennett, 2003). All these characteristics suggest that this industry is confronted by 'wicked problems' (Green, 1999). Becker (2002) defines problems as being wicked in the sense that they are very difficult to solve.

2.3.2 Nature and Characteristics of Construction Projects

The goal of construction project is to build something (Elbeltagi, 2009). Construction projects consist of processes, a process consists of a series of actions and tasks which leads to certain goals. The "input" to the construction system is the injection of resources including funding, design expertise, material and labor in the construction process while the "output" is the finished product that meets the required project objectives (Chan, 2007).

A construction project is considered successful if it applies the iron triangle's constraints: cost, time and quality, conceived by Martin Barnes in 1969. While Nitithamyong et al. (2004) remarked that the success of construction projects depends upon technology, process, people, procurement, legal issues, and knowledge management, which must be considered equally. Baccarini (1999) uses the concept project success in a different approach, viewing it as product success, which implies the quality and impact of the product to the end user, in terms of satisfaction of user's needs, meeting strategic organizational objectives and satisfaction of stakeholders' need, when a project execution is finished.

Therefore, we can conclude that the main characteristics of the construction project are:

1. Project-based: The construction sector is to a large extent, project-based. Engineers, contractors, and workers are formed for a limited time to complete a specific project.

2. Fragmentation: In the construction industry, design and production are often separated (Widén, 2002). Broadly speaking, design is a process of creating the description of a new facility, usually represented by detailed plans and specifications while construction planning is a process of identifying activities and resources required to make the design a physical reality. Hence, construction is the implementation of a design envisioned by architects and engineers (Hendrickson, 1998).

3. Complexity: The tendency in construction towards the production of unique, non-standard products led to buildings that are complex to construct (Benmansour and Hogg, 2002). Complexity in construction arises from both uncertainty and interdependence (Gidado, 1996). Uncertainty relates to the resources employed, the environment in which construction takes place, and the level of scientific knowledge required. Interdependence refers to the heterogeneous background of the actors involved (Loikkanen and Hyvönen, 2011).

4. Uniqueness: There is no place for standardization; each project is unique. Its characteristic features include flexibility, openness to change, searching for information and resources in the external environment, anticipation, creativity, experimenting and informal communication (Lukášová, 2010).

5. Risky: Construction projects are subject to many risks due to the unique features of construction activities, such as long period, complicated processes, abominable environment, financial intensity and dynamic organizational structures (Zou and Zhang, 2008).

2.3.3 Construction Project Management

According to Casey (2008), construction is translating designs into reality. Management controls a process subject to limited resources or constraints. Construction Management delivers a product according to specifications and stakeholder expectations. Walker (2007) defined construction management as the planning, co-ordination and control of a project from conception to completion on behalf of a client.

2.3.4 Construction Industry in the Developing Countries

Construction activities and its output are an integral part of a country's national economy and industrial development. The construction industry is often regarded as a driver of economic growth, especially in developing countries (Anaman and Amponsah, 2007). However, projects in developing countries are highly uncertain, and operate in a highly unstable, unpredictable and poorly resourced environment (Cusworth and Franks, 1993; Jekale, 2004). The nature and characteristics of the construction industry in developing countries, is different from that of the developed countries in many aspects (Yimam, 2011).

According to Jekale (2004), the construction industry in many developing countries is characterized by too fragmented and compartmentalized, public sector dominated market, considerable government interventions, considerable foreign finance, and low development of indigenous technology. Moreover, the construction industry in developing countries depends on imported inputs such as construction materials, machinery, and skilled work force. Table (2.1) presents a summary of the major differences in the nature of the projects in developing and developed countries.

Table (2.1): Nature of Projects in Developing and Developed Countries.

Criteria	Developing Countries	Developed Countries
Ownership	Most projects are public owned*	Most are private*
Type	Infrastructure projects dominate**	More or less mix of projects*
Time	Private projects are short time*	Medium time*
Environment issue	Highly sensitive to the environment**	Moderately sensitive to the environment
Complexity	Complex, uncertain, unstable and unpredictable environment**	Complex, dynamic, relatively stable and to some extent predictable environment***
Availability of Resources	Extreme scarcity of resources***	Resource available at cost (constrained)
Privacy	Under - developed private sector and forces of market*	Developed private sector and forces of market*
Governmental Issue	Significant involvement of government in business*	Market economy*

* (Voropajev, 1998), ** (Jekale, 2004), *** (Cusworth and Franks, 1993).

Unfortunately, project management in developing countries is facing many challenging problems and non-conducive environment (Jekale, 2004). Many projects in such countries end up uncompleted, abandoned or unsustainable (Andersen, 2008). According to Cusworth and Franks (1993), most of the special problems of project management in developing countries are related to the environment, which can be attributed to the turbulence and rapid change in the project environment, and severe scarcity of resources in those countries. Lack of institutional capacity and trained personnel are other main reasons why projects fail in developing countries

(Voropajev, 1998). Furthermore, the lack of awareness about the benefits and applications of project management in many developing countries, combined with the presence of few trained project managers and wrong perception that sees project managers as an unnecessary expense, has contributed to the low level of development of project management in those countries (Andersen, 2008). In addition, political instability in developing countries severely affects economic development in the construction industry.

2.3.5 Construction Industry in Palestine

In Palestine, as in other developing countries in the world, there is a natural high increase in population. Such population growth requires constructing facilities such as housing, infrastructure, education, medical care and other services (Al-Sabah, 1997).

Construction is one of the largest sectors in the Palestinian economy and an important driver of job creation. The construction sector in Palestine experienced a considerable growth in the aftermath of 1967; its share of GDP increased from less than 9 % in 1985 to more than 23 % in 1995. During that period the sector's contribution fluctuated in an upward long-run trend bounded by 9 % and 19 % from 1970 to 1980, and by 15.2 % and 23 % from 1989 to 1995 (PECDAR, 1997). However, it appears that in 2004 the construction sector's contribution to the GDP was reduced to 9 % due to the second Intifada in Palestine (The World Bank, 2004; PCBS, 2004). After that, the sector has grown at an annual rate of 20.5% and made the largest sectorial contribution to overall GDP growth since 2006 (The Portland Trust, 2013).

It is roughly estimated that the total number of industrial firms working in this sector is 350 construction- related production, regardless the size of the enterprise and the field of specialty. These are ready mix concrete, bricks, stone crushers, asphalt products, cement precast manholes, cement pipes, curb stone and cement tiles (USAID, 2009). Like the construction industry in other developing countries, the construction industry in Palestine is in a crisis. It is challenged by many problems. Generally, the current state of the industry is characterized by:

- The practitioners are with limited personal experience in project management.
- The practitioners are with limited personal experience in strategic management.
- The practitioners are with limited personal experience in stakeholders' management.
- Lack of internal innovative working environment.
- Lack of external innovative working environment.
- Most projects fail to finish on time, on budget and to achieve required quality.
- Fluctuation in the price of construction materials.
- Outdated technology.
- Dominance to the Israeli economy that is a fatal threat to the industry.

- The Construction industry has high competition in bids.
- Construction workers are almost unskilled and with little education.
- No social security benefits and no health care for construction workers.

2.4 Innovation in Construction

2.4.1 Definitions of Innovation

When defining innovation it is necessary to recognize that innovation is not invention (Burmester, 2005). According to some, invention is a new product, innovation is a new customer benefit. Invention is the conversion of cash into ideas and innovation is the conversion of ideas into cash. Projects are vehicles of the transition from invention to innovation (Fagerberg et al., 2004).

Many definitions and interpretations of innovation can be found within the innovation literature. For instance, Galbraith (1984) defines innovation as the application of a new idea to create a new process or product that can differentiate a company and maintain it fit as environmental forces and competitors' strategies change. Drucker (1985) sees innovation as the process that creates markets that nobody before even imagined. Whereas Pinchot and Pinchot (1996) enlarges the scope of the term by relating it to the methods, relationships and processes of the organization. In general, DOC Department of Commerce (2008) defines innovation as the design, development, and implementation of new or altered products, services, processes, organizational structures, and business models to create value for the customer and financial returns for the firm practicing innovation.

In order to stimulate innovation in the construction sector, it is important to recognize that innovation in construction is not confined to new technological inventions (Slaughter, 2000). According to Civil Engineering Research Foundation CERF (2000), innovation in construction is perceived as: *"The act of introducing and using new ideas, technologies, products and/or processes aimed to solve problems, viewing things differently, improving efficiency and effectiveness, or enhancing the standard of living"*

2.4.2 Dimensions of Innovation

In order to develop an understanding of innovation that is reflective to the construction projects environment, there is a need to split innovation into several dimensions.

- **Dimension (1): Scale of Innovation**

Tidd et al. (2003) defines the scale of innovation as incremental or radical. According to Norman and Verganti (2012), incremental innovation includes improvements within a given frame of solutions (doing better what we already do) while radical innovation refers to change of frame (doing what we did not do before). Minor incremental changes are more frequent in the construction industry, but radical changes are the most powerful (Koskela and Vrijhoef, 2001). Few examples of radical innovations in the construction are illustrated in Table (2.2).

Table (2.2): History of Radical Innovations in the Construction Industry

Period	Description	Benefits
18th Century – early 19th century	Creation of factories and improvements in metal work	*Less work had to be performed by the hands. *Rapid increase of the rate at which building could be completed.
19 th century	Creation of high-speed electric elevator	* Rapid way to reach the heights in the skyscrapers. * Efficiency, relatively low installation cost.
19 th -20 th century	Creation of new materials: structural steel and reinforced concrete	*Steel is a strong material that is needed for the interior of the large-scale building projects. *Combination of steel and concrete provides a strong support system that cost lower than using brick or other materials.
21st century	Introduction of Computer-aided design (CAD)	*Design of all types of buildings with the benefits of lower product development cost and saving time for their drawings.
Future	Issues of sustainable development and ecology	*The issues of sustainability have become important for the construction industry.

Gann and Salter (2000) and Wolstenholme (2009)

- **Dimension (2): Objectives of Innovation**

From a construction industry perspective, innovation can be broadly classified as either ‘Organizational innovation’ or ‘Technical innovation’. Organizational innovation may result from the introduction of changes to the organizational structure, introduction of advanced management techniques, and implementation of new corporate strategic orientations (Anderson and Manseau, 1999). Technical innovation can take the form of either ‘product’ or ‘process innovation. Product innovation describes the case where a new product is the outcome. Process innovation denotes innovation where the process by which a product is developed is exposed to new ideas and, therefore, leads to new and often more sophisticated methods of production (Egbu, 2004).

- **Dimension (3): Types of Innovation**

As shown in Figure (2.3), three innovation types were identified within the construction project environment; system, process, and components. The three definitions differ because of the nature of interaction with the construction project. The system innovation exists at a higher level than the project, and governs the project. The process innovation exists as the function and purpose of the project, whereas the component innovation exists only as an element of the project (Rogers, 1983; Freeman, 1984). According to Prieto (2009), a systemic innovation produces the largest productivity gains. Systemic innovation is that form of innovation that requires multiple specialist firms to change their processes in a coordinated fashion (Taylor and Levitt, 2005). Examples of systemic innovation in the engineering and construction industry include: Integrated Supply Chain Management, BIM and PPP.

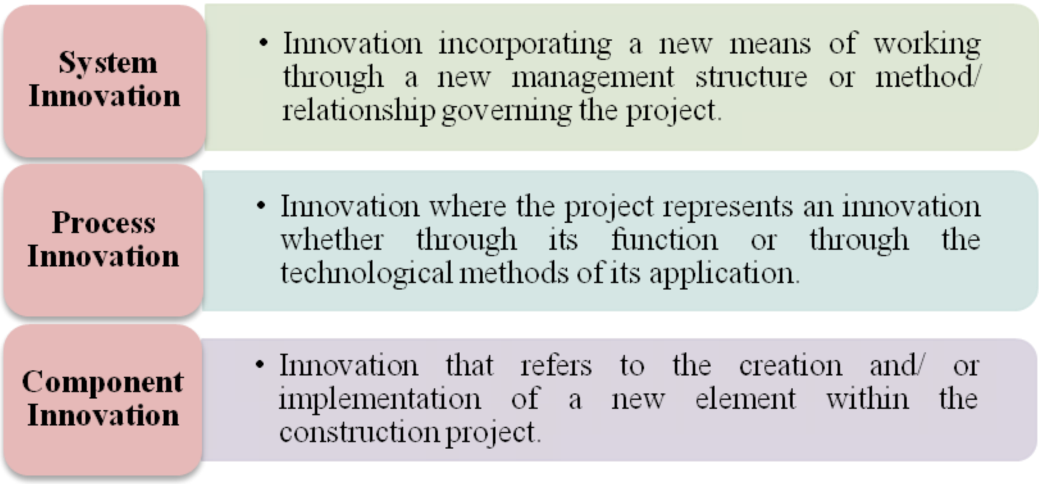


Fig (2.3): Innovation Space; Adapted from Rogers (1983) and Freeman (1984)

Recently, the Conference Board CEO Challenge (2012) has realized innovation in construction by seven Dimensions Construction Innovation (7-DCI):

- D1: Construction Materials: referring to innovations in materials, i.e., the development of ultra-strength concrete.
- D2: Construction Machinery/Production Technology: referring to incremental and disruptive innovations in the area of production technology used off-site or on-site.
- D3: Construction Components: This dimension refers to the modular structure of a building.
- D4: Construction Time: This dimension refers to the time necessary for planning, setting up of the site, construction and finishing.
- D5: Construction Ecology: This dimension refers to ecological factors related to the construction process itself or the construction product.

- D6: Construction Product Performance: This dimension refers to innovations related to the construction products performance or services related to those products.
- D7: Construction Management: This dimension refers to innovation created on the managerial level.

2.4.3 Innovation in the Construction Industry in Palestine

In spite of the political situation and the conflict between Israel and Palestine, the participants in construction sector still invest every opportunity to survive. Globally, Palestine occupied the 12th rank of the stone producers worldwide in 2002 (Sultan, 2014). The topic of recycling the stone slurry in Palestine has occupied a significant promising field in Palestine recently. According to the most updated and comprehensive study in stone waste management field that examined the quantity of the slurry generated in Palestine, there is 750,000 cubic meters of liquid slurry generated annually in the West Bank (Al-Joulani and Salah, 2014).

Moreover, one of the most expensive and important components of construction is the steel used to reinforce building structures. Thousands of tons of steel throughout the lifespan of the project will be used, so careful accounting of this expensive building resource is required. Palestinian construction workers trained in the handling, cutting and bending of steel take great care to use precise measurements to minimize errors and waste. Small leftover pieces of steel are gathered up and sent back to steel factories to be melted back down to liquid form and reused in another larger rod or sheet (Rawabi, 2015)

Currently, there is also mobilization for the water in the stone-cutting factory. Stone-cutting is a water intensive process. Water is used to control dust, to cut, wash and polish stone surfaces and to cool high-heat machine grinders in the stone-cutting operation. A stone-cutting factory like Rawabi's, which operates around the clock, would consume 10,360 liters of water per day. Recycle and reuse is the only way to avoid unnecessary water consumption of water. Rawabi’s water recycling system reduces the level of water consumption to less than 10% of the quantity required without reuse. Water comes out of the stone factory and flows into a special collection system. Used water, which is contaminated with stone dust, cannot be permitted to seep into the soil where it would cause damage to groundwater, aquifers and the water table. Instead, all the wastewater byproducts are run through a special filtration and compression system which removes the stone dust and large particles from the water. The cleaned water is returned to the factory for reuse in a continuous closed loop (Rawabi, 2015)

2.4.4 Innovation Value Chain IVC

Hansen and Birkinshaw (2007) recommend to view innovation as a value chain. The innovation value chain IVC offers a tailored and systematic approach to assessing firm-level innovation performance (Hansen and Birkinshaw, 2007). It breaks innovation down into three phases: idea generation, idea conversion and idea diffusion of developed concepts, that includes six critical tasks, namely, internal sourcing, cross-unit sourcing, external sourcing, selection, development, and company- wide spread of the idea (Yokomizo et al., 2013). Figure (2.4) shows the links of the value chain and key questions to measure each link.

	IDEA GENERATION			CONVERSION		DIFFUSION
	In-house	Cross-pollination	External	Selection	Development	Spread
	Creation within a unit	Collaboration across units	Collaboration with parties outside the firm	Screening and initial funding	Movement from idea to first result	Dissemination across the organisation
Key questions	Do people in our unit create good ideas on their own?	Do we create good ideas by working across the company?	Do we source enough good ideas from outside the firm?	Are we good at screening and funding new ideas?	Are we good at turning ideas into viable products, businesses, and best practices?	Are we good at diffusing developed ideas across the company?

Figure (2.4): Innovation Value Chain; (Hansen and Birkinshaw, 2007)

Based on the innovation value chain (IVC) approach, Salford Centre for Research and Innovation (Ozorhon et al., 2010)) developed a framework for analyzing innovation in construction. It is considered as a strategic approach tool that a manager can use in order to assess the strength and weakness of the whole innovation process (Hseih et al., 2011). In this framework, as shown in Figure (2.5), based on the level of innovation capacity, ideas are generated through the acquisition of necessary knowledge and investment, then these ideas are converted into product/process/service innovations within the company. Finally, these innovations are exploited to achieve performance benefits and impacts (Ozorhon et al., 2010).

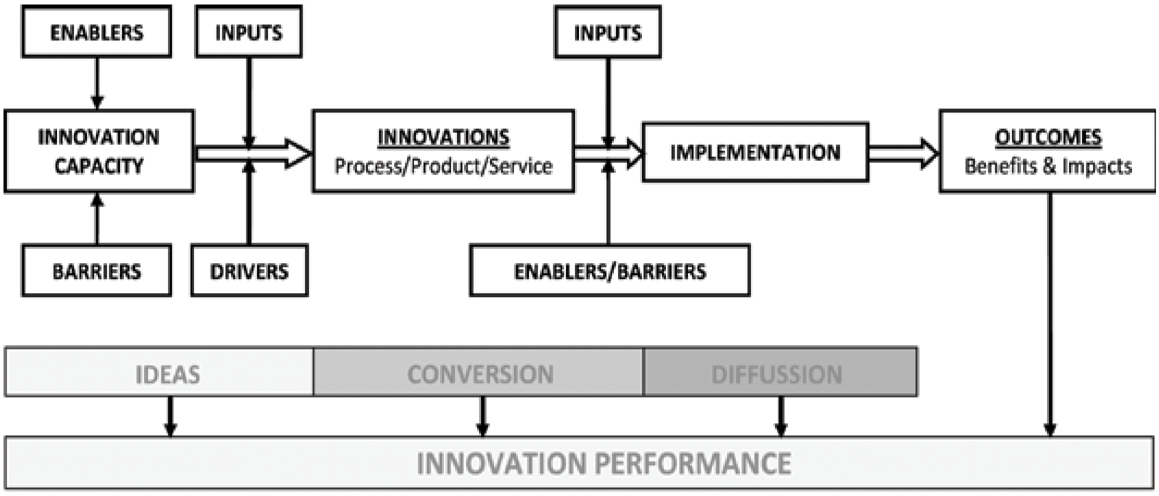


Figure (2.5): Framework for analyzing innovation in construction; (Ozorhon et al., 2010)

To consider the first objective of this thesis; to identify the shape of innovation value in construction projects, the innovation value chain model is developed, as shown in Figure (2.6). In this model, innovative activities depend extensively on the factors that create the need for organization to innovate (drivers), the factors that facilitate innovation within an organization (enablers), the factors that impede the uptake of innovation (barriers), and to what extent does the organization derive the outcomes of innovation (impacts).

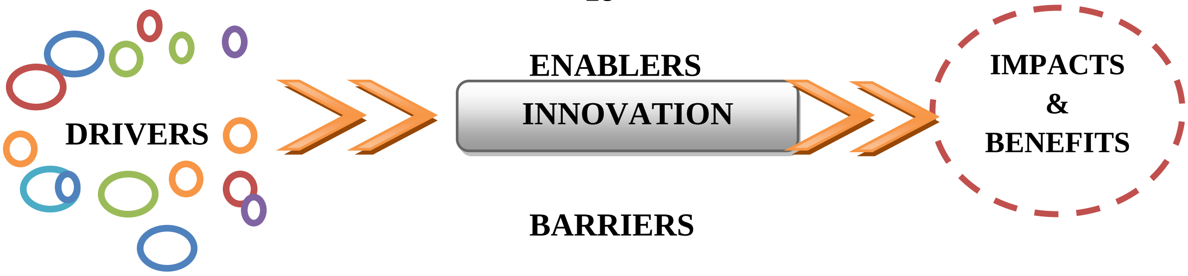


Figure (2.6): Innovation Value Chain Model

In the following sections, there is enough information about these four factors;

2.4.4.1 Drivers of Innovation

Organizations need to drive more innovation in their products and services. They need to innovate rapidly and they need to do it cost-effectively (PwC Advisory Oracle Practice, 2012). The drivers of innovation are, of course, constantly changing. In construction, cost, time and efficiency are often quoted as overriding priorities (Loosemore and Holliday, 2012). According to Xu and Quaddus (2013), in order to stay ahead of the competition, organizations have to continually develop new competitive advantage. However, competitive advantages do not tend to stay competitive advantages without significant effort. Over time, the edge may erode as competitors try to duplicate a successful advantage for themselves and as the market changes (Ehmke, 2008).

A number of studies have been carried out to determine the drivers of innovation in construction projects. Bossink (2004) carried empirical research on innovation in the Dutch construction industry. He concluded that drivers of innovation are classified into four distinctive categories: environmental pressure, technological capability, knowledge exchange, and boundary spanning. Gambates et al. (2007) conducted research to benchmark the current level of innovation in the US construction industry. The findings suggest that the motives behind innovation are cost savings. Followed closely in order by increasing productivity/efficiency, improving quality, schedule reduction, creating a competitive advantage, safety, and entrance into a new market. While Nam and Tatum (1997) stated that the requirements of clients can drive the creative ideas and innovative designs that are necessary to deliver some projects. Salford Centre for Research and Innovation (Ozorhon et al., 2010) conducted a survey to the applicants of the 2009 North West Regional Construction Awards. The results showed that the main driver was performance improvement. Followed in order by environment/sustainability factors, meeting end-user requirements, technological developments, competition, regulation and design trends.

As shown in Figure (2.7), based on the literature review and several interviews with experts, who having good experience in the field of construction, this research assumes that the drivers of construction innovation are: (1) Reducing time, (2) Reducing costs, (3) Improving quality, (4) Competition, (5) Responding to client/customer needs, (6) Improving efficiency/productivity, and (7) Rapid development of technology.

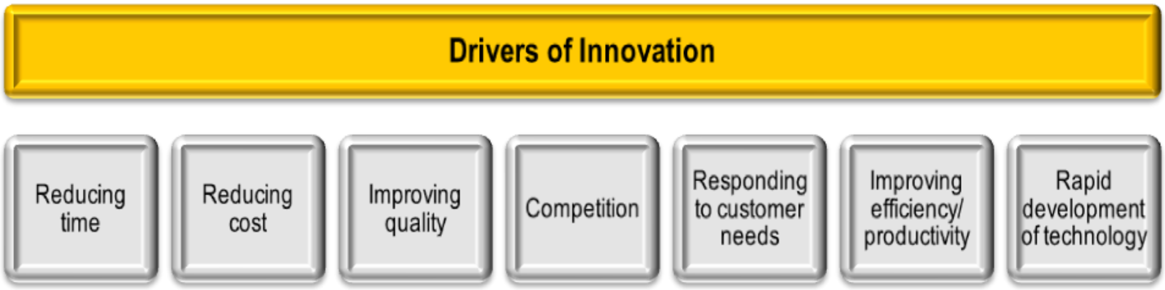


Figure (2.7): Drivers of Innovation

2.4.4.2 Enablers of Innovation

Three factors are necessary to achieve innovations: motivation, time and money. Those participating in the process must be motivated and provided with sufficient time and money to carry out the task. All three factors are necessary to some extent. No matter how motivated, no one can achieve anything without time and money. Similarly, an infinite amount of time and money will achieve nothing if there is no motivation (Wide'n, 2002).

A number of studies have been carried out to determine the enablers of innovation in construction. Loosemore and Holliday (2012) undertook semi- structured interviews and focus groups with thirty of the UK's recognized leaders. The interviews and focus groups were guided by one simple question, "What would enable more innovation to happen in the construction sector?" The results showed four main innovation enablers, namely: (1) collaboration; (2) regulation; (3) skills, education & research, and (4) leadership. According to Salford Centre for Research and Innovation survey (Ozorhon et al., 2010); the main enabler of innovation is leadership. Followed in order by supportive work environment, collaboration with partners, deep understanding of the customer, education

& training policy, knowledge management practices, encouraging staff to get involved with external networks, use of problem solving techniques, awards, grants, funds, government schemes, reward schemes and at last emphasis on research & development.

Barlow (2000) states: the presence of ‘champions’ within firms is commonly cited as a necessary ingredient for innovation. While Prather (2010) agrees that, the working climate that the leaders create is the single biggest factor governing the success of the organization’s total innovation effort. Based on the results of a survey conducted by Romero and Martinez-Roman et al. (2012), other features that influence innovation are: education, experience, internal motivation, stimulation, the size of the organization and the economic sector.

As shown in Figure (2.8), based on the literature review and several interviews with experts, who having good experience in the field of construction, this research assumes that the enablers of construction innovation are: (1) Incentives, reward and bonuses, (2) Organizational innovative culture, (3) Involvement of the client, (4) Top management support, (5) Work experience, (6) Training & development, and (7) Leadership.

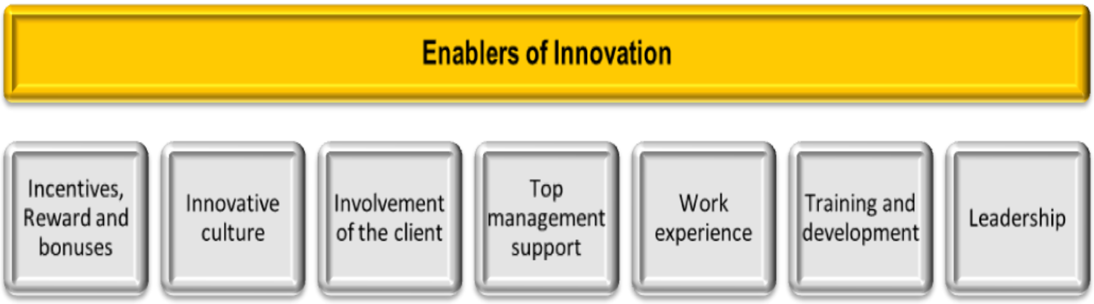


Figure (2.8): Enablers of Innovation

2.4.4.3 Barriers of Innovation

Experimenting with new ideas and seeking innovative alternatives are often considered as endeavors that increase uncertainty and may put at risk the project success. Such a culture of risk avoidance has led to the situation where people are not bothered to think of performing innovatively (Maqsood et al., 2003). Thus, innovations are often confronted with different types of barriers that might terminate, or at least, harm innovative projects (Barlow, 2000).

A number of studies were carried out to determine the barriers of innovation in construction. Construction Productivity Network (1997) agreed that the temporary nature of the project teams and the short-term relationships between organizations makes the transfer of innovations from project to project and firm to firm extremely difficult. Barrett and Sexton (2006) illustrated that project-based nature of the construction industry is a significant barrier to innovation, while Pries and Janzen (1995) identified the fragmented nature of the process, the uniqueness of each project and the long life spans of the products as three factors that limited innovation within construction. Pries and Janszen (1995) also illustrated that innovations within construction were restricted by a resistance and inability to diffuse innovations throughout the industry. Blayse and Manley (2004) argued that regulations and standards (e.g., building codes) may influence the propensity to adopt innovations and shape the direction of technological change. Moreover, construction has the ability to absorb the excluded (DeSouza,2000). It provides employment for those with little education or skill, many of them from the poorest sections of society (Geneva, 2001).

According to Salford Centre for Research and Innovation survey (Ozorhon et al., 2010), the top ten barriers of innovation, in order, are economic conditions, availability of financial resources, fragmented nature of the construction business, unwillingness to change, lack of government role model, inappropriate legislation, risk in commercializing innovations, temporary nature of construction projects, extensive inter-organizational change required and lack of awareness.

As shown in Figure (2.9), based on the literature review and several interviews with experts, who having good experience in the field of construction, this research assumes that the barriers of construction innovation are: (1) Lack of Effective Management, (2) Time pressure and deadlines, (3) Limited budget, (4) Poor coordination and communication between project participants, (5) Construction clients lack of interest in innovations, (6) Low Salaries and job insecurity, (7) Inadequate planning, (8) Content with success and fear of unknown, (9) Work overload or under load, (10) Work-life balance problems, (11) Lack of collaboration due to competition, (12) Accidents during construction, (13) Too many restrictive building codes, (14) Lack of required construction material/ tools/equipments, and (15) Israel's occupation and related obstacles.

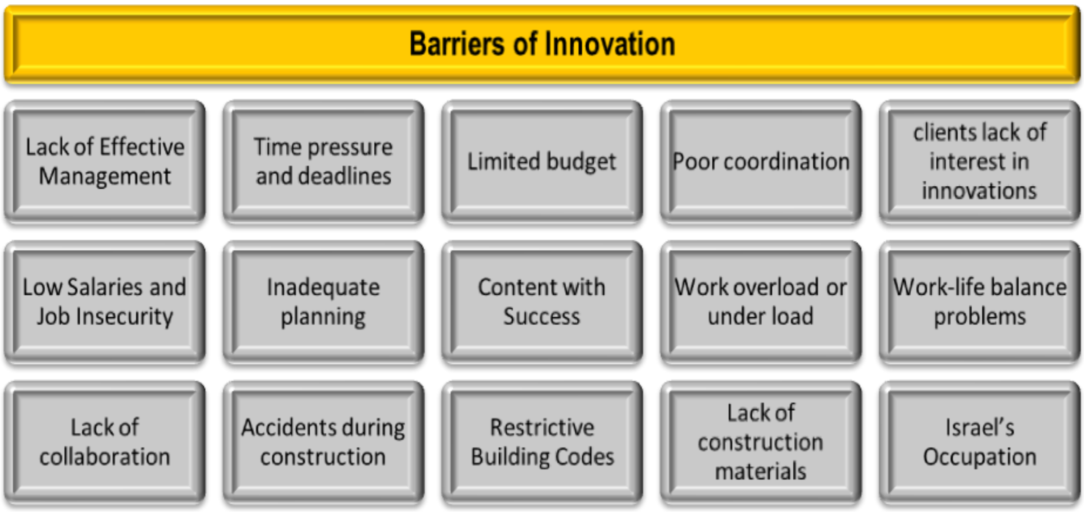


Figure (2.9): Barriers of Innovation

2.4.4.4 Impacts of Innovation

By obtaining a better idea of the expected benefits of innovation, we can improve our understanding of why a company would choose to innovate and how it might measure its success (Ozorhon et al., 2010). Innovation, whatever type or extent, has a purpose to create or develop a new product or process that would increase company's profit and strengthen it's position in the market. Competition is the main reason of innovation, therefore different firms innovate differently (Šakalytė and Bartuševičienė, 2013).

The innovative practices didn't only lead to a number of project level benefits such as reduction in duration and cost, improved quality and environmental performance, but also wider benefits such as enhanced corporate image, client and end-user satisfaction, and improved quality of life. With respect to Eaton et al. (2006), the benefits of innovation in construction included the improvement of working conditions, lower construction costs, quicker construction times and better value for clients. Innovation can also result in increased organizational commitment and higher organizational motivation (Dulaimi et al., 2002). According to Salford Centre for Research and Innovation survey (Ozorhon et al., 2010), the top ten impacts of innovation, in order, were better company image, improvement of services, improvement of client satisfaction, improvement of product quality, improvement of processes, increase in technical capability, increase in organizational effectiveness, new services, new products and new processes.

As shown in Figure (2.10), based on the literature review and several interviews with experts, who having good experience in the field of construction, this research assumes that the impacts of construction innovation are: (1) Creating a competitive advantage, (2) Increase the profitability, (3) Improving staff motivation and working conditions, (4) Improving customer satisfaction, (5) Develop an integrated stakeholder communication, (6) Increase in organizational effectiveness, and (7) Flexibility to change.

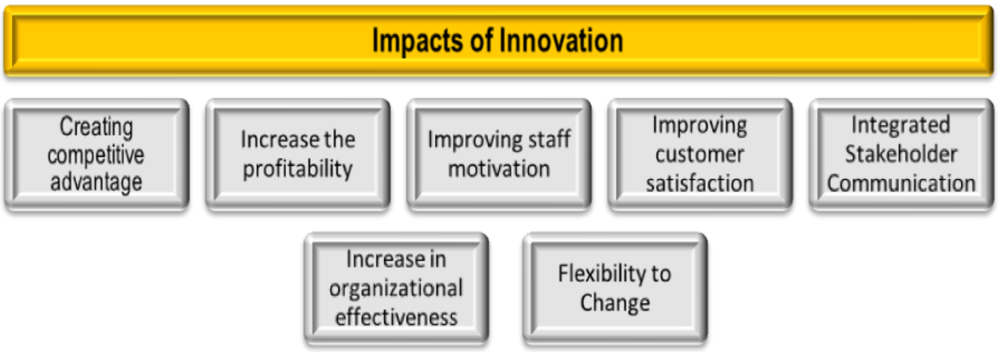


Figure (2.10): Impacts of Innovation

2.5 Research Conceptual Framework

2.5.1 Innovation Best Practices in Construction Project Management

According to some, if the invention is compared with a seed of a plant, the innovation is the fruit of a tree that will result from planting the seed. Planting the seed only is not enough. The seed must be planted in the right place, time, and environment. An increased interest has been placed on understanding which practices affect more substantially the innovation capability of the company (Verhaeghe and Kfir, 2002).

Based on experiences in innovation consulting for different branches, as shown in Figure (2.11), Kearney (2006) has developed the "House of Innovation" model. This model depicts the most important building blocks of successful innovation management. It tests innovation practices, according to four dimensions: (1) An innovation strategy that is aligned with the business strategy, (2) An organization that drives innovation by its structure and culture, (3) A product-life-cycle process that continually develops the capabilities for idea generation and (4) Enabling factors for innovation management. In the same context, Neely and Hii (1998) posit that the innovation capacity of a firm regards three interrelated perspectives: (1) Culture, (2) Internal processes and (3) External environment.

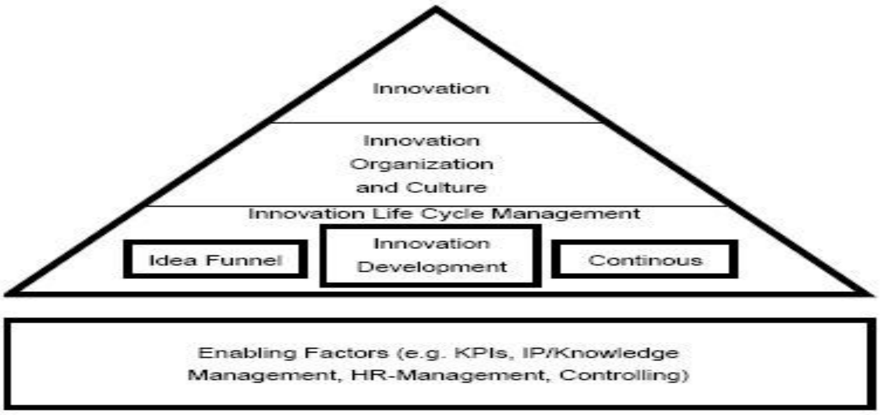


Figure (2.11): The AT Kearney House of Innovation; (Kearney, 2006).

From construction perspective, Dikmen et al. (2005) developed a conceptual framework to investigate value innovations and the four elements of their framework are: (1) Objectives, (2) Strategies, (3) Environmental barriers/drivers and (4) Organizational factors. While Seaden and Manseau (2001) argue that innovation in construction regards the linkages between four other factors: (1) Business environment, (2) Business strategy, (3) Innovative practices and (4) Business outcomes.

To consider the second objective of this thesis, to investigate the best innovation practices that must be integrated with project management applications in order to enhance project management competencies. As shown in Table (2.3), 26 factors that may affect innovation were identified through an extensive literature review. Factors of similar nature were grouped together; giving rise to four main groups, as shown in Figure (2.12), that are: (1) Strategic Management, (2) Internal Innovative Work Environment, (3) External Innovative Work Environment and (4) Stakeholder Management. In the following sections, there is enough information about these four practices.

Table (2.3): Theoretical Practices of Innovation

Strategic Management	**Stakeholder's Management**
1. Establishing a vision which embraces innovation 2. Establishing SMART objectives 3. Formulating Strategies 4. Conducting internal audit "Strength & Weakness" 5. Conducting external audit "Opportunities & Threats"	1. Identifying Stakeholders 2. Exploring stakeholders' needs and constraints to projects 3. Analyzing conflicts among stakeholders 4. Ensuring effective communication between stakeholders 5. Evaluating the stakeholder satisfaction 6. Stakeholder involvement in decision-making 7. Keeping and promoting an ongoing relationship with stakeholders
Internal Innovative Work Environment	**External Innovative Work Environment**
1. Employee motivation and job satisfaction 2. Providing appropriate internal conditions for workers in terms of ventilation, lighting, services, tools, etc. 3. Providing innovative culture in the organization 4. Dynamic, open minded and supportive top management 5. Providing rewards and recognition for creative work 6. Workloads are managed to ensure staff have sufficient time to pursue innovation 7. Providing training for employees	1. Responding to change in customer needs 2. Utilizating of new technology 3. Dealing with social and environmental variables 4. Dealing with the economic and political variables 5. Collaborating and communicating with competitors 6. Collaborating and communicating with suppliers 7. Reacting to market changes and consequently competitiveness

Figure (2.12): Innovation Best Practices

2.5.1.1 The First Innovative Practice: Strategic Management

Strategic management consists of the analysis, decisions, and actions an organization undertakes in order to create and sustain a competitive advantage. Thus, strategic management is concerned with the analysis of strategic objectives (vision, mission, and strategic objectives), along with the analysis of the internal and external environment of the organization.

To make strategic analysis, this requires managers to define the corporate vision & mission, specify SMART (**S**pecific, **M**easurable, **A**chievable, **R**ealistic and **T**ime scaled) objectives, develop strategies and set policy guidelines. Without a vision of where is the company going, often there can be limited success in innovation (Baldwin, 2014). Furthermore, the identification of a clear mission for a project is widely considered essential for the effective management of stakeholders (Winch, 2002). To have a good strategic analysis, also objectives should be stated as action verbs and appropriate strategy is needed to state how the corporation will achieve its objectives. In addition, using policies can make sure that employees throughout the firm make the right decisions and take actions that support the company's mission, objectives and strategies (Wheelen and Hunger, 2010).

On the other side, to make environmental analysis, SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is the most important environmental scanning technique. A good SWOT analysis can help a company to understand itself better. It is an important guideline for making a proper marketing strategy plan (Huiru, 2011).

2.5.1.2 The Second Innovative Practice: Internal Innovative Work Environment

Prather (2010) agrees that human factors are critically important in the innovation process, but adds that they need the right work environment. Innovation needs a good atmosphere to develop in (Baldwin, 2014). Innovation cannot flourish in a climate of job dissatisfaction where people do the minimum to keep their jobs (Chen and Huang, 2009). For innovation to flourish, people need to be intrinsically motivated to perform (Prather, 2010).

There are a number of key internal factors to the construction firms that influence innovation, including the organizational climate for innovation, skills and capabilities of the workforce, availability of resources, top level commitment, processes to facilitate and integrate innovation, and company strategy (Nam and Tatum, 1997).

According to Ahmed (1998), organizational culture is a major determinant of innovation. This statement recognizes that whatever actions are taken and whatever money is spent on innovation, if employees in organizations and institutions are not interested in creative and innovative activities, the end result will be less than desirable (Engineers Australia, 2012). Moreover, providing the hygienic factors (pay and benefits, job security, status, company policy and administration, relationships with co-workers, physical environment and supervision) will not result in job satisfaction but rather not dissatisfaction (Maughan, 2012).

Later, Hana (2013) stated that innovations could only turn out to be successful if they are supported by top management and if an innovative creative team is developed and composed of people that may be considered knowledge employees. Top management must encourage innovation by setting forth one or more challenges to the appropriate people. Without a challenge, there may be no drive to innovate, nothing to provide the impetus (Baldwin, 2014). Baldwin (2014) argued that the better everyone in the company understands the goals and objectives of the company, the better this process of innovation should be. While Dulaimi et al. (2002) found that companies should give employees freedom in their workload so that they have an opportunity to develop and experiment with new ideas.

2.5.1.3 The Third Innovative Practice: External Innovative Work Environment

Innovative companies have strong links with their suppliers, are always finding out what customers want, and are always comparing themselves with existing competitors or with companies of other industry sectors (Yokomizo et al., 2013). Thus, a critical component of successful innovation is the ability of a firm to exploit and utilize external knowledge from different sources of innovation (Lin et al., 2002). The generation and utilization of knowledge depend on the frequency and density of the interactions with external sources of innovation and the firm's openness to external knowledge (Caloghirou et al., 2004). Organizations that do not recognize the impact of various innovations and have not adapted to changing environments have justifiably been forced out of the mainstream of construction activities (Hendrickson, 1998).

Milliken (1987) argued that the environmental uncertainty arises from the organization's inability to predict its environment, or in other words, to predict the factors that characterize its environment. According to Bourgeois (1980), these factors are usually classified into two groups; general and task external business environment factors. The general environment is typically composed of factors such as social values, educational, political, economic, legal, behavioral, demographic, natural environment, natural resources, and technological (Grant, 1999). Asheghian and Ebrahimi (1990) argued further that the task environment is the closest environment of the organization and the elements that made it is influencing the organization directly. This environment is made up of factors such as consumers, competitors, suppliers, labor market, industrial and financial resources.

The construction literature provides insight into a number of possible variables from the external environment of construction organizations that could influence creative and innovative behavior. According to Hana (2013), in the process of innovation, knowledge is an essential element, that helps to gain an advantage over other organizations. Gann and Salter (2000) stated that government has a key role to play in promoting and supporting innovation in the production of the built environment. While Tatum (1991) argued that development and effective use of new technology can provide important competitive advantages for engineering and construction firms. These advantages stem from distinctive technical capability, improvements in operations, and image as a technically progressive company.

2.5.1.4 The Fourth Innovative Practice: Stakeholder Management

Project Management Institute PMI (2008) defined project stakeholders as individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion. The checklist of stakeholders in a construction project is often large and would include the owners and users of facilities, project managers, facilities managers, designers, shareholders, legal authorities, employees, subcontractors, suppliers, process and service providers, competitors, banks, insurance companies, media, community representatives, neighbors, general public, government establishments, visitors, customers, regional development agencies, the natural environment, the press, pressure groups, civic institutions, etc. (Newcombe, 2003).

To ensure a successful project, the project team must identify the stakeholders, determine their requirements and expectations, and manage their influence in relation to the requirements (Othman et al., 2011). Stakeholder analysis should be carried out in an early phase of the project, where stakeholders are identified and classified into key, primary or secondary stakeholders. The classification is based on their potential motivation and power to influence the outcome of the project (Antvik and Sjöholm, 2007). More often than not, the diverse interests of project stakeholders exacerbate the changeability and make management very difficult, if not impossible (Zou and Zhang, 2008).

An increasing number of studies have identified the importance of stakeholder management in construction projects. Freeman et al. (2007) believe that identifying stakeholder interests is an important task to assess stakeholders. Freeman et al. (2007) also consider analyzing the conflicts and coalitions among stakeholders as an important step for stakeholder management. Walker et al. (2008) consider identifying stakeholder, prioritizing stakeholders, visualizing stakeholders, engaging stakeholders, and monitoring effectiveness of communication as the basic steps for stakeholder management. Elias et al. (2002) proposed eight steps for managing the stakeholder process started by: developing a stakeholder map of the project, preparing a chart of specific stakeholders, identifying the stakes of stakeholders, preparing a power versus stake grid; conducting a process level stakeholder analysis, conducting a transaction level stakeholder analysis, determining the stakeholder management capability of the R&D projects, and analyzing the dynamics of stakeholder interactions.

Olander and Landin (2008) found that the project managers should be highly skilled negotiators and communicators in order to be capable of managing individual stakeholder’s expectations and creating a positive culture change within the overall organization project. Consequently, the results of the stakeholder management are dependent on the project manager’s experience, relationships, and capability (Karlson, 2002).

2.6 Research Hypotheses

Based on the above, a successful project management requires effective controlling and alignment with innovation. It is therefore worthwhile to integrate innovation practices with project management applications to maximize the success of construction projects. From this point forth, this study is concerned with two topics and the interplay between them, namely “innovation” and “project management”. In this study, the relationships were established by assessing the correlations between the four previous innovation practices and project management. The research conceptual model, shown in Figure (2.13), was used to identify research hypotheses. Ten hypotheses were developed to explore the relationships among the five constructs that are:

- *H1: There is a positive relationship between strategic management and project management.*
- *H2: There is a positive relationship between internal innovative work environment and project management.*
- *H3: There is a positive relationship between external innovative work environment and project management.*
- *H4: There is a positive relationship between stakeholders management and project management.*
- *H5: There is a positive relationship between strategic management and internal innovative work environment.*
- *H6: There is a positive relationship between internal innovative work environment and external innovative work environment.*
- *H7: There is a positive relationship between external innovative work environment and stakeholders management.*
- *H8: There is a positive relationship between strategic management and external innovative work environment*

- *H9: There is a positive relationship between internal innovative work environment and stakeholders management.*

- *H10: There is a positive relationship between strategic management and stakeholders management.*

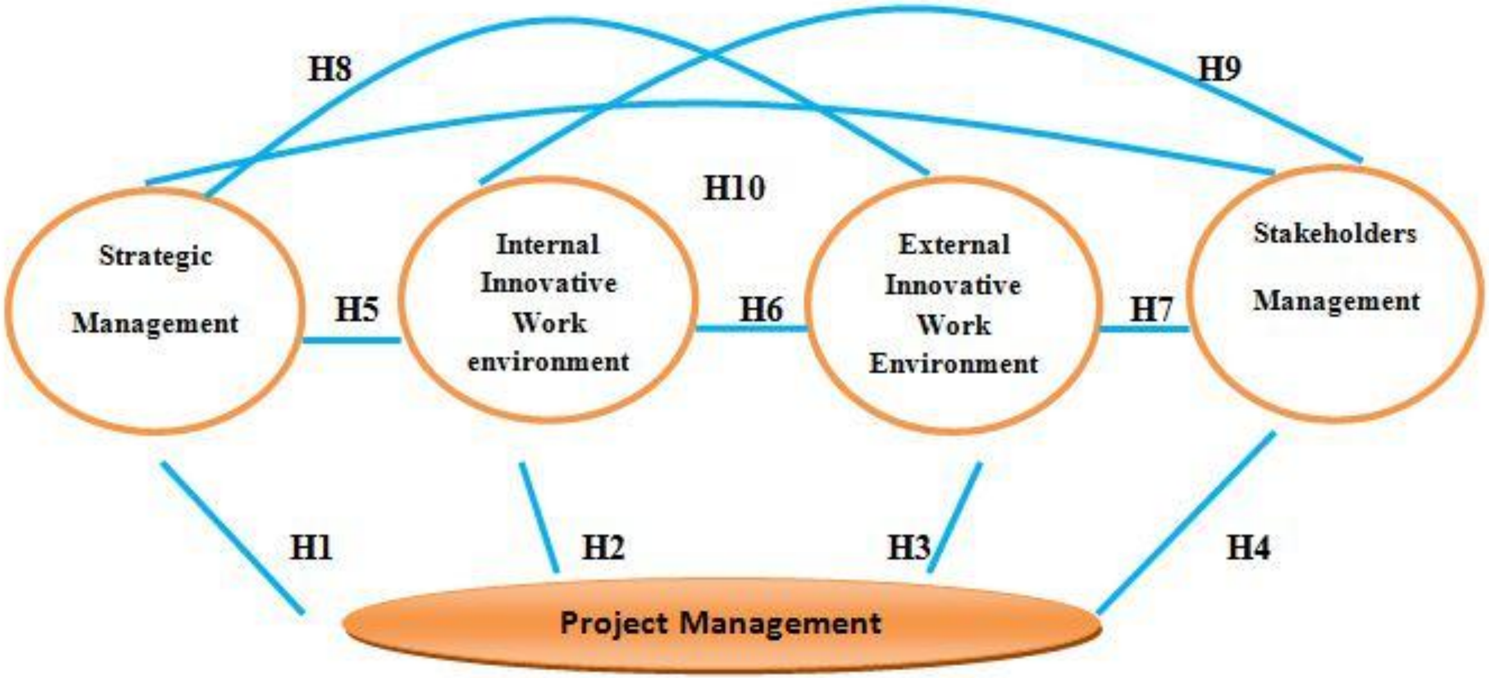


Figure (2.13): Research Conceptual Model

Based on the above, the main research hypothesis is:

"Innovation correlates positively with Project Management"

Chapter Three

Research Methodology

3.1 Chapter Overview

In order to test the hypotheses and answer the questions of the research, a convenient research methodology was chosen. A description of the characteristics of the methodological approach and data collection technique is provided in this chapter.

3.2 Research Design

Burns and Grove (2003) define a research design as a blueprint for conducting a study with maximum control over factors that may interfere with the validity of the findings. Depending on the objectives of research, research projects can be grouped into three types: exploratory, descriptive, and explanatory. Exploratory research tends to tackle new problems on which little or no previous research has been done (Brown, 2006). Descriptive research is used to justify current practices and identify factors that hinder or enhance practice as one gets a whole picture from the informants (Burns & Grove, 2003). Explanatory research attempts to go above and beyond what exploratory and descriptive research to identify the actual reasons a phenomenon occurs, it attempts to “connect the dots” in research, by identifying causal factors and outcomes of the target phenomenon (Bhattacherjee, 2012).

This thesis attempts to contribute towards developing a framework that will eventually be useful to increase the competencies of project management in the construction sector. In order to reach this purpose, an exploratory research inquiry was used to identify and analyze best practices related to innovation in construction.

3.3 Research Strategy

Bryman (2008) identified research strategy as a general orientation to the conduct of research. There are two types of research strategies: quantitative research and qualitative research. Qualitative and quantitative approaches should not be viewed as polar opposites; instead, they represent different ends on a continuum (Newman & Benz, 1998). Qualitative research is a type of research where the data are not in the form of numbers (Blaxter et al., 2001). According to Creswell (2003), the qualitative approach is based on constructivist perspectives (i.e., individual experiences) or advocacy/participatory perspective (i.e., political, collaborative or change oriented). Quantitative research is a type of research where the data is in the form of numbers (Blaxter et al., 2001). The quantitative approach basically uses post-positivist claims for developing knowledge (i.e., cause and effect thinking, reduction to specific variables, use of measurement and testing of theories).

In this research, a mixed method that combines both qualitative and quantitative forms were used in data collection. A structured questionnaire and closed personal interviews were used in this research. The questionnaire was used to get valid data needed to complete the research, as well as, the interviews were conducted with experts to explore their opinions and benefits from their experiences.

3.4 Research Methodology Flow Chart

Figure (3.1) illustrates the methodology flow chart of the research that consists of (5) phases.

- The first phase of the research includes a literature review that was undertaken to review the basic concepts of innovation and project management in a construction environment.

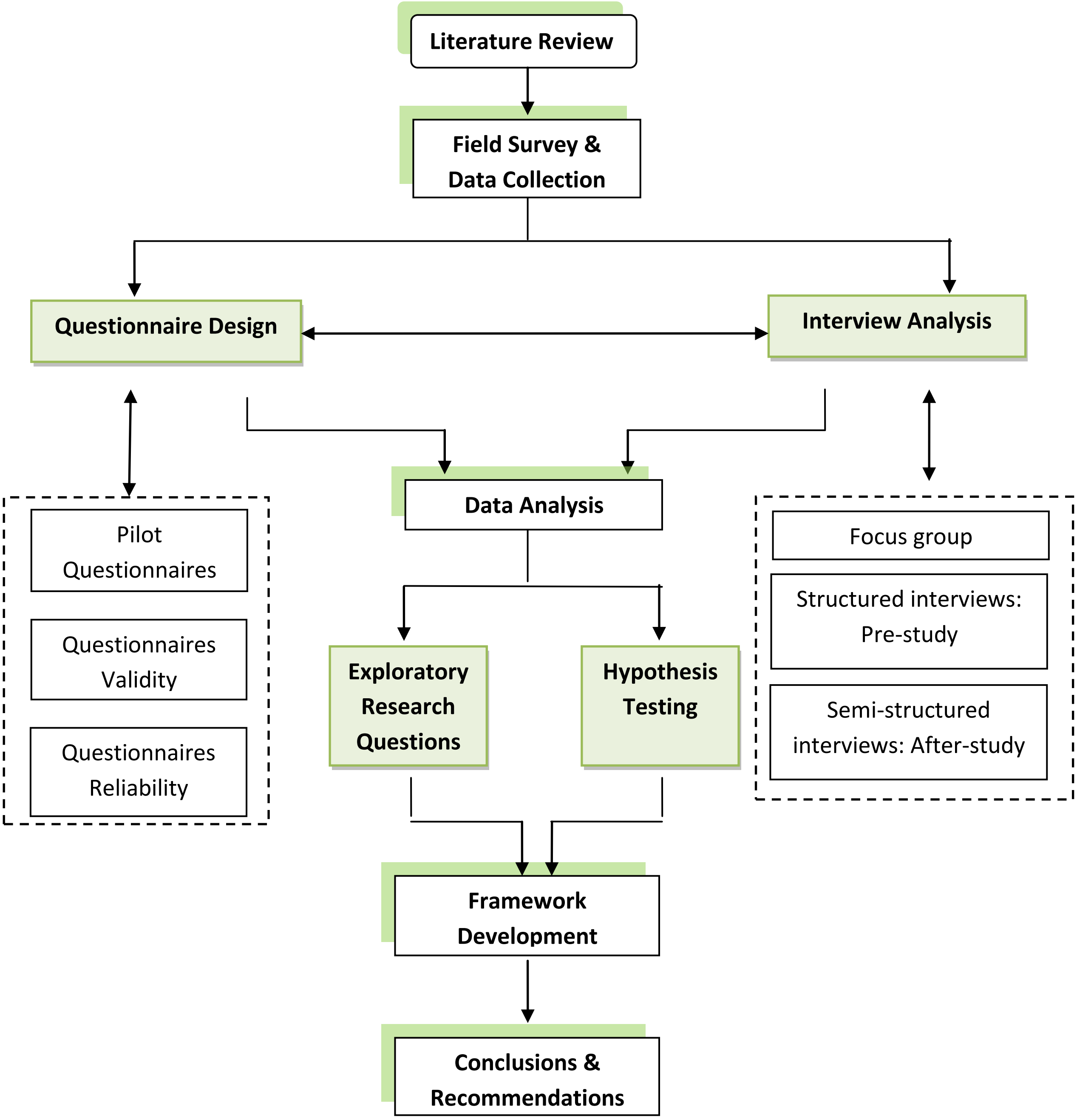


Figure (3.1): Research Methodology Flow Chart

- The second phase includes a survey and data collection. A survey can be conducted via interviews or questionnaires (Fellows & Liu, 2003). In the case of this research, both interviews and questionnaires were used. A questionnaire was used to get the required information needed to complete the research as well as the interviews were conducted with experts to collect in-depth information and enrich the analysis. Through questionnaire design, a pilot study was conducted by experts to test whether the questions were clear, valid and easy to answer. The data was collected from a large-scale survey of 365 actors in construction and engineering firms.

- The third phase of the research is a data analysis and discussion. The statistical software (SPSS) was used to perform the required analysis. The data was analyzed through two phases: exploratory research questions and hypothesis testing.

- The fourth phase of the research is framework development. Based on literature reviews and findings of the research conceptual model, the researcher devised a framework to be applied in the engineering and construction firms.
- The fifth phase of the research includes the conclusions, recommendations to the construction industry practitioners, and suggestions for future research.

3.5 Research Population and Sample Size

The target population of this study was the consulting and contracting firms that reside at WB- Palestine. Unfortunately, there are no official reports mentioning the number of projects' owners in the West-Bank such as government, agencies, ministries, municipalities and international agencies. Therefore, construction clients were excluded.

The selected contractor companies had a valid registration according to the Palestinian Contractors Union (PCU) records. The PCU divided the contracting companies into five major categories depending on their size, executed projects, capitals, and qualifications of the staff, where class 5 designates the smallest contractors and class 1 designates the largest. The selected contractors are classified under the first and second classes in the following fields: building, roads, water and sewage. Contractors that are registered under the third, fourth, and fifth classes were neglected because some of them did not have sufficient experience in construction field. The selected consultant companies consist of all consulting offices that had a valid membership of the Engineering Association in WB- Palestine. Consulting engineers had a valid registration in the following fields: building, roads, project management, water, and sewage feild. At the end of 2013, there were 220 construction companies registered with the PCU under the 1st and 2nd classes and 477 consulting/engineering firms registered with the Engineering Association. The companies were distributed through the cities as shown in Figure (3.2).

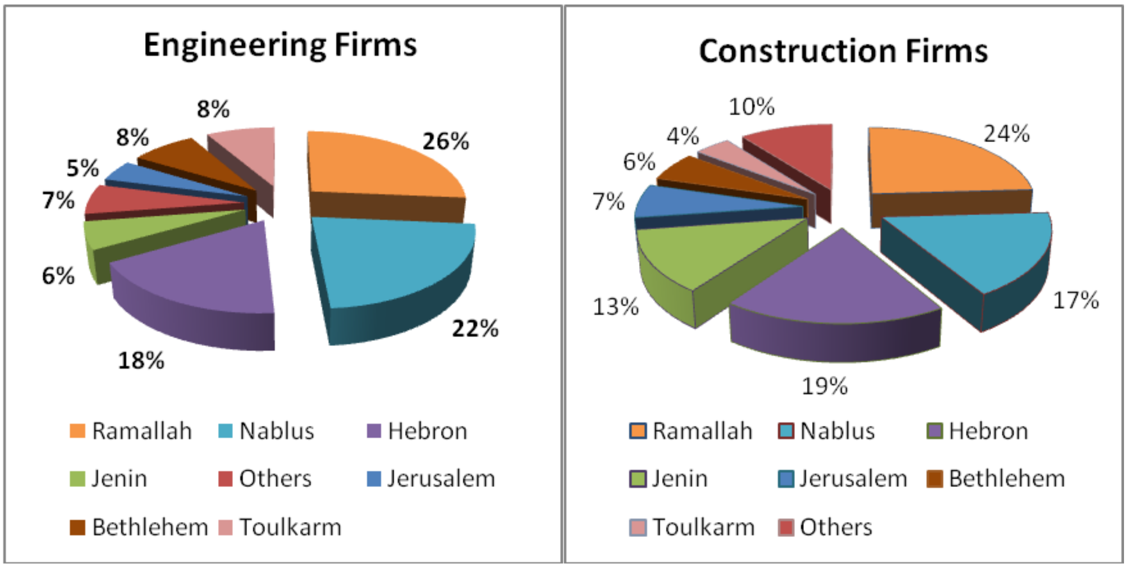


Figure (3.2): Firms' Geographic Distribution

According to the targeted area, the total number of available population is 697 (220 construction companies and 477 consulting firms). To obtain statistically representative sample size of the population, the researcher used the following simple formula as advanced by (Kapoor, 2010).

$$n = \frac{m}{1 + \frac{m-1}{N}} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where

- n = correction for limited population
- N= population
- m = sample size, m is calculated by following equation

$$m = \frac{z^2 * p * (1-p)}{\varepsilon^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where

- z = value related to the confidence level (e.g. 1.96 for 95% confidence level)
- p = degree of variance between the elements of population (0.5)
- ε = maximum error (0.05)

$$m = \frac{(1.96)^2 * 0.5 * (1 - 0.5)}{(0.05)^2} = 385 \qquad n = \frac{385}{1 + \frac{385 - 1}{697}} = 249$$

- The total number required was 249 questionnaires.
- The total number returned and useable from the consultants was 220 questionnaires.
- The total number returned and useable from the contractors was 140 questionnaires.

Based on the results of sample size computation, this study needed 249 participants to complete the survey. For this study, more than 1000 postal and electronic questionnaires were distributed among top managers, project managers and engineers of each participated organizations. However, the total number returned and useable was only 360 questionnaires. This represented a response rate of 52.4%. Figure (3.3) shows that the consultants' response rate is 46.1%, while the contractors' response rate is 63.6 %.

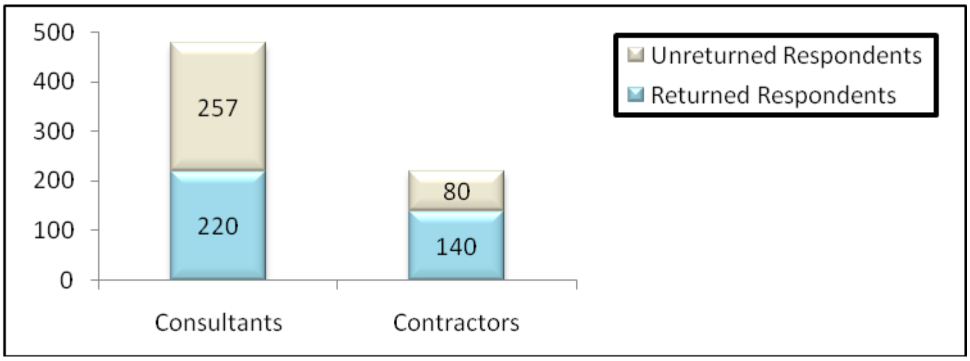


Figure (3.3): Questionnaire's Response Rate

3.6 Field Survey and Data Collection

Data used for the survey were both primary and secondary. The primary data of research included: (1) structured questionnaires on a 5- point Likert scale and (2) interviews with some stakeholders' experts to collect in-depth information. The Secondary data of research included a literature search. The literature review was conducted through books, internet, international journals and PCU & PCBS publications. As shown in Figure (3.1), the field survey and data collection in this study were explored using both questionnaire survey and interview analysis technique.

3.6.1 Questionnaire Survey

The questionnaire survey is the most commonly used research method and can be used to gather information on any topic from large or small numbers of people. It is a written list of questions and the answers are recorded by respondents (Frankfort-Nachmias & Nachimas, 1992). The main advantages of questionnaires are the ease of completion and analysis, access to dispersed respondents and accuracy. On the other hand, the main disadvantages of questionnaires are low response rate and some delay in getting results (Kumar, 1999).

3.6.1.1 Questionnaire Design

Data for this research was primarily gathered through a structured questionnaire. The questionnaire was designed actually for assuring obtaining accurate results. Thus, questionnaire parts were constructed based on literature review, local publications reviewing, and several interviews with consultants and contractors, who having good experience in the field of construction, and together with revision and modifications by local experts. The questionnaire was comprised three major parts.

Part one of the questionnaire was mainly designed to obtain general information regarding the participants' gender, type of organization, years of experience in the construction field, respondents' position and company's geographic location.

Part two of the questionnaire (36 items) obtains information on the factors that contribute to the construction innovation value chain, which consisted of four sections: (1) drivers of innovation, (2) enablers of innovation, (3) barriers of innovation, and (4) impacts of innovation. Respondents were asked to rank the drivers, enablers, barriers and impacts of innovation, according to their own judgment and working experience in Palestinian construction industry. All questions were closed, items measured with a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Part three of the questionnaire (35 items) illustrates the factors influencing innovation. These factors were collected from previous studies, own experience and pilot study. The factors were included in five components: (1) Strategic Management, (2) Stakeholders Management, (3) Internal Innovative Work Environment, (4) External Innovative Work Environment, and (5) Project management. These factors were considered to represent best practice in supporting the innovativeness of construction PM. This part asked the respondents to rate their organization's performance. All items in this section were measured with a five-point Likert scale ranging from 1 (not at all) to 5 (very great extent).

The final version of the questionnaire was designed in English language (attached in Appendix A), while the distributed version was in Arabic language (attached in Appendix B), since the Arabic language is much more effective and easier to be understood. To distribute questionnaires quickly and to collect data in electronic format, an online questionnaire was developed using a Google Drive form. Questionnaire link was sent by email and respondents' replies were returned directly to a database without noticing sender information. In general, the contact person was the firm owner or a senior manager. Participation in the survey was voluntary. The incentive was the option to receive the results of the research of the survey. The return rates for mail surveys oscillate only 20%. It was surprising that many of the targeted samples do not have email or cannot use the email (especially in the contracting companies). To ensure the results were not biased against firms that did not use email systems, survey forms were distributed through the post to a random sample of practitioners who are part of the Palestinian Contractors Union (PCU) under the first and second classes or member in Engineering Association.

3.6.1.2 Questionnaire Pilot study

A pilot study provides a trial run for the questionnaire, which involves testing the wording of questions, identifying unclear questions, testing the technique used to collect the data, etc. (Naoum, 2007). Furthermore, a pilot study is an opportunity for improving the questionnaire, filling in gaps and determining the time required for completing the questionnaire. Prior to disseminating the questionnaire, a pilot study was conducted with five experts to test whether the questions are clear, valid and easy to answer.

3.6.1.3 Questionnaire Validity

Validity refers to the degree to which an instrument measures what it is supposed to be measuring (Polit & Hungler, 1985). High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid, it truly reflects the concept it is supposed to measure (Wood & Haber, 1998). The structure validity test was used to evaluate the validity. It measures the correlation coefficient between one field and all the fields of the questionnaire that have the same level of Likert scale (Polit & Hangler, 1985).

Table (3.1) clarifies Spearman correlation coefficient for each item of the drivers, enablers, barriers, impacts and the total of the innovation value chain field. The P-values are less than 0.05, so the correlation coefficients of this field are significant at α = 0.05. Therefore, it can be said that the data of innovation value chain field are consistent and valid to be measured.

Table (3.1): Correlation Coefficient of Each Field of Innovation Value Chain

Item	Number of Items	Spearman Correlation Coefficient	P-Value (Sig.)
Drivers of innovation	7	0.664	0.000*
Enablers of innovation	7	.0.700	0.000*
Barriers of innovation	15	0.697	0.000*
Impacts of innovation	7	0.633	0.000*

* Correlation is significant at the 0.05 level

Table (3.2) clarifies the Spearman correlation coefficient for each item of the practices and the total of the innovation PM practices field. The P-values are less than 0.05, so the correlation coefficients of this field are significant at α = 0.05. Therefore, it can be said that the data of the innovation PM best practices field are consistent and valid to be measured.

Table (3.2): Correlation Coefficient of Each Field of Innovation Practices

Item	Number of Items	Spearman Correlation Coefficient	P-Value (Sig.)
Strategic Management	5	0.828	0.000*
Stakeholders	7	0.848	0.000*
Internal Environmental	7	0.853	0.000*
External Environmental	7	0.729	0.000*
Project Management	9	0.852	0.000*

*Correlation is significant at the 0.05 level

3.6.1.4 Questionnaire Reliability

The reliability of an instrument is the degree of consistency (Polit & Hangler, 1985). In this research, in order to ensure the internal consistency of Likert scale of the questionnaire, Cronbach's Alpha test was used as shown in Table (3.3). The normal range of Cronbach's coefficient alpha (α) value between 0.0 and + 1.0. The closer the Alpha (**α**) is to 1, the greater the internal consistency of items in the instrument being assumed. For most purposes, the reliability coefficients above 0.7 are considered satisfactory (Burns & Grove, 2003).

Table (3.3): Cronbach's Alpha Test

Cronbach's Alpha	Internal Consistency
$\propto \geq 0.9$	Excellent
$0.7 \leq \propto < 0.9$	Good
$0.6 \leq \propto < 0.7$	Acceptable
$0.5 \leq \propto < 0.6$	Poor
$\propto < 0.5$	Unacceptable

(Cortina, 1993)

According to the Cronbach's Alpha test of the questionnaire, as shown in Table (3.4), the total reliability of the questionnaire is 0.939 that is excellent. As well as the values of the Cronbach's Alpha for all the variables are ranging between 0.732 and 0.943, indicating that some scales are more reliable than others, but all well beyond 0.70, which is good.

Table (3.4): Cronbach's Alpha

Item	Number of Items	Cronbach's Alpha	Internal Consistency
Drivers of innovation	7	0.732	Good
Enablers of innovation	7	0.765	Good
Barriers of innovation	15	0.733	Good
Impacts of innovation	7	0.799	Good
Strategic Management	5	0.905	Excellent
Stakeholders Management	7	0.902	Excellent
Internal Innovative Environmental work	7	0.918	Excellent
External Innovative Environmental work	7	0.902	Excellent
Project Management	9	0.943	Excellent
Total	**71**	**0.939**	**Excellent**

3.6.2 Interviews Analysis

Interview techniques are more appropriate to collect in-depth information and can cover a wider area of application than questionnaires. The main advantage of interviews is that they provide more opportunity to obtain qualified answers and to clarify or restate questions that the respondent cannot understand. The disadvantages of interviews include being time-consuming, expensive and providing information that can be difficult to analyze. Moreover, interviews may be more subjective than questionnaires (Kumar, 1999; Moore, 1983).

3.6.2.1 Focus Group

At first, data was collected from a focus group of seven experts working in the construction industry and have an experience in their companies ranging from 20 to 25 years. A focus group is a discussion-based interview involving several participants and a moderator, whose role is to facilitate the discussion (Brewerton & Millward, 2001). A focus group was used in this study for eliciting ideas, thoughts and perceptions from experts and also to understand the problems they are facing during managing their construction works. The collected ideas were then used in formulating the questionnaire.

3.6.2.2 Structured Interviews: Pre-study

The structured interview was formulated to answer the main research questions. Seven interviews were conducted with experts representing various institutions in the construction industry, varying from consultants, contractors and project managers. The main reason of using structured interviews in this research was identifying new factors about the drivers, enablers, barriers and impacts of innovation that reflects the real situation of PM in the Palestinian construction sector and that were not mentioned in the literature review. The length of interviews was around 30 minutes. At the end of the interviews, interviewees were asked to comment on the questionnaire and make the required correction before it was distributed. A list of questions used in a structured interview approach is presented in (Appendix C).

3.6.2.3 Semi-Structured Interviews: Post-study

After receiving the filled questionnaires and analyzing the data, the researcher commenced the qualitative part of this research. Seven semi-structured interviews were conducted with professionals working in construction and engineering firms to explain and verify the results. Interviewees were asked for explanations about the extreme and unexpected results. Notes have been made during each interview and when all interviews were conducted, patterns were matched and main observations were made.

3.7 Normality Test

Before data analysis of the survey items began, an assessment of the normality of data is a prerequisite for many statistical tests because not all random variables are normally distributed. Table (3.5) presents the results from two well-known tests of normality: the Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. The null hypothesis is that the data is normally distributed. The null hypothesis is rejected if significance is less than $\propto = 0.05$.

Table (3.5): Normality Test: Kolmogorov-Smirnova & Shapiro-Wilk

Elements	Kolmogorov -Smirnova	Sig P-value	Shapiro -Wilk	Sig P-value
Drivers	0.120	0.000	0.949	0.000
Enablers	0.125	0.000	0.949	0.000
Barriers	0.113	0.000	0.941	0.000
Impacts	0.120	0.000	0.929	0.000
Strategic Management	0.101	0.000	0.971	0.000
Stakeholders Management	0.098	0.000	0.957	0.000
Internal Innovative Environmental work	0.090	0.000	0.961	0.000
External Innovative Environmental work	0.110	0.000	0.962	0.000
Project Management	0.074	0.000	0.965	0.000

From the results, all the P-values for each group are less than $\alpha = 0.05$, this gives a basis for the assumption that the data is not normally distributed and non-parametric statistics should be used for data analysis.

Basically, there is at least one non-parametric equivalent for each parametric test. Table (3.6) contains several statistical analyses for both parametric and non-parametric test.

Table (3.6): Parametric vs Non-Parametric Tests

Analysis Type	Parametric	Non-parametric
Compare means between two distinct/independent groups	Two-sample t-test	Wilcoxon rank- sum test
Compare two quantitative measurements taken from the same individual	Paired t-test	Wilcoxon signed-rank test
Compare means between three or more distinct/ independent groups	Analysis of variance (ANOVA)	Kruskal-Wallis test
Estimate the degree of association between two quantitative variables	Pearson coefficient of correlation	Spearman’s rank correlation

Chapter Four
Data Analysis

4.1 Chapter Overview

To analyze the empirical data collected through the field exploratory survey, quantitative statistical analysis of the questionnaire was done by using the statistical software SPSS. In this chapter, at first, the analysis of data is done to discuss the characteristics of the study population. After that, descriptive analysis is done to rank the relative importance of the drivers, enablers, barriers and impacts of innovation in Palestinian construction sector. At the end of this chapter, bivariate correlation analysis is done for getting some useful relationships among specific variables.

Based on the data obtained from the quantitative survey and its evaluation, it is possible to state that organizations find it important to concentrate on innovation. As shown in Figure (4.1), only 2% of the organizations mentioned that they did not find this aspect important when they asked, "How important is innovation for the future of construction?"

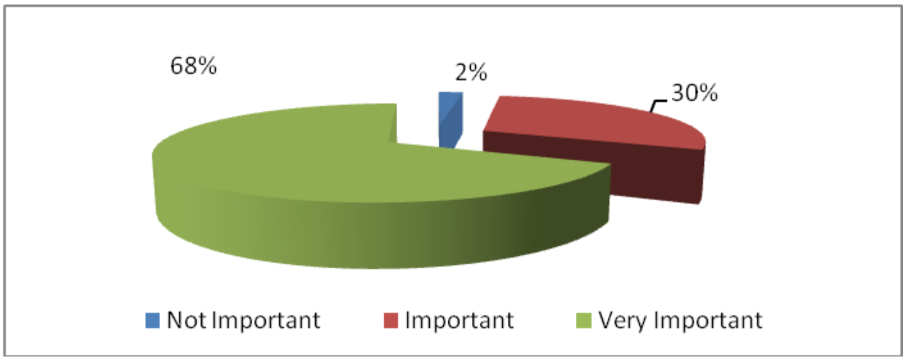


Figure (4.1): Importance of innovation

4.2 Study Population

4.2.1 Gender

As shown in Figure (4.2), analysis of gender distribution confirms that the Palestinian construction industry is traditionally male-dominated sector, (66.6%) survey participants were men and (33.4%) of the participants were women.

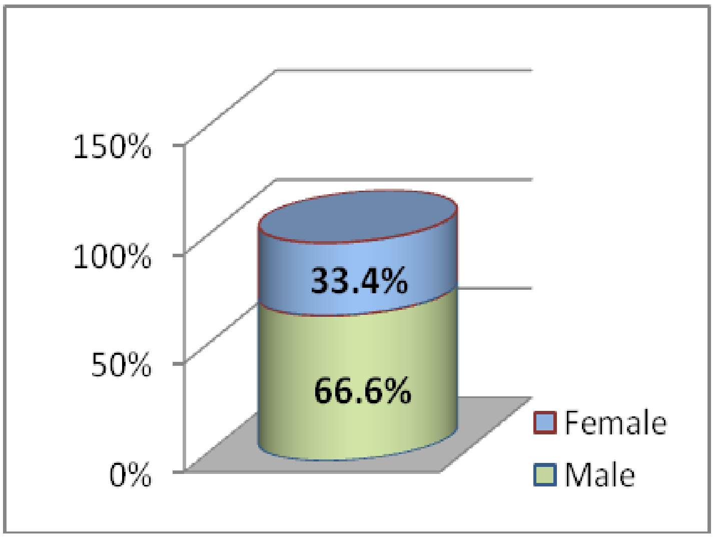


Figure (4.2): Distribution of Gender

4.2.2 Types of Organizations

Figure (4.3) shows that 60% of the respondents have been working in consulting organizations while 40% have been working in contracting organizations.

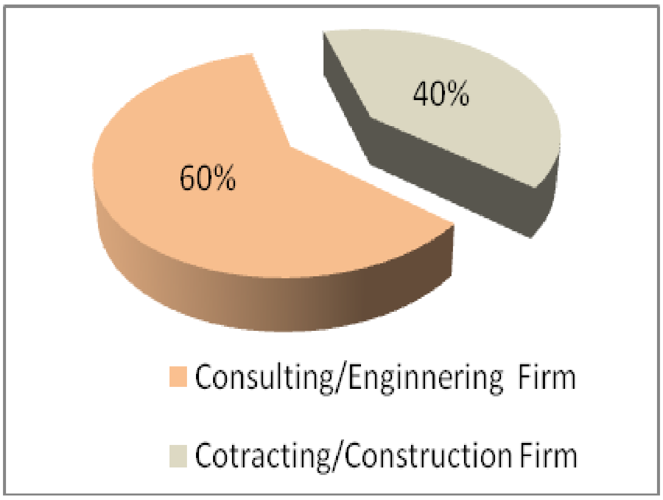


Figure (4.3): Distribution of organization

4.2.3 Research Location

Figure (4.4) shows that most of the companies in the sample population (40%) are located in Ramallah city, in the middle of the West Bank. It also shows that 26% of the companies are located in Nablus and 10% of the companies are located in Jenin and Tulkarm, which means 36% of the companies in the sample are located in the north of the West Bank. Also, 18% of the companies in the sample are located in the south of the West Bank, where 14% of the companies are located in Hebron and 4% of the companies are located in Bethlehem. While only 4% of the companies are located in East Jerusalem.

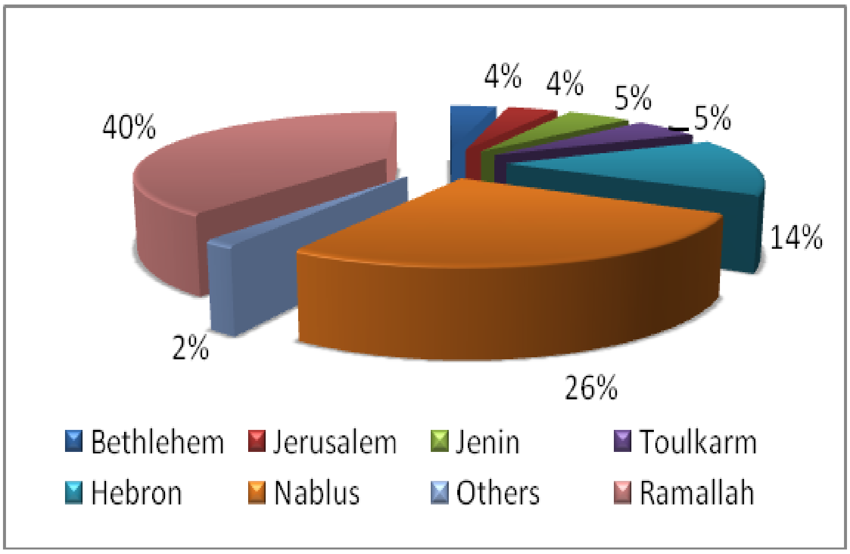


Figure (4.4): Company location

4.2.4 Years of Experience

Figure (4.6) shows that 62% of the respondents have more than 15 years of experience and only 3% of the respondents has less than 5 years of experience while 14% have between 5 and 10 years of experience and 21% have between 5 and 10 years of experience.

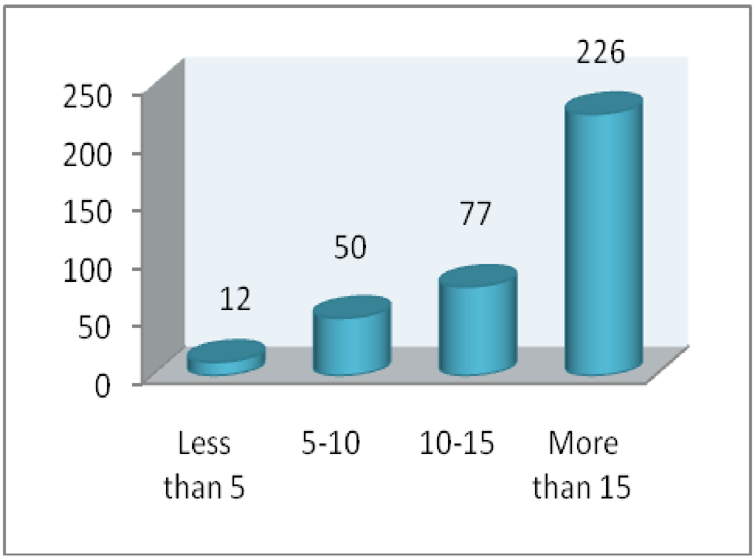


Figure (4.5): Respondents experience

4.2.5 Position of Respondents

One of the main objectives of the study was to obtain a managerial perspective on the study. Respondents were classified based on their positions in their organizations. Figure (4.5) shows that (47) 21% of the consultants respondents are engineers, (39) 18% are project managers, and (134) 61% are firm managers. On the other hand, (19) 13% of the contractors respondents are engineers, (34) 23% are project managers and (92) 63% are firm managers. The results show that the highest level of respondents holds positions of firm managers in both the contractors' organizations and consultants' organizations. Thus, this is an indication that the questionnaire respondents are key persons in their firms.

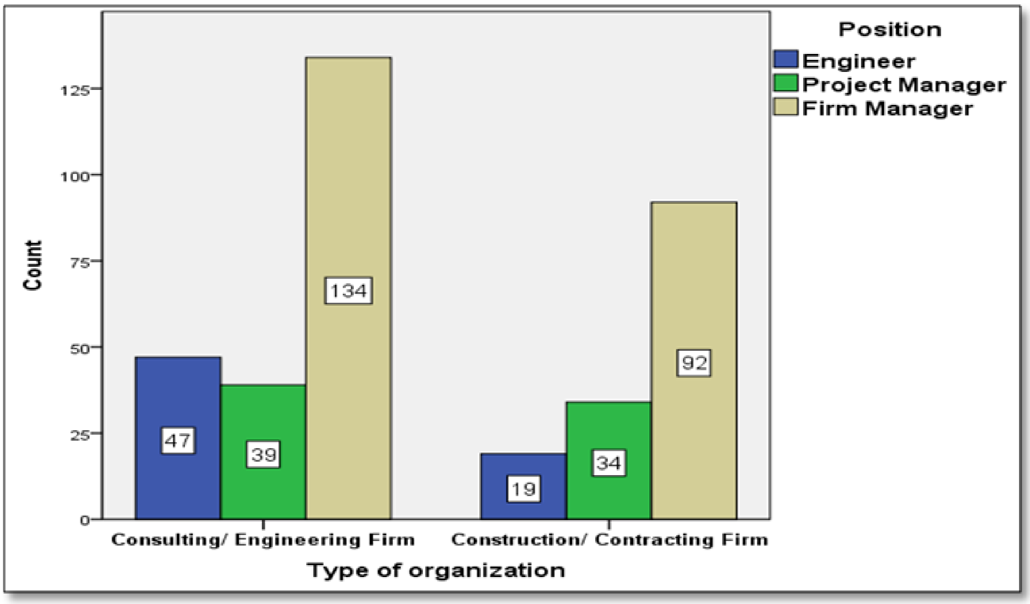


Figure (4.6): Respondent position

4.3 Innovation Value Chain

Introduction of innovation value chain, taking in consideration drivers, enablers, barriers and impacts of innovation was significant to identify the surrounded environment that affect innovation in construction. Thus, this thesis attempts to reveal the perceptions of the two main groups, consultants and contractors, towards the related factors along the innovation value chain.

To give an overall picture of the relative importance of the key drivers, barriers, enablers and impacts along the innovation value chain of the construction industry; the data was analyzed by the Relative Importance Index (RII) method. The respondents were asked to rank the factors, according to the degree of importance (1 – affects with little degree; 2 – affects somehow; 3 –affects with average degree; 4 – affects with large degree; 5 – affects with very large degree).

For analyzing data by ordinal scale, a relative importance index was used. This index was computed by the following equation (Lim and Alum, 1995):

$$\text{Relative Important Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_1 + n_2 + n_3 + n_4 + n_5)} * 100$$

Where:

- n_1 – number of respondents who answered “little effect”
- n_2 – number of respondents who answered “some effect”

- n_3– number of respondents who answered “average effect”
- n_4 – number of respondents who answered “high effect”
- n_5 – number of respondents who answered “very high effect”

The Mann-Whitney U test, which is a nonparametric test that compares two unpaired groups, was also used to complete the analysis. This test is based on assuming null hypotheses (Ho) of existence of no significant difference in the point of views between consultants and contractors. The null hypothesis (Ho) is rejected if significance is less than $\propto = 0.05$.

4.3.1 Drivers of Innovation

Table (4.1) shows the Relative Importance Index (RII), the Rank (R) for each driver in a descending order and the P-values of the Mann-Whitney U test. The results show that there is consistency across both organizations with regard to the drivers of innovation. Under the group of drivers of innovation, “reducing costs” is the most important factor compared the other factors. It was ranked as first according to both consultants and contractors with a relative importance index of 90.09% and 90.48% respectively. It is interesting to note that the overall respondents also ranked reducing time as the second most important factor and improving quality as the third most important factor. This result is justified, as cost, time, and quality are the basic measures of project success. In other words, a project is often considered successful if it finished within its budget estimate, finished within its scheduled time frame, and performed as designed (Scott-Young & Samson, 2008). Based on the results obtained from this survey, the triple constraints of projects: quality, cost and time are the primary drivers of construction innovation. Therefore, it is necessary to have a clear set of objectives in term of time, cost and quality to better suit the innovation environment.

Table (4.1): Drivers of innovation ranked in descending order

Drivers of Innovation	Overall Respondent		Consultant		Contractor		P-value (Sig.)
	RII	Rank	RII	Rank	RII	Rank	
Reducing costs	90.25	1	90.09	1	90.48	1	0.891
Reducing time	89.32	2	89.91	2	88.41	2	0.276
Improving quality	88.49	3	88.73	3	88.14	3	0.496
Competition	87.34	4	88.00	4	86.34	4	0.449
Improving efficiency/ productivity	86.58	5	87.09	5	85.79	5	0.405
Responding to client/ customer needs	85.32	6	86.00	6	84.28	6	0.048
Rapid development of technology	83.78	7	85.00	7	81.93	7	(0.005)

The overall respondents ranked “competition” as the fourth important factor, “improving efficiency/ productivity” was ranked as the fifth important factor and “responding to client/customer needs” was ranked as the sixth important factor. This, however, was contrary to the findings of several scholars who investigated drivers of innovation in construction projects. Manley and McFallan (2002) surveyed participants in the Queensland road and bridge sector in Australia, they found that the most common driver of innovation was efficiency/productivity, followed by clients as the second most important driver. Similarly, Thorpe et al. (2009) conducted research on 100 small residential housing contractors operating in South-East Queensland in Australia. They found that the principal driver for innovation was improving productivity/efficiency and meeting customers' requirements. Moreover, Barlow (2000) observed that the more demanding and experienced the client, the more likely it is to stimulate innovation in projects it commissions.

"Rapid development of technology" was considered the least important drivers by both consultants and contractors. Although Manyika (2009) stressed that the internet and telecommunications networks provide better capabilities and opportunities for innovation.

The analysis also shows that there is no statistically significant difference between the consultants and contractors towards the most drivers of innovation. According to the results of the Mann-Whitney U test, the P-values for all drivers are greater than $\alpha = 0.05$ expect the P-value of "rapid development of technology", it is smaller than $\alpha = 0.05$, this means that the consultants keep up with technological developments rather than contractors. This result is justified, as in a rapidly technological development, consultants need to keep up to the latest construction materials, building codes, environmental standards and engineering programs to maintain its competitiveness.

4.3.2 Enablers of Innovation

Table (4.2) shows the seven enablers placed in descending order according to the overall respondents as follows: (1) incentives, reward and bonuses, (2) organizational innovative culture, (3) involvement of the client, (4) top management support, (5) training and development, (6) work experience and (7) leadership.

Results show that incentives system has a high effect on innovation; the relative importance index for this factor is 91.12% according to the overall respondents. Dulaimi et al. (2002) also found in their research that successful innovation might come about if companies establish a rewards system to recognize innovators and to promote future innovation.

Furthermore, the results indicated that “innovative culture” is the second most important factor related to the other factors. Many researchers have emphasized the role of innovative culture in the diffusion of innovation. Ahmed (1998) stated that organizational culture is a major determinant of innovation, having major facilitating and constraining effects on the successful implementation and maintenance of innovation. According to Engineers Australia (2012), whatever actions are taken and whatever money is spent on innovation, if employees in organizations and institutions are not interested in creative and innovative activities, the result will be less than desirable. Therefore, it is equally important to promote an innovative culture within organizations.

Table (4.2): Enablers of innovation ranked in descending order

Enablers of Innovation	Overall Respondent		Consultant		Contractor		P-value (Sig.)
	RII	R	RII	R	RII	R	
Incentives, Reward and bonuses	91.12	1	91.18	1	91.03	1	0.747
Organizational innovative culture	88.55	2	87.73	2	89.79	2	0.629
Involvement of the client	84.05	3	83.91	4	84.28	3	0.694
Top management Support	83.89	4	84.18	3	83.45	4	0.629
Training and development	80.99	5	80.00	6	82.48	5	0.185
Work experience	79.45	6	80.27	5	78.34	7	0.486
Leadership	78.36	7	78.36	7	78.21	6	0.808

"Involvement of the client" was ranked by the overall respondents as the third position with a relative importance index value 84.05%. While "Top management support" was ranked by the overall respondents in the fourth position with a relative importance index value 83.89%. According to Porter (1998), to gain competitive advantage it is necessary for the innovating company to make sure that the demands of the client are fulfilled at acceptable cost for the client, while Hana (2013) stated that innovations can only turn out to be successful if they are supported by top management.

Egbu et al. (1998) noted that training and development could play an important role in the development of innovation. In this survey "Training and development" was ranked by the overall respondents in the fifth position with a relative importance index value 80.99%. Consequently, the research established that "work experience" and "leadership" had less effect on enabler of innovation in construction. However, Hoffman et al. (1998) found in their research that the two most important internal factors that significantly influence innovative activities in organizations are employee qualifications and strong leadership.

The results of the Mann-Whitney U test suggests that respondents were homogeneous with respect to all items with regard to enablers of innovation, all P-values were greater than $\alpha = 0.05$, this gives a basis for the assumption that the consultants had a statistically no significant difference in the point of views with the contractors.

4.3.3 Barriers of Innovation

The results in Table 4.3 illustrate the ranking of 15 factors under the group of barriers of innovation. These factors were placed in descending order according to their importance. "Lack of effective management" was ranked first with a relative importance index of 91.29%. This result might be justified; the presence of an effective management is a foregone conclusion. Effective management can provide a bridge to help managers get to their goals. It also increases the ability of the management teams to deliver the construction project within the time, allocated budget and expected degree of quality.

Table (4.3): Barriers of innovation ranked in descending order

Barriers of Innovation	Overall Respondent		Consultant		Contractor		P-value (Sig.)
	RII	R	RII	R	RII	R	
Lack of Effective Management	91.29	1	91.09	1	91.59	1	0.855
Time pressure and deadlines	86.74	2	87.73	2	85.24	4	0.142
Limited budget	86.19	3	86.00	4	86.48	2	0.863
Poor coordination and communication between participants	85.04	4	87.09	3	81.93	9	(0.000)
Construction clients lack of interest in innovations	83.40	5	81.36	8	86.48	3	(0.001)
Low salaries and job insecurity	83.07	6	84.09	5	81.52	12	0.162
Inadequate planning	82.47	7	82.27	6	82.76	5	0.900
Content with Success and Fear of Unknown	82.36	8	82.09	7	82.76	6	0.846
Work overload or under load	81.75	9	81.18	9	82.62	7	0.449
Work-life balance problems	80.38	10	80.09	10	80.83	13	0.806
Lack of collaboration due to competition	80.22	11	79.09	11	81.93	10	0.245
Accidents during construction	80.22	12	79.09	12	81.93	11	0.245
Too many Restrictive Building Codes	79.89	13	78.09	12	82.62	8	0.015
Lack of required construction material/ tools/equipments	71.40	14	71.18	14	71.72	14	0.385
Israel's Occupation and Related Obstacles	57.37	15	57.45	15	57.24	15	0.881

From the summary of results, it can be observed that the key factors that contributed most to prevent innovation in construction projects in Palestine are "Time pressure" and "Limited budget". They were ranked by the overall respondents in the second and third positions with a relative importance index 86.74% and 86.19% respectively. "Poor coordination and communication between project participants" was ranked by the overall respondents in the fourth position with a relative importance index 85.04%, followed closely in order by "Construction clients' lack of interest in innovations", "Low salaries and job insecurity", "Inadequate planning", "Content with Success and Fear of Unknown", "Work overload or under load", "Work-life balance problems", "Lack of collaboration due to competition", and "Accidents during construction". Consequently, the research established that "Too many restrictive building codes" (RII = 79.89%), "Lack of required construction material/tools/equipments" (RII = 71.40%) and Israel's occupation and related obstacles (RII = 57.37%) had less effect on limiting innovation in construction.

The analysis also shows that there is no statistically significant difference between the consultants and contractors views towards the most barriers of innovation. According to the results of the Mann-Whitney U test, the p-values for all barriers are greater than $\alpha = 0.05$ expect the p-value of "Poor coordination and communication between project participants" and "Construction clients lack of interest in innovations", they are smaller than $\alpha = 0.05$. As shown in Table (4.3), consultants consider "poor coordination and communication between project participants" impede the uptake of innovation more than the contractors do. According to Xue et al. (2007), construction project consists of a myriad of activities, so it necessitates the large numbers of participants who have different characters to carry out the specific task to complete the project goal. In this effort, consultants always face challenges in coordination between participants. On the other side, contractors consider “construction clients lack of interest in innovation” impede the uptake of innovation more than the consultants do. This result is justified, as construction clients focus more on minimizing costs and reducing construction time more than increasing the quality of the projects.

4.3.4 Impacts of Innovation

Unsurprisingly the results show that the main impact of innovation is “Creating a competitive advantage”. Nevertheless, it is interesting to note that the other are close behind. This indicates that although there is a recognition that innovation ought to provide a competitive advantage, but also applying innovation can increase the profitability, improve staff motivation and working conditions, develop an integrated stakeholder communication, increase in organizational effectiveness and also increase the ability of the organization to be more flexible to any internal or external change.

Table (4.4): Impacts of innovation ranked in descending order

Impacts of Innovation	**Overall Respondent**		**Consultant**		**Contractor**		**P-value (Sig.)**
	RII	**R**	**RII**	**R**	**RII**	**R**	
Creating a competitive advantage	85.64	1	86.18	1	84.83	1	0.392
Increase the profitability	84.66	2	85.55	3	83.31	4	0.100
Improving staff motivation and working conditions	84.55	3	86.09	2	82.21	5	(0.013)
Improving customer satisfaction	84.33	4	84.45	5	84.14	2	0.731
Develop an Integrated Stakeholder Communication	84.22	5	84.36	6	84.00	3	0.694
Increase in organizational effectiveness	83.51	6	85.36	4	80.69	7	(0.001)
Flexibility to Change	82.47	7	82.73	7	82.07	6	0.473

The analysis also shows that there is no statistically significant difference between the views of consultants and contractors towards the most impact of innovation. According to the results of the Mann-Whitney U test, the p-values were greater than $\alpha = 0.05$ expect the p-value of “Improving staff motivation and working conditions” and “Increase in organizational effectiveness”, they are smaller than $\alpha = 0.05$. As shown in Table (4.4), consultants consider both of them can be achieved by applying innovation practices more than the consultants do. This result is justified, as engineering offices recognize the fact that providing good working conditions can increase in organizational effectiveness and decrease the employees’ turnover rate.

4.3.5 Interviews Analysis

As mentioned earlier in the research methodology, for identifying new factors about the drivers, enablers, barriers and impacts of innovation that reflects the real situation of PM in the Palestinian construction sector and that were not mentioned in the literature review, the research has used the qualitative methodological approach in data analysis. The summary of the pre-study structured interviews that was conducted with seven experts working in the construction industry and have an experience in their companies ranging from 20 to 30 years revealed that:

- Most **drivers** of innovation revolve around issues of responding to customer needs, reducing costs, reducing time, improving efficiency and improving quality.

- Most **enablers** of innovation is the presence of both creative engineers and skilled contractors that cooperate with each other to deliver the project that meet the needs of all stakeholders involved to complete it.
- Most **barriers** of innovation revolve around issues of lack of effective management, lack of communication and resistance to change.
- The **impact** of applying innovation can lead to a number of benefits such as client satisfaction, employee satisfaction, improvement of working conditions and innovation can also result in increased organizational productivity.

A summary of the structured interview results is presented in (Appendix C).

4.4 Bivariate Analysis

In this part of the analysis, some research hypotheses were examined to explore any possible significant differences in the innovation value chain items that can be attributed to the independent variables; respondent's position, years of experience in the construction field, and company's geographic location. The factors were linked together using bivariate analysis. Because data is not normally distributed, the bivariate analysis was calculated using Kruskal-Wallis test. The Kruskal-Wallis is the non-parametric version of ANOVA and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups. This test is based on assuming the null hypothesis (Ho) of existence of no significant relationship between two variables. The null hypothesis (Ho) is rejected if significance is less than $\propto = 0.05$.

$H1_0$: No statistically significant differences at $\alpha = 0.05$ in the importance of the key driver, enabler, barrier and impact of innovation in Palestine can be attributed to the position of the participants.

As shown in Table (4.5), Kruskal-Wallis H test shows that there is a statistically significant difference (P-value less than 0.05) according to the position of participants in the degree of importance of the driver of innovation (reducing costs), enabler of innovation (reward system) and the impact of innovation (creating a competitive advantage). However, there is no statistically significant difference (P-value = 0.43) according to the position of participants in the degree of importance of the key barrier of innovation (lack of effective management).

Table (4.5): Bivariate analysis according to the position of participants

Factor	Position	Rank	Chi-Square	Sig. (P- value)	Acceptance
Reducing cost as the main driver of innovation.	Engineer	197.23	17.80	0.000	Reject H_0
	Project Manager	216.32			
	Firm Manager	168.08			
Incentives, Reward and bonuses as the main enabler of innovation	Engineer	196.91	10.10	0.006	Reject H_0
	Project Manager	205.99			
	Firm Manager	171.51			
Lack of Effective Management as the main barrier of innovation	Engineer	194.36	1.69	0.430	Accept H_0
	Project Manager	185.92			
	Firm Manager	178.74			
Creating a competitive advantage as the main impact of innovation	Engineer	177.86	8.30	0.016	Reject H_0
	Project Manager	210.43			
	Firm Manager	175.64			

The results from the Kruskal-Wallis H test does not indicate which of the three groups (engineer, project manager and firm manager) differ from one another. To understand the differences, a post hoc test was conducted to test variation between the groups. Refering to Appendix D, there is a significant difference (P-value less than 0.05) in the degree of importance of the driver of innovation (reducing cost) only between firm manager and project manager (p = 0.0017). There is a significant difference (P-value less than 0.05) in the degree of importance of the enabler of innovation (reward system) between firm manager and project manager (p = 0.0076), as well as between engineer and firm manager (p = 0.0373). Furthermore, there is a significant difference (P-value less than 0.05) in the degree of importance of the impact of innovation (creating a competitive advantage) between firm manager and project manager (p = 0.0082), as well as between engineer and project manager (p = 0.0239).

$H2_0$: No statistically significant differences at $\alpha = 0.05$ in the importance of some selected items of innovation value chain can be attributed to years of experience in the construction field.

As shown in Table (4.6), Kruskal-Wallis H test shows that there are no statistically significant differences (P-value more than 0.05) according to the years of experience in the degree of importance of the three barriers of innovation: "work-life balance problems", "low salaries and job insecurity" and "Israel's occupation and related obstacles. However, there are a statistically significant difference (P-value less than 0.05) according to the years of experience in the degree of importance of the two enablers of innovation: "top management support" and "work experience". To understand the differences, a post hoc test was conducted to test variation between the groups. (Refering to Appendix D, there is a significant difference (P-value less than 0.05) in the degree of importance of the enabler of innovation (top management support) between (less than 5 years) and (more than 15 years) (p = 0.0073), as well as between (5-10 years) and (more than 15 years) (p = 0.0065). Furthermore, there is a significant difference (P-value less than 0.05) in the degree of importance of the enabler of innovation (work experience) between (less than 5 years) and (more than 15 years) (p = 0.0011).

Table (4.6): Bivariate analysis according to the experience in the construction field

Factor	Years of experience	Rank	Chi-Square	Sig. (P-value)	Acceptance
Top management support as enabler of innovation	less than 5	194.51	9.12	0.028	Reject H_0
	5-10	199.81			
	10-15	175.30			
	more than 15	165.23			
Work experience as enabler of innovation	less than 5	209.99	13.33	0.004	Reject H_0
	5-10	188.65			
	10-15	177.52			
	more than 15	162.57			
Work-life balance problems as barrier of innovation	less than 5	192.04	1.01	0.798	Accept H_0
	5-10	180.90			
	10-15	178.70			
	more than 15	179.91			
Low Salaries and Job Insecurity as barrier of innovation	less than 5	200.30	6.75	0.080	Accept H_0
	5-10	188.86			
	10-15	160.92			
	more than 15	174.06			
Israel's Occupation and Related Obstacles as barrier of innovation	less than 5	191.71	3.28	0.351	Accept H_0
	5-10	176.75			
	10-15	161.39			
	more than 15	188.65			

$H3_0$: No statistically significant differences at $\alpha = 0.05$ in the importance of one of the innovation value chain items can be attributed to the company's geographic location.

As shown in Table (4.7), according to the company's geographic location, the significant probability is 0.548 for the impact of innovation (Increase the profitability), thus we can't reject the null hypothesis.

Table (4.7): Bivariate analysis according to the company's geographic location

Factor	Location	Rank	Chi-Square	Sig. (P- value)	Acceptance
Increase the profitability as impact of innovation	Others	137.00	5.93	0.548	Accept H_0
	Jenin	210.56			
	Bethlehem	213.38			
	Jerusalem	162.27			
	Toulkarm	174.37			
	Hebron	175.27			
	Nablus	190.72			
	Ramallah	177.52			

Chapter Five

Framework Development

5.1 Chapter Overview

The construction industry has long been criticized for its conservatism and lack of innovation (Ozorhon et al., 2010). Moreover, the construction industry consistently scores poorly against standard measures of innovation (NESTA, 2006). Thus, the overall aim of this research is to explore the best innovation practices that are suitable for the construction industry and then to assess the extent these innovative practices are being practiced at construction and engineering firms in the WB-Palestine. According to the extensive literature review, besides the PMI's nine areas, this research including 26 innovation practices that have been all categorized into five main groups: (1) Strategic Management, (2) Stakeholders Management, (3) Internal Innovative Work Environment, (4) External Innovative Work Environment, and (5) Project Management. The researcher assumed that organizations wanting to improve their innovation performance should consider adopting similar practices. In this study, as shown in Figure (5.1), the relationships were established by assessing the correlations between these five constructs.

5.2 Hypotheses Testing

As shown in Figure (5.1), the research conceptual model consists of ten hypotheses. These hypotheses were tested in two sets of correlations. The first one tests the correlation among the four innovative practices and the second one tests the correlation between project management and each one of the innovative practices. The data was collected from a large scale survey of 365 actors in construction and engineering firms in WB-Palestine, and analyzed using the statistical software SPSS.

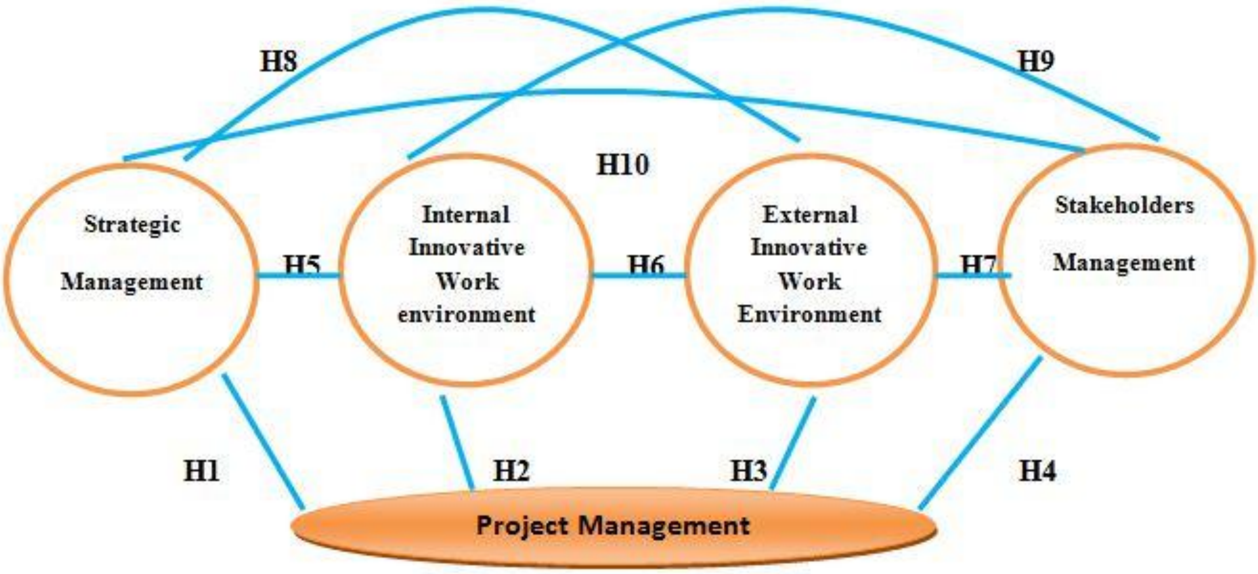


Figure (5.1): Research Conceptual Model

The bivariate correlations were calculated using the Spearman's correlation coefficient test. This test is based on assuming the null hypothesis (Ho) of existence of no significant relationship between the different groups. The null hypothesis (Ho) is rejected if significance is less than $\alpha = 0.05$.

- **Testing the Correlation among the Innovation Practices**

This section discusses the first set of correlations that describes the relationship among the four innovation practices: (1) strategic management, (2) internal innovative work environment, (3) external innovative work environment and (4) stakeholder management. Table (5.1) presents the Spearman's correlation coefficient among these four innovative practices. According to the results, all of the P-values are below $\propto = 0.05$, which means the rejection of (Ho) and the existence of significant relationships among the four innovation practices. Furthermore, the results show that "strategic management" and "stakeholders' management" have the greatest correlation (0.705). This result was also verified by Morrison and Wilson (1996). They argued that to create a favorable future, organization's stakeholders must be involved in envisioning the most desirable future and then in working together to make this vision a reality. Morrison and Wilson (1996) also mentioned that the key to strategic management is to understand that people communicating and working together will create this future, not some words written down on paper.

Table (5.1): Correlation Coefficient among innovation practices

Innovation Practices	Spearman's Correlation	Strategic Management	Stakeholders Management	Internal Innovative Work Environment	External Innovative Work Environment
Strategic Management	Correlation Coefficient	1.000*			
	P-value (Sig.)	0.000			
Stakeholders Management	Correlation Coefficient	**0.705***	1.000*		
	P-value (Sig.)	0.000	0.000		
Internal Innovative Work Environment	Correlation Coefficient	**0.634***	**0.697***	1.000*	
	P-value (Sig.)	0.000	0.000	0.000	
External Innovative Work Environment	Correlation Coefficient	**0.529***	**0.568***	**0.542***	1.000*
	P-value (Sig.)	0.000	0.000	0.000	0.000

* Spearman's Correlation is significant at the 0.05 level

- **Testing the Correlation between PM and Innovation Practices**

This section discusses the second set of correlations that describes the relationship between project management and each one of the innovative practices. Kavanagh and Naughton (2009) also addressed the link between innovation and project management. Their finding entails that increasing levels of project management positively correlate with increasing level of innovations, that effectively support an existence of a link between innovation and project management. However, after a certain threshold, very high levels of project management become negatively correlated with innovation. As an explanation of this phenomenon, Kavanagh and Naughton (2009) suggest that formal methods of project management can facilitate exploitation of existing knowledge, but hinder the exploration of new ones. Table (5.2) presents the Spearman's correlation coefficient between the project management and each one of the innovative practices. According to the results, all of the P-values are below $\propto = 0.05$, which means the rejection of (Ho) and that all innovative practices are positively related to project management. Moreover, the results show that “stakeholder management” and “project management” have the greatest correlation (0.661), which means that successful project management requires effective controlling and alignment with stakeholder management, especially in the construction sector. Both “Guidelines to the Project Management Body of Knowledge (PMI, 2008), and “Swedish Standard, SS-ISO 10006” (SS- ISO, 1998) have also emphasized the importance of identifying and managing all relevant stakeholders in order to ensure the success of a project.

Table (5.2): Correlation Coefficient among innovation PM practices

Innovation Practices	Spearman's Correlation	Project Management
Strategic Management	Correlation Coefficient	**0.629***
	P-value (Sig.)	0.000
Stakeholders Management	Correlation Coefficient	**0.661***
	P-value (Sig.)	0.000
Internal Innovative Work Environment	Correlation Coefficient	**0.641***
	P-value (Sig.)	0.000
External Innovative Work Environment	Correlation Coefficient	**0.550***
	P-value (Sig.)	0.000

* Spearman's Correlation is significant at the 0.05 level

In general, the correlation coefficients reported for both sets of correlations indicate the significance of innovative practices and project management. Therefore, the nine proposed hypotheses in the research conceptual model are accepted and summarized in Figure (5.2).

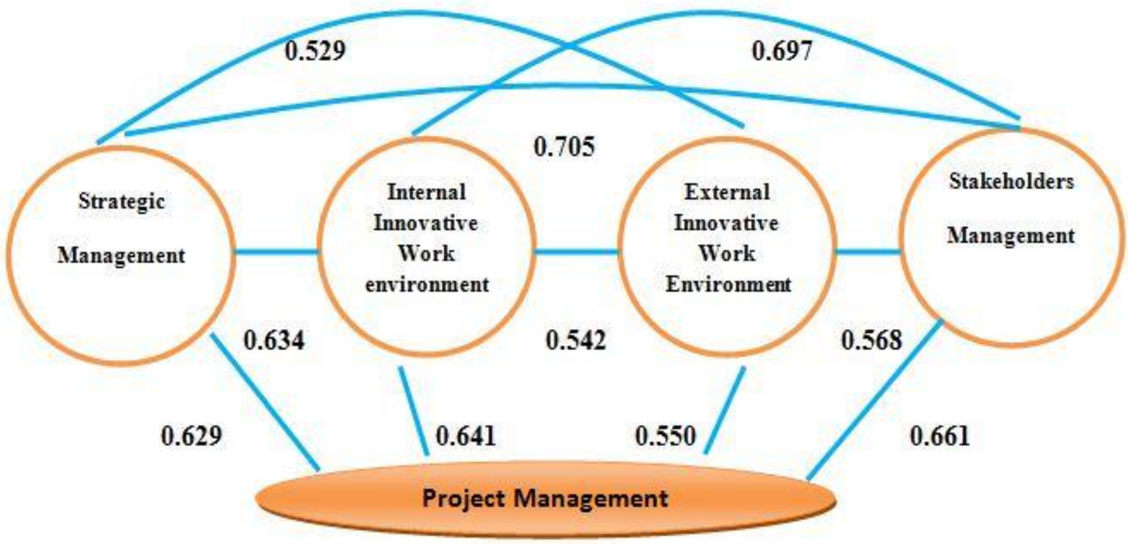


Figure (5.2): Hypothesis Testing

As a result, the findings of this research effectively supported an existence of a link between innovation and project management and proved that project management, when integrated with innovative practices, can enable organizations have competitive advantage and, at the end, lead to real successful construction projects, from a point view of all stakeholders involved.

Based on the above, the main research hypothesis is accepted:

"Innovation correlates positively with Project Management"

5.3 Innovation Assessment

To assess the extent of innovation practices in construction and engineering firms in WB- Palestine, respondents were asked to rank the degree to which each survey item was practiced at their companies using a five- point Likert scale. Respondents chose one of each of the following responses for each survey item: (1) not at all, (2) to a slight degree, (3) to a moderate extent, (4) to a great extent, and (5) to a very great extent. The application degree of each practice was identified by classifying the response averages into five degrees. These degrees, which are based on five intervals were calculated as follows: the interval length was calculated by dividing the response range (5 which corresponds to a very great extent minus 1 which corresponds to not at all) by the number of intervals which is 5, as follows: (5-1) /5= 0.8, Table (5.3) shows the intervals and there represented scaling degrees used in the research.

Table (5.3): Scaling Degrees

Interval	**Degree**
1.00-1.80	Very low
> 1.80-2.60	low
> 2.60-3.40	moderate
> 3.40-4.20	High
> 4.20-5.00	Very High

As shown in Table (5.4), descriptive statistics were used to get means, standard deviation and application degree for each practice. As well as Mann Whitney U statistic was used to show if there is a significant degree of agreement among the construction and engineering firms. This test is based on assuming null hypotheses (Ho) of existence of no significant difference in the degree of application. The null hypothesis (Ho) is rejected if significance is less than $\propto = 0.05$.

Table (5.4): Application Degree for Best Innovation Practices ranked in descending order

Rank	Innovation practices	Mean	Standard Deviation	Application Degree	P-Value (Sig.)
1	Stakeholder Management	3.78	0.767	High	(0.002)
2	External Innovative Working Environment	3.69	0.732	High	0.157
3	Project Management	3.60	0.897	High	0.613
4	Strategic Management	3.52	0.888	High	0.121
5	Internal Innovative Working Environment	3.42	0.971	High	0.700
	Total	3.60	0.704	High	0.119

In light of the above analysis, it can be noticed that the total average response to the innovation is (3.60) out of (5.00) which is considered high. Therefore, we can say that there is a high degree of innovation in the construction industry in WB-Palestine. All the five (5) practices are incidentally accepted, since they all have mean scores greater than (3.4) on a 5-point Likert scale. The findings reveal that the practice for which companies are most appropriate for the implementation is “stakeholders’ management”, followed in order by external innovative working environment, project management, strategic management, and internal innovative working environment. Unfortunately, the findings show that the factors that contribute least to the innovation are internal work environmental related, such as: innovative culture, top management support, training for employees, motivation and reward systems. As a result, creating the appropriate conditions for employees is one mean by which innovation can be fostered. By the interpretation of the P-values, it is observed that the P-values for all practices are greater than $\alpha = 0.05$, except the P-value of “stakeholders management”, it is smaller than $\alpha = 0.05$. This result is justified, as consultants, not contractors, often make stakeholders management during the preliminary design stage (Architecture Vision) to identify the key players to design and construct a specific project.

Based on the above, there is sufficient information to accept the Null Hypothesis and to declare that there is almost no difference between the two groups in terms of applying innovation practices in Palestinian construction sector. Table (5.5) outlines the means of the all practices under their related groups.

From the findings, it can be observed that the top five practices that have been applied in Palestinian construction sectors are:

(1) Dealing with social and environmental variables (3.95).

(2) Identifying stakeholders (3.90).

(3) Ensuring effective communication between stakeholders (3.85).

(4) Evaluation the stakeholders' satisfaction (3.84).

(5) Exploring stakeholders' needs and constraints to projects (3.82).

It can be noticed that most of these factors are related to stakeholders' management group. On the other side, the least five practices have been applied in Palestinian construction sectors are:

(1) Provide training for employees (3.16).

(2) Provide rewards and recognition for creative work (3.17).

(3) Conducting external audit "Opportunities & Threats"(3.35).

(4) Conducting internal audit "Strength & Weakness" (3.36).

(5) Dynamic, open minded and supportive top management (3.38).

It can be noticed that these factors are related to strategic management and internal innovative work environment.

Table (5.5): Application Degree for Innovation Practices

Innovation Project Management Best Practices			
Strategic Management			**Mean**
Establishing a vision which embraces innovation			3.81
Establishing SMART objectives			3.62
Formulating Strategies			3.84
Conducting internal audit "Strength & Weakness"			3.36
Conducting external audit "Opportunities & Threats"			3.35
Total			**3.52**
Internal Innovative Working Environment	**Mean**	**External Innovative Working Environment**	**Mean**
Provide rewards and recognition for creative work	3.17	Dealing with economic and political variables	3.81
Dynamic, open minded and supportive top management	3.38	Responding to change in customer needs	3.64
Provide innovative culture	3.52	Utilization of new technology	3.56
Provide appropriate internal conditions for workers	3.61	Dealing with social and environmental variables	3.95
Provide training for employees	3.16	Communicate with competitors	3.61
Workloads are managed	3.46	Reacting to market changes	3.58
Employee motivation and job satisfaction	3.64	Collaborate and communicate with suppliers	3.69
Total	**3.42**	**Total**	**3.69**
Project Management	**Mean**	**Stakeholder's Management**	**Mean**
Integration Management	3.84	Identifying Stakeholders	3.90
Quality Management	3.71	Exploring stakeholders' needs and constraints to projects	3.82
Cost Management	3.73	Analyzing conflicts among stakeholders	3.66
Time Management	3.66	Ensuring effective communication	3.85
Scope Management	3.54	Evaluation the stakeholder satisfaction	3.84
Communication Management	3.51	Stakeholder involvement in decision-making	3.69
Procurement Management	3.68	Keeping and promoting an ongoing relationship with stakeholders	3.67
HR Management	3.55		
Crisis Management	3.53		
Total	**3.60**	**Total**	**3.78**

5.4 Interview Analysis

Based on the after-study semi-structured interviews that conducted with seven professionals working in the construction industry in order to explain and verify the results as mentioned earlier in the research methodology, the major points of these interviews can be summarized as follows:

- Most of interviewees argued that the degree of application of innovative practices is to some extent low and the state of project management in the construction needs to be strengthened. This is because the construction industry has complexity in nature and contains a large number of stakeholders.

- Most of the interviewees agreed that there is a strong relationship between project management and innovation. Moreover, they argued that high level of innovation would lead to reduce deficiencies in construction project management.

- Most of the interviewees revealed that innovation needs a greater interest of all stakeholders involved to complete a construction project, especially the managers and the owners of engineering and construction firms.
- Most of the interviewees agreed that internal innovative work environment, especially top management support is the most powerful practice for innovation. On the other side, some found that strategic

management is the most critical factor for the successful construction projects.

- Most of the interviewees argued that strong cooperation between the engineer, contractor and construction client is recognized as important to facilitate innovativeness and that construction client is perceived as having the greatest influence on innovativeness.
- Most of the interviewees recommended that top managers must be aware about the positive impacts of innovation and actively participate in its implementation rather than resisting it.
- Most of the interviewees argued that through training and development, employees could acquire the knowledge and skills needed for doing their particular jobs. It also increases their commitment, motivation, and reduces employee turnover.
- Finally, all interviewees argued that project management can be improved if the construction industry is more innovative.

5.5 Framework Development

Based on literature reviews and findings of the research conceptual model, the researcher devised a framework to be applied in the engineering and construction firms. The framework is intended to be an effective management tool for supporting construction project management. It gives the potential for the managers to enhance their project management process and enables them to cope with changes and developments in both external and internal environment. This framework could also be used in a field that has something to do with project management. According to Levitt (2002), in order to have innovation project management, successful innovation requires more than just putting creative people in a room and hoping they come up with valuable new products or processes. So as shown in Figure (5.3), the framework rests on a foundation of five building blocks comprises four main levels for achieving innovation in construction: *Strategic Management* at the top of the schematic, *Internal Innovative Work Environment and External Innovative Work Environment* in the middle part of the framework and at the end of the framework both *Stakeholders Management and Project Management*.

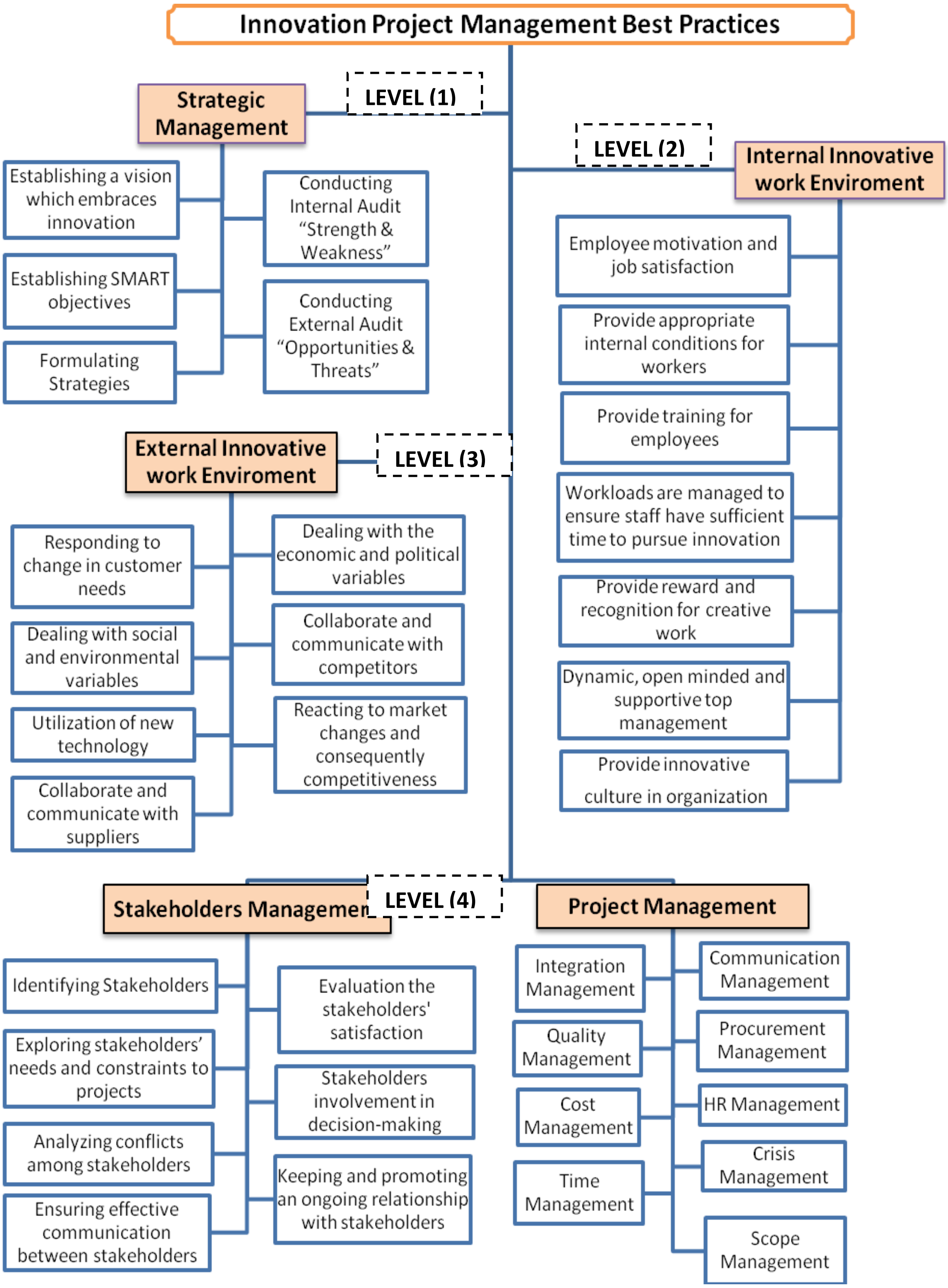


Figure (5.3): Conceptual Framework for Project Management Innovation

Level One: Strategic Management.

At the beginning, each organization, whatever its business, should focus on specific areas of interest by making strategic management. Without a clear vision, mission and objectives, organizations cannot survive in such turbulent environment, especially the construction environment. Therefore, organizations need to have:

- ✓ A clear vision that embraces innovation besides defining the optimal desired future state to what an organization is focused on achieving in five, ten, or more years.
- ✓ A reason for existence by developing SMART objectives. A SMART objective is Specific, Measurable, Achievable, Realistic and Time scaled.
- ✓ A defined strategy to chart the directions to achieve the objectives within a timeframe and to establish a roadmap for success.

Level Two: Internal Innovative Work Environment.

After doing strategic management and before looking for enhancing the external environment, top managers have to provide an internal innovative work environment for all individuals within the organization. They must start with building strong relationships between the employees and managers, based on trust, honesty and mutual interests.

Research has shown that enhancing construction industry requires a good internal atmosphere and innovative culture to motivate staff to think in creative ways and requires open minded and supportive top management to create the challenge and push people to think out of the box. Moreover, for continuous improvement, organizations need to provide reward and recognition for creative work besides offering the sufficient requirements and training for their employees.

Level Three: External Innovative Work Environment.

To make tangible improvements and to be competitive in the market place, where technology is changing fast and customers become more sophisticated; companies need to create external innovative work environment. They need to cope with changes and react to the external forces of change, such as customers, competitors, suppliers, technology, economic, social, environmental and political variables.

Level Four: Effective Stakeholder Management and Project Management

Project management and stakeholders' management must work in an integrated manner to ensure success, project managers must have a capability in managing both in parallel. Project management provides project managers with the capabilities needed to manage the scope, time, cost, quality, risk and procurement necessary to accomplish all interrelated tasks. It also provides a guide for integration management, as well as human resource management and communications management to identify the most suitable approach to complete projects. However, project success is tied to effectively communicate and manage relationships with the various stakeholders of the project. This makes stakeholder management an important issue in project management (Assudani & Kloppenborg, 2010). Effective communication creates a bridge between diverse stakeholders involved in a project, connecting various cultural and organizational backgrounds, different levels of expertise, and various perspectives and interests in the project execution or outcome (Čulo & Skendrović, 2010). Thus, in order to ensure the success of construction projects, challenging project management, including innovation, should be integrated with effective stakeholder management.

Chapter Six

Conclusions &Recommendations

6.1 Chapter Overview

This chapter finalizes the thesis by providing conclusions of the research, recommendations to the construction industry practitioners, and suggestions for further research.

6.2 Conclusions

This research has one primary aim and two objectives, which were achieved through an exploratory research inquiry of structured questionnaires with interviews.

- ***The main aim of this research*** *is to assess the extent of applying the innovation practices in WB- Palestine in construction and engineering firms.*

According to the quantitative statistical analysis done by 365 actors in construction and engineering firms in WB-Palestine, the total average response to the innovation is (3.60) out of (5.00) which is considered high. Therefore, we can say that there is a high degree of innovation in Palestinian construction industry.

The following illustrate how each of the objectives of the study is established.

- ***Objective 1****: Present a clear picture of the relative importance of the key drivers, barriers, enablers and impacts of innovation along the construction innovation value chain.*

To consider objective one, the research work began with the review of the previous studies done in the field of innovation value chain. Innovation was investigated in terms of its drivers, enablers, barriers, and impacts. After that, the innovation value chain model was developed as shown in Figure (6.1). Based on the literature review and the local situation in Palestine, this research assumes (7) drivers, (7) enablers, (15) barriers and (7) impacts of innovation in construction where the results of the analysis showed that:

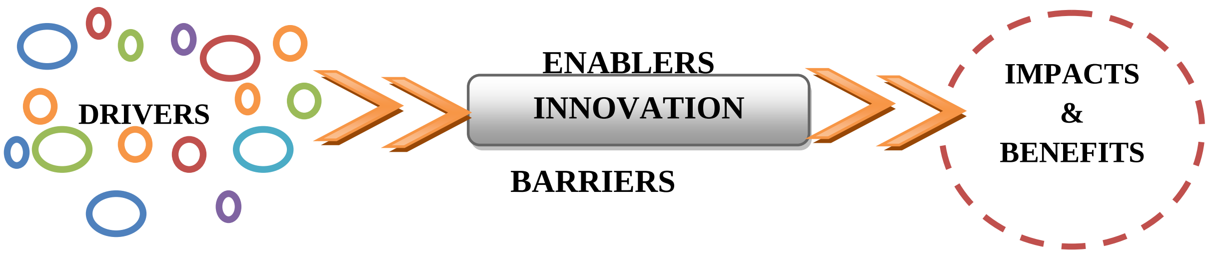


Figure (6.1): Innovation Value Chain Model

1. "Reducing costs" is the main driver of innovation. Followed in order by reducing time, improving quality, competition, improving efficiency/productivity, responding to client/customer needs, and rapid development of technology, as shown in Table (4.1).

2. "Incentives, rewards and bonuses system" is the main enabler of innovation. Followed in order by organizational innovative culture,

involvement of the client, top management support, training and development, work experience, and leadership, as shown in Table (4.2).

3. "Lack of effective management" is the main barrier of innovation. Followed in order by time pressure, limited budget, poor coordination and communication between project participants, construction clients' lack of interest in innovations, low salaries and job insecurity, inadequate planning, content with success and fear of the unknown, work overload or under load, work-life balance problems, lack of collaboration due to competition, and accidents during construction. Consequently, the research established that too many restrictive building codes, lack of required construction material/ tools/equipments and Israel's occupation have the least effect on limiting innovation in construction, as shown in Table (4.3).

4. "Creating a competitive advantage" is the best impact of innovation. Followed closely in order by increase the profitability, improving staff motivation and working conditions, improving customer satisfaction, develop an integrated stakeholder communication, increase in organizational effectiveness, and flexibility to change, as shown in Table (4.4).

- ***Objective 2****: Investigate the best innovation practices that must be integrated with project management applications in order to enhance project management competencies.*

To consider objective two, a conceptual model was developed based on an extensive literature review done in the fields of innovation and project management. According to the literature review, besides the PMI's nine areas, this research, including 26 innovative practices that have been all categorized into five main groups: (1) Strategic Management, (2) Stakeholders Management, (3) Internal Innovative Work Environment, (4) External Innovative Work Environment and (5) Project Management. In this study, as shown in Figure (6.2), the relationships were established by assessing the correlations between these five constructs.

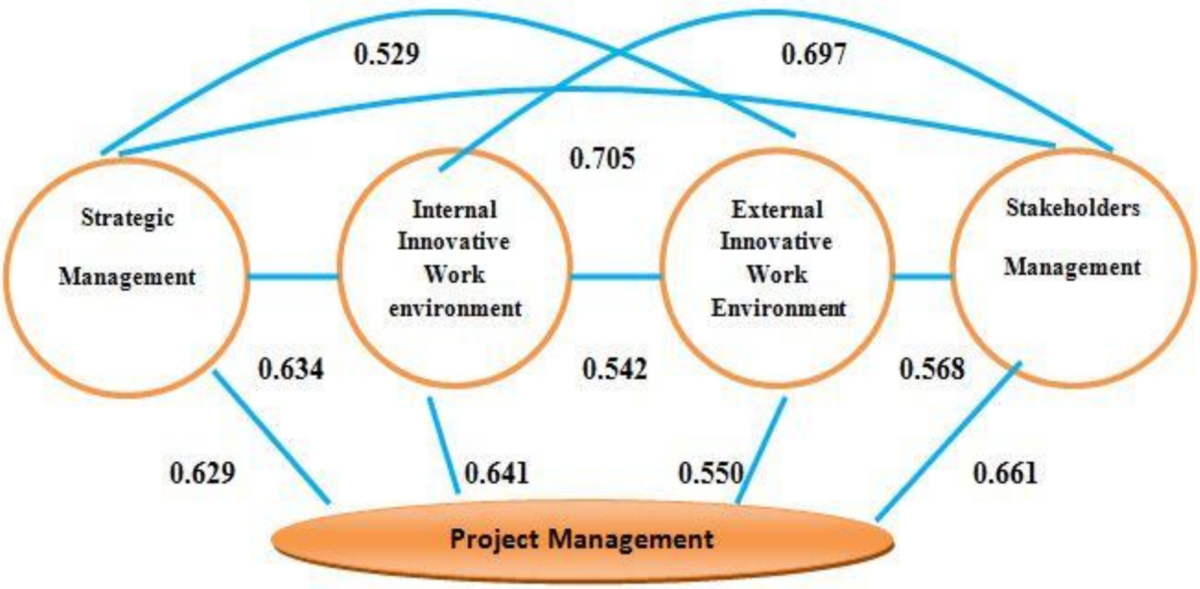


Figure (6.2): Research Conceptual Model - Hypotheses Testing

In general, the results of hypotheses testing showed that there is a statistically significant relationship at a significant level ($\alpha \leq 0.05$) between the five practices. Therefore, the best innovation project management practices, as they shown earlier in Table (5.1), are:

1. Strategic Management
2. Stakeholders' Management
3. Internal Innovative Work Environment
4. External Innovative Work Environment
5. Project Management

6.3 Research Contribution

The findings of this research constitute a basis for construction and engineering firms to enhance their construction project management. It provides a useful framework intended to allow companies to learn about innovation project management best practices that offer a roadmap for sustainable competitive advantage. It also assist companies in understanding their current level of innovation to help them in clarify their strengths and weaknesses.

6.4 Recommendations

Research has shown that companies with high level of innovation are more likely to have higher project management competencies. Thus, the study proposes a set of recommendations to the construction industry practitioners to improve their project management performance:

- The construction project is complex and has interconnected nature; it is a collaborative work from different stakeholders who have different interests and expectations. Managers are, therefore, of critical importance to create a good relationship with all related stakeholders in order to be capable of meeting their expectations.

- Top managers must be aware about the positive impacts of innovation and participate actively to implement it rather than to resist it.
- Unfortunately, the findings show that the factors that contribute least to the innovation are internal work environmental related. So, in order to make tangible improvements in Palestinian construction project, organizations need to recognize that improving innovation requires internal innovative environmental work, such as: innovative culture, top management support, training for employees, motivation and reward systems.
- Top managers need to cope with changes and react to the external forces of change, such as customers, competitors, suppliers, technology, economic, social, environmental, and political variables.
- It is necessary for organizations to monitor and evaluate their level of innovation. Such monitoring and evaluation is very important to assist them in understanding their strengths and weakness and so to enhance their capabilities in the current dynamic environment where change is the only constant truth.
- To sum up, it is worthwhile to integrate innovation practices with project management applications to maximize the success of construction projects. Thus, it is necessary to take an integrated view of

the five innovation PM practices in order to improve the companies' ability to innovate.

Finally, the conceptual framework for project management innovation shown in Figure (5.3) is recommended to be used in a field that has something to do with project management.

6.5 Suggestions for Future Research

One of the main limitations of this research was the lack of prior research studies on the subject "*Innovation Practices in Project Management*" which is considered relatively new to the construction industry. This presents an important opportunity for other researchers to explore more innovation practices from other perspectives.

In addition, the assessment of innovation was limited to the selected sample of consulting and contracting firms. It is recommended that future researches expand the study for projects' owners such as government, agencies, ministries, municipalities and international agencies. It is also recommended to evaluate the innovation practices in project management as a case study of construction projects in the Palestine.

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Appendix (A)

An-Najah National University
Faculty of Graduates Studies
Engineering Management Program

Questionnaire about Assessing Innovation Practices in Project Management: the case of Palestinian Construction Projects

Dear Respondent,
Thank you for finding time for filling in this *questionnaire*. The main aim of this research is to assess the innovation practices in the Palestinian construction sector. This *questionnaire* is divided into two parts. The first part is intended to investigate the basic components of the innovation including the drivers, enablers, barriers, and outcomes. The second part is ranking questions that are intended to assess the innovation ability of construction firms. Such evaluation is very important to improve project performance. It should take around 10 minutes to complete the questionnaire. Your cooperation is highly appreciated. Please be assured that the information in this questionnaire will be used only for academic research.

Prepared by: eng. Rawan AL-Bajjeh

Part One: General Questions

1. **Gender**: ☐ Male ☐ Female

2. **Professional Work Experience in Construction Sector (years):**

☐ less than 5 ☐ 5-10 ☐ 10-15 ☐ 15-20 ☐ more than 20

3. **Place of work:**

☐ Ramallah ☐ Bethlehem ☐ Hebron ☐ Toulkarm

☐ Nablus ☐ Jenin ☐ Jerusalem ☐ Others

4. **Type of organization you are working in/for:**

☐ Consulting/ Engineering organization ☐ Contracting organization

5. **What description best suits your position?**

☐ Firm Manager ☐ Project Manager ☐ Engineer ☐ Others

6. How important is innovation for the future of construction?

☐ Not Important ☐ Important ☐ Very important

Part Two: Ranking Questions

- Phase One: To identify the key drivers, enablers, barriers and outcomes to innovation in construction sector, for each item choose the rank from (1-5)

Note: (1) Affects with little degree, (2) Affects something, (3) Affects with average degree, (4) Affects with large degree, and (5) Affects with very large degree.

	➢ **Drivers of Innovation** **To what extent do the following factors create the need for your organization to innovate?**	**Rank**				
		1	**2**	**3**	**4**	**5**
1	Reducing cost					
2	Reducing time					
3	Improving quality					
4	Competition					
5	Improving efficiency/ productivity					
6	Responding to client/ customer needs					
7	Rapid development of technology					
	➢ **Enablers of Innovation** **To what extent do the following factors help promote innovation within your organization?**	**Rank**				
		1	**2**	**3**	**4**	**5**
1	Incentives, Reward and bonuses					
2	Organizational innovative culture					
3	Involvement of the client					
4	Top management Support					
5	Training and development					
6	Work experience					
7	Leadership					
	➢ **Barrier of innovation** **To what extent do the following factors limit innovation within your organization?**	**Rank**				
		1	**2**	**3**	**4**	**5**
1	Lack of Effective Management					

2	Time pressure and deadlines					
3	Limited budget					
4	Poor coordination and communication between participants					
5	Construction clients lack of interest in innovations					
6	Low Salaries and Job Insecurity					
7	Inadequate planning					
8	Content with Success and Fear of Unknown					
9	Work overload or under load					
10	Work-life balance problems					
11	Lack of collaboration due to competition					
12	Accidents during construction					
13	Too many Restrictive Building Codes					
14	Lack of required construction material/ tools/equipments					
15	Israel's Occupation and Related Obstacles					
	➢ **Benefits/Outcomes of innovation** **To what extent does your organization derive the following outcomes of innovation?**	**Rank**				
		1	**2**	**3**	**4**	**5**
1	Creating competitive advantage					
2	Increase the profitability					
3	Improving staff motivation and working conditions					
4	Improving customer satisfaction					
5	Develop an Integrated Stakeholder Communication					
6	Increase in organizational effectiveness					
7	Flexibility to Change					

- **Phase Two: To assess for innovativeness, for every item choose the level that most accurately describes your organization**

Note: (1) Not at all, (2) To a slight degree, (3) To a moderate extent, (4) To a great extent, and (5) To a very great extent.

Innovation Best Practices		Level				
Factor #1: Strategic Management		**1**	**2**	**3**	**4**	**5**
1	Establishing a vision which embraces innovation					
2	Establishing SMART objectives					
3	Formulating strategies					
4	Conducting internal audit “Strength & Weakness”					
5	Conducting external audit “Opportunities & Threats”					
Factor #2: Stakeholders’ Management		**1**	**2**	**3**	**4**	**5**
1	Identifying Stakeholders					
2	Exploring stakeholders’ needs and constraints to projects					
3	Analyzing conflicts among stakeholders					
4	Ensuring effective communication between stakeholders					
5	Evaluation the stakeholder satisfaction					
6	Stakeholder involvement in decision-making					
7	Keeping and promoting an ongoing relationship with stakeholders					
Factor #3: Internal Innovative Working Environment		**1**	**2**	**3**	**4**	**5**
1	Provide reward and recognition for creative work					
2	Provide appropriate internal conditions for workers in terms of ventilation, lighting, services, tools, etc.					
3	Provide innovative culture in the organization					
4	Employee motivation and job satisfaction					
5	Dynamic, open minded and supportive top management					
6	Workloads are managed to ensure staff have sufficient time to pursue innovation					
7	Provide training for employees					
Factor #4: External Innovative Working Environment		**1**	**2**	**3**	**4**	**5**
1	Responding to change in customer needs					

2	Utilization of new technology					
3	Dealing with social and environmental variables					
4	Dealing with the economic and political variables					
5	Collaborate and communicate with competitors					
6	Collaborate and communicate with suppliers					
7	Reactivity to market changes and consequently competitiveness					
	Factor #5: Project Management	**1**	**2**	**3**	**4**	**5**
1	Integration Management					
2	Quality Management					
3	Cost Management					
4	Time Management					
5	Scope Management					
6	Communication Management					
7	Procurement Management					
8	Human Resources Management					
9	Risk Management					

****If you have any question, contact me at “eng.rawan888@hotmail.com”*

Appendix (B)

جامعة النجاح الوطنية
كلية الدراسات العليا
قسم الإدارة الهندسية

الموضوع: طلب تعبئة استبيانة

تقييم مستوى الإبداع والابتكار في إدارة المشاريع
(دراسة تطبيقية على المشاريع الإنشائية الفلسطينية)

عزيزي القارئ:
أشكرك على تخصيص جزء من وقتك لتعبئة هذ ه الاستبيانة، التي تهدف إلى تقييم مستوى الإبتكار والإبداع في إدارة المشاريع الهندسية الفلسطينية، وذلك استكمالا لمتطلبات الحصول على درجة الماجستير. ينقسم هذا الاستبيان إلى قسمين: القسم الأول يهدف إلى معرفة الجوانب الأساسية للإبتكار والإبداع في المشاريع الإنشائية والتي تشمل المحفزات، العوامل المساعدة، العوائق، والنتائج. أما القسم الثاني فهو يهدف إلى تقييم مستوى الإبتكار لدى الشركات المؤهلة من قبل اتحاد المقاولين ونقابة المهندسين. هذا التقييم سوف يستغرق منك حوالي 10 دقائق لإتمامه. الرجاء التفضل بقراءة جميع فقرات الاستبيان بدقة، ووضع الدرجة التي تراها مناسبة أمام كل فقرة بموضوعية وحياد. علما بأن كافة المعلومات سوف تكون سرية ولن تستخدم إلا لأغراض البحث العلمي.

الباحثة: م. روان البجة
بإشراف د. أيهم جعرون

أولاً: معلومات عامة

يرجى التكرم بالإجابة على الأسئلة التالية بوضع إشارة (X) في مربع الإجابة التي تناسبك.

1. **الجنس** ☐ ذكر ☐ أنثى

2. **عدد سنوات الخبرة**

☐ أقل من 5 سنوات ☐ 5-10 سنوات ☐ 10-15 سنة ☐ 15-20 سنة ☐ 20 سنة وأكثر

3. **مكان العمل**

☐ رام الله ☐ نابلس ☐ طولكرم ☐ جنين

☐ بيت لحم ☐ الخليل ☐ القدس ☐ غير ذلك

4. **نوع المؤسسة**

☐ مكتب هندسي/ استشاري ☐ شركة مقاولات ☐ غير ذلك

5. **المسمى الوظيفي**

☐ مدير عام ☐ مدير مشروع ☐ مهندس ☐ غير ذلك

6. ما مدى أهمية الإبداع والإبتكار لمستقبل المشاريع الإنشائية في قطاع البناء والتشييد في الضفة الغربية

☐ غير مهم ☐ مهم ☐ مهم جدا

ثانيا: جوانب الإبداع والإبتكار في إدارة المشاريع الإنشائية

إلى أي مدى توافق على العبارات التالية الرجاء وضع إشارة (x) في مربع الخيار الذي يناسبك	درجة الموافقة				
العبارات	**أوافق بشدة**	**أوافق**	**محايد**	**لا أوافق**	**لا أوافق بشدة**
دوافع الإبداع والإبتكار إلى أي مدى هذه الدوافع تشجع وتحفز على ابتكار الأفكار والإبداع في العمل؟					
تقليل تكلفة المشروع					
تقليل وقت المشروع					
تحسين جودة المشروع					
الحاجة إلى تحسين الأداء (تخفيض التكاليف وزيادة الإنتاجية والكفاءة)					
المنافسة في سوق العمل					
التطور السريع للتكنولوجيا					
القدرة على الاستجابة لمتطلبات الزبائن المتجددة والمتنوعة					
العوامل المساعدة على تعزيز الإبداع والإبتكار إلى أي مدى هذه العوامل تساعد على تعزيز الإبداع والإبتكار داخل الشركة؟					
الخبرة في مجال العمل					
منح الحوافز المادية والمعنوية للمبدعين في العمل					
ثقافة الشركة التي تشجع على الابداع في العمل					
التنسيق بين المالك وباقي أطراف المشروع					
الحصول على دعم الجهات الادارية العليا					
تدريب الموارد البشرية بالمهارات الجديدة اللازمة للمشروع					
توفر المهارات القيادية لدى مدير المشروع					
المعوقات التي تحد من الإبداع والابتكار إلى أي مدى هذه العوامل تعيق وتمنع ابتكار الأفكار والإبداع في العمل ؟					
مقاومة التغيير وتفضيل حالة الاستقرار					

سوء الإدارة					
انخفاض الأجور وانعدام الاستقرار الوظيفي					
قوانين البناء المستجدة والروتين الإداري					
عدم تطبيق الاستراتيجيات بناءا على التخطيط المسبق					
عدم استقرار حجم العمل (ضغط العمل/ قلة العمل)					
التواصل الضعيف بين أطراف المشروع					
عدم توفر مواد البناء التي تساعد على الابداع والابتكار في العمل					
عدم وجود روح المنافسة (المنافسة في العطاءات)					
الاحتلال الإسرائيلي وما يتصل به من العقبات					
عدم القدرة على الحفاظ على نوع من التوازن بين العمل والحياة					
عدم اهتمام مالك المشروع بالابداع والابتكار في العمل					
ضيق الوقت المخصص لتسليم المشروع					
زيادة نسبة الحوادث المسجلة في المشاريع الانشائية					
الميزانية المحدودة للمشروع					
نتائج واثار الإبداع والابتكار إلى أي مدى هذه الفوائد مرتبطة بالإبداع والابتكار؟					
تحسين الأداء بشكل جذري أو تدريجي					
زيادة الأرباح					
رفع مستوى رضا الزبائن					
رفع مستوى التفاعل والمشاركة بين الموظفين					
مراعاة أفضل لمطالب ومصالح كافة أطراف المشروع					
الحصول على ميزة تنافسية في سوق العمل					
المرونة وسرعة التأقلم مع التغيرات الطارئة على سوق العمل					

ثالثا: درجة تطبيق عناصر الإبتكار والإبداع لدى الشركات العاملة في المشاريع الإنشائية

ما هي درجة قيام الشركة التي تعمل فيها بالأمور التالية الرجاء وضع إشارة (x) أسفل الدرجة الّتي تعبر عن مستوى الشركة	الدرجة (1-5)				
	بدرجة كبيرة جدا	بدرجة كبيرة	بدرجة متوسطة	بدرجة قليلة	بدرجة قليلة جدا
معايير التقويم	**5**	**4**	**3**	**2**	**1**
1. التخطيط الاستراتيجي					
رؤية ورسالة الشركة واضحة ومفهومة من قبل العاملين فيها					
صياغة أهداف طويلة وقصيرة المدى مبنية على مؤشرات قياس دقيقة					
تحليل البيئة الداخلية (نقاط القوة والضعف)					
تحليل البيئة الخارجية (الفرص والتهديدات)					
وضع السياسات الإدارية والتنفيذية لدعم مراحل التنفيذ					
إدارة ذوي العلاقة في المشاريع الانشائية (المالك، المهندس/ الاستشاري، المقاول الرئيسي، المقاول الفرعي، مدير المشروع، المورّد)					
تحديد من هم ذوي العلاقة وأصحاب المصلحة في المشروع					
تحديد احتياجات وتوقعات ذوي العلاقة في المشروع					
المحافظة وتعزيز العلاقات الجيدة مع ذوي العلاقة					
تقيم وقياس مدى رضا ذوي العلاقة عن تحقق توقعاتهم من المشروع					
إشراك ذوي العلاقة في اتخاذ القرارات					
القدرة على إدارة الخلافات والتضارب في الأهداف					
2. توافر البيئة الداخلية الملائمة للعمل الإبداعي					
وجود ثقافة الابداع داخل الشركة					
توفر الظروف الداخلية المناسبة للعاملين من حيث التهوية والإضاءة والخدمات والأدوات...					
توزيع المهام بين العاملين توزيعا عادلا بما يتناسب مع قدراتهم وتخصصاتهم					
تزويد العاملين بالبرامج التدريبية والورش التطبيقية التي تتواءم مع طبيعة عملهم					
الإدارة العليا تـنشر روح الإبداع والإبتكار بين الأفراد					
تقديم الحوافز والمكافآت والعلاوات					
3. توافر البيئة الخارجية الملائمة للعمل الإبداعي					
القدرة على التجاوب مع التغيير في احتياجات الزبون وتوقعاته					

التعامل والتواصل مع المنافسين					
التعامل والتواصل مع الموردين					
التفاعل مع تغيرات السوق، وبالتالي القدرة على المنافسة					
التعامل مع المتغيرات الاقتصادية والسياسية التي تؤثر على سوق العمل					
التعامل مع المتغيرات البيئية والاجتماعية التي تؤثر على سوق العمل					
مواكبة التكنولوجيا والحداثة					
4. مجالات المعرفة المتعلقة بإدارة المشاريع					
إدارة التكامل (Integration Management)					
إدارة الجودة (Quality Management)					
إدارة الكلفة (Cost Management)					
إدارة الوقت (Time Management)					
إدارة نطاق المشروع (Scope Management)					
إدارة التواصل (Communication Management)					
إدارة المشتريات (Procurement Management)					
إدارة الموارد البشرية (Human Resources Management)					
إدارة المخاطر (Crisis Management)					

شكراً على حسن تعاونكم

للتواصل على الإيميل: *eng.rawan888@hotmail.com*

Appendix (C)

The Structured Interviews

Dear Sir:

This interview will be conducted with some experts in the WB- Palestine as a tool for a thesis degree in Engineering Management in order to identify the drivers, enablers, barriers and impacts of innovation that reflects the real situation of PM in the Palestinian construction sector.

The information in this interview will be used only for academic research, with a complete commitment to absolute confidence.

Researcher: Rawan Khader Ghaben

Supervisor: Dr. Ayham Jaaron

- **Name:**
- **Position:**
- **Experience in Construction Field:**
- **Questions asked to experts in the interviews:**

1. What are the key drivers of innovation in the construction industry?
2. What are the key enablers of innovation in the construction industry?
3. What are the key barriers of innovation in the construction industry?
4. What are the key impacts of innovation in the construction industry?

Summary of the Interviews

	Drivers of Innovation	Enablers of Innovation	Barriers of Innovation	Impacts of Innovation
Respondent 1	Cost reduction	Reward system	Environmental pressure	Higher market share
Project manager	Customer needs and requirements	Investment in training	Lack of qualified staff	Reduced rework
22 years experience	Time constrain	Involvement from suppliers	Lack of effective management	Improve working conditions
	Differentiation	Effective communication	Change resistance	Job satisfaction
	Regulations	Employee involvement	Unrealistic deadline	Time saving
Respondent 2	Technology	Investment in training	Procurement procedure	Customer satisfaction
Consultant	Competition	Clearly defined objectives	Economic conditions	Higher productivity
30 years experience	Differentiation	Work experience	Unwilling to change	Increase market share
	Cost reduction	Effective communication system	Working environment	Employee motivation
	Profitability	Leadership	Job insecurity	Profitability
Respondent 3	Design trend	Client involvement	Short work cycles	Customer satisfaction
Consultant	Regulations	Education & training	Poor quality system	Higher productivity
26 years experience	Competition	Employee involvement	Union environment	Employee motivation
	Cost reduction	Rewards	Change resistance	Improve working conditions
	Time constraint	Work experience	Fear of failure	Increase quality of projects
Respondent 4	Cost reduction	Effective communication	Weather conditions	Cope with change and development
Project manager	Customer needs and requirements	Supportive management	Variation in workload	Profitability
24 years experience	Regulations	Regular meeting	Failure to understand stakeholders	Job satisfaction
	Differentiation	Funds	Restrictive building codes	Employee motivation
	Increase quality of projects	Good Planning	Weak investment	Improve working conditions
Respondent 5	Getting a competitive	Good communication	Client worries in profitability	Environmental safety

Contractor 25 years experience	advantage	environment		
	Higher productivity	Organizational culture	Turnover in the company	Improve working conditions
	Cost reduction	Effective information gathering	Lack of awareness	Increase quality of construction projects
	Customer satisfaction	Technological capability	Union environment	Higher productivity
	Champion	Top managers	Short work cycles	Increase market share
Respondent 6 **Contractor** 20 years experience	Differentiation	Strategic management	Poor quality system	More repeat customer
	Cost reduction	Work experience	Lack of effective team	Reduced rework
	Market conditions	Environmental workplace	Long time working	Employee job satisfaction
	Champion	Effective leadership	Shortage of building materials	Improve working conditions
	Technology	Reward system	Variation in work load	Higher productivity
Respondent 7 **Consultant** 22 years experience	Cost reduction	Technological capability	No participation in decision making	Increase in technical capability
	Time saving	Good communication environment	Limited strategic planning	Revenue growth
	Individuals in the organization	Effective communication system	Fear of failure	More repeat customer
	Differentiation	Environmental workplace	Priced-based competition	Increase quality of construction projects
	Customer needs and requirements	Reward system	Complexity of the projects	Time saving

Appendix (D)

Post hoc Test

From the findings of the Bivariate Analysis, we know that there are significant differences between the groups as a whole. The tables below show which groups differ from each other.

As shown in Table (1), there is a significant difference (P-value less than 0.05) according to the position of participants in the degree of importance of the driver of innovation (reducing cost) between firm manager and project manager (*p* = 0.0017). However, there is no difference between the engineer and project manage (*p* = 0.1170), as well as between engineer and firm manager (*p* = 0.2544).

Table 1: Post hoc Test (1)

Reducing cost						
(I) Position	(J) Position	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Engineer	Project Manager	-.1943	.1236	.1170	-.4374	.0489
	Firm Manager	.1163	.1018	.2544	-.0840	.3165
Project Manager	Engineer	.1943	.1236	.1170	-.0489	.4374
	Firm Manager	.3105	.0980	.0017	.1178	.5032
Firm Manager	Engineer	-.1163	.1018	.2544	-.3165	.0840
	Project Manager	-.3105	.0980	.0017	-.5032	-.1178

As shown in Table (2), there is a significant difference (P-value less than 0.05) according to the position of participants in the degree of importance of the enabler of innovation (reward system) between firm manager and project manager (*p* = 0.0076), as well as between engineer and firm manager (*p* = 0.0373). However, there is no difference between the engineer and project manage (*p* = 0.6843).

Table 2: Post hoc Test (2)

Incentives, Reward and bonuses						
(I) Position	(J) Position	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Engineer	Project Manager	-.0457	.1122	.6843	-.2663	.1750
	Firm Manager	.1932	.0924	.0373	.0115	.3750
Project Manager	Engineer	.0457	.1122	.6843	-.1750	.2663
	Firm Manager	.2389	.0889	.0076	.0640	.4138
Firm Manager	Engineer	-.1932	.0924	.0373	-.3750	-.0115
	Project Manager	-.2389	.0889	.0076	-.4138	-.0640

As shown in Table (3), there is a significant difference (P-value less than 0.05) according to the position of participants in the degree of importance of the impact of innovation (creating a competitive advantage) between firm manager and project manager (p = 0.0082), as well as between engineer and project manager (p = 0.0239). However, there is no difference between the engineer and firm manage (p = 0.8439).

Table 3: Post hoc Test (3)

Differentiation						
(I) Position	(J) Position	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Engineer	Project Manager	-.2248	.0991	.0239	-.4197	-.0299
	Firm Manager	-.0161	.0817	.8439	-.1767	.1445
Project Manager	Engineer	.2248	.0991	.0239	.0299	.4197
	Firm Manager	.2087	.0786	.0082	.0542	.3632
Firm Manager	Engineer	.0161	.0817	.8439	-.1445	.1767
	Project Manager	-.2087	.0786	.0082	-.3632	-.0542

As shown in Table (4), there is a significant difference (P-value less than 0.05) according to the years of experience in the degree of importance of the enabler of innovation (top management support) between (less than 5 years) and (more than 15 years) (p = 0.0073), as well as between (5-10 years) and (more than 15 years) (p = 0.0065). However, there are no differences between other groups.

Table 4: Post hoc Test (4)

Top management Support						
(I) Professional Work Experience in Construction Sector (years)	(J) Professional Work Experience in Construction Sector (years)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
less than 5	5-10	.0058	.1139	.9591	-.2181	.2298
	10-15	.2068	.1463	.1584	-.0809	.4945
	more than 15	.2885	.1069	.0073	.0783	.4987
5-10	less than 5	-.0058	.1139	.9591	-.2298	.2181
	10-15	.2010	.1437	.1629	-.0817	.4836
	more than 15	.2827	.1033	.0065	.0796	.4858
10-15	less than 5	-.2068	.1463	.1584	-.4945	.0809
	5-10	-.2010	.1437	.1629	-.4836	.0817
	more than 15	.0817	.1382	.5547	-.1901	.3535
more than 15	less than 5	-.2885	.1069	.0073	-.4987	-.0783
	5-10	-.2827	.1033	.0065	-.4858	-.0796
	10-15	-.0817	.1382	.5547	-.3535	.1901

As shown in Table (5), there is a significant difference (P-value less than 0.05) according to the years of experience in the degree of importance of the enabler of innovation (work experience) between (less than 5 years) and (more than 15 years) (p = 0.0011). However, there is no difference between other groups.

Table 5: Post hoc Test (5)

Experience						
(I) Professional Work Experience in Construction Sector (years)	(J) Professional Work Experience in Construction Sector (years)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
less than 5	5-10	.1784	.1178	.1308	-.0532	.4101
	10-15	.2346	.1513	.1220	-.0630	.5322
	more than 15	.3629	.1105	.0011	.1455	.5803
5-10	less than 5	-.1784	.1178	.1308	-.4101	.0532
	10-15	.0562	.1486	.7056	-.2361	.3485
	more than 15	.1845	.1068	.0851	-.0256	.3946
10-15	less than 5	-.2346	.1513	.1220	-.5322	.0630
	5-10	-.0562	.1486	.7056	-.3485	.2361
	more than 15	.1283	.1430	.3701	-.1529	.4094
more than 15	less than 5	-.3629	.1105	.0011	-.5803	-.1455
	5-10	-.1845	.1068	.0851	-.3946	.0256
	10-15	-.1283	.1430	.3701	-.4094	.1529

جامعة النجاح الوطنية

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الملخص

يساهم القطاع الإنشائي إلى حد كبير في الناتج المحلي الإجمالي الفلسطيني، كما يعتبر العمود الفقري لعدد كبير من الصناعات الإنشائية التي تساهم في التطور الحضاري والإقتصادي. وحيث أن مشاريع البناء في عصرنا الحالي أصبحت أكثر حجماً وتعقيداً ، فإن إدارتها تتطلب وجود ممارسات من الإبداع والابتكار ، بالإضافة إلى وجود بيئة عمل تتوفر فيها كافة الظروف التي تشجع على الإبداع.

إن هدف الدراسة هو تفعيل دور الإبداع في إدارة المشاريع الإنشائية، حيث أن إدارة المشاريع تعتبر من أهم العوامل التي يتوقف عليها نجاح المشروع أو فشله . فقد قامت الدراسة بتقديم صورة واضحة عن أهم الدوافع والعوامل والعوائق التي تؤثر على الإبداع، بالإضافة إلى الآثار الجيدة المترتبة عليه. كما قامت الدراسة بإلقاء الضوء على بعض الممارسات التي من شأنها أن تزيد من كفاءة إدارة المشاريع ، ومن ثم قام الباحث بقياس درجة تطبيقها في فلسطين.

تمت مراجعة الدراسات السابقة لتحديد عوامل الإبداع في ادراة المشاريع الإنشائية. كما تمت إضافة عوامل أخرى لها علاقة بالوضع المحلي في فلسطين بناءا على أراء خبراء محليين. بالإضافة إلى ذلك، تم عمل استبيان تم توزيعه على 365 مكتب هندسي وشركة مقاولات في الضفة الغربية، وقد استخدم البرنامج الإحصائي SPSS في معالجة البيانات.

أظهرت نتائج البحث بأن المحرك الرئيسي للإبداع هو تقليل تكلفة المشروع، والعامل المساعد على الإبداع هو وجود نظام المكافأة والعلاوات، أما العائق الرئيسي للإبداع فهو عدم وجود إدارة فعالة للمشروع، ومن حيث الفوائد المترتبة عليه، فقد تبين أن الفائدة الكبرى منه هي

الحصول على ميزة تنافسية في سوق العمل. بالإضافة إلى ذلك، فقد توصل الباحث من خلال الدراسة إلى وجود علاقة قوية بين إدارة المشاريع الإنشائية وبعض الممارسات، والتي تشمل: (1) الإدارة الإستراتيجية، (2) توفير بيئة عمل داخلية تشجع على الإبداع والابتكار، (3) توفير بيئة عمل خارجية تشجع على الإبداع والابتكار ، (4) إدارة فعّالة لأطراف المشروع وأصحاب المصلحة. و اعتمادا على نتائج البحث، قام الباحث بتطوير نموذج يساعد الشركات على تبني مفهوم الإبداع في إدارة المشاريع الإنشائية.