An-Najah National University Faculty of Graduate Studies

# Building a Framework for Material Supply Management for Construction Projects in West Bank

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This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Engineering Management, Faculty of Graduate Studies, An-Najah National University, Nablus, Palestine.

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This Thesis was defended successfully on 16/01/2017, and approved by

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ii

# Dedication

iii

"To my parents... Fawaz & Layla"

Who raised me to be the person I am today

## Acknowledgments

First and foremost I am extremely grateful to Almighty Allah for what I am and for everything I have, for all the support granted to me. This effort would not be reached without God's limitless guidance and help.

The recognition of this work was only possible due to several people's collaboration, to which I desire to express my gratefulness.

I wish to express my most sincere gratitude and appreciation to my supervisor: Dr. Riyad Awad for his professional guidance, invaluable advices, unlimited support and continuous encouragement to make this research possible.

My appreciation is also extended to An Najah National University for giving me the opportunity to carry out this study. Furthermore, great thanks are also to my colleagues and lecturers in the Engineering Management Department for their continual encouragement and support.

To all my friends, thank you for your understanding and encouragement, special thanks to my friend Nour Mansour, many thanks for your support throughout my study period. Your friendship makes my life a wonderful experience. I cannot list all the names here, but you are always in my heart.

Finally, A special feeling of gratitude and most appreciations are to my loving parents, brothers: Ala', Oday, Ahmad, sister: Sara, and my aunt: Reem. Thanks for your unconditional love, guidance, encouragement, support and patience that give me the power all life...

This thesis is only the beginning of my journey.

V

أنا الموقعة أدناه، مقدمة الرسالة التي تحمل العنوان:

# Building a Framework for Material Supply Management for Construction Projects in West Bank

# بناء إطار لعملية إدارة توريد المواد في مشاريع الإنشاءات في الضفة الغربية

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

### Declaration

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

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Date:	التاريخ:

## Abbreviations

abbriviation	Definition
SCM	Supply chain management
MSM	Material supply management
PCU	Palestinian contractors union
PCBS	Palestinian cenral bareu of statistics
SC	Supply chain
MSCM	Material supply chain management

## **Table of Contents**

No.	Contents	Page
	Dedication	iii
	Acknowledgments	iv
	Declaration	V
	Abbreviations	vi
	Table of Contents	vii
	List of Tables	ix
	List of Figures	xi
	List of Appendices	xii
	Abstract	xiii
	Chapter One: Introduction	1
1.1	Overview	2
1.2	Problem statement	4
1.3	Research statement	5
1.4	Research Objectives	5
1.5	Research Questions	6
1.6	Research Hypothesis	6
1.7	Thesis structure	7
	Chapter Two: Literature Review	10
2.1	Construction Industry	11
2.1.1	Analysis of the Construction Sector in West Bank	12
2.2	Supply Chain Management	13
2.2.1	Construction Supply Chain Management (CSCM)	16
2.2.2	Material Supply Management in construction	18
2.3	Traditional Construction project management	19
2.4	Supply Chain Management Concepts	21
2.5	Supply Chain Management Practices	23
2.6	Challenges	25
	Chapter Three: Methodology	28
3.1	Introduction	29
3.2	Research approach	29
3.3	Questionnaire Design	31
3.4	Research Population	32
3.5	Sampling Instrumentation and Procedure	33
3.6	Instrumentation	35
3.7	Validity of the Questionnaire	36
3.8	Reliability of the Questionnaire	36
3.9	Procedure	36
3.10	Data Analysis	37
3.11	Interviews	37

No.	Contents	Page
3.11.1	Interviews design	37
3.11.2	Interviews analysis	38
	Chapter Four: Data Analysis	39
4.1	Introduction	40
4.2	Questionnaires analysis	40
4.3	Interview Analysis	66
	Chapter Five: Discussion	67
5.1	Overview	68
5.2	Results Discussion	68
5.2.1	Interviews Discussion	68
5.2.2	Questionnaire Discussion	70
5.2	A Framework for material supply chain management	70
5.5	for construction projects	19
	<b>Chapter Six: Conclusions and Recommendations</b>	86
6.1	Overview	87
6.2	Conclusions	87
6.3	Recommendations	89
6.4	Research Contributions	90
6.5	Recommendations for Future Studies	90
	References	92
	Appendices	102
	الملخص	Ļ

List of Tables

No.	Table		
Table (1)	Definitions of supply chain.		
Table (2)	Likert Scale classifications.		
Table (3)	Distribution of Sample According to company status.	33	
Table (4)	Distribution of Sample According to Study Independent Variables.	34	
Table (5)	Cronbach Alpha formula for the study tool.	36	
Table (6)	Distribution of study Sample for the implementation of MSM.	41	
Table (7)	Means, Standard Deviations and estimated level of the current practices of MSM process of the first phase.	44	
Table (8)	Means, Standard Deviations and estimated level of the current practices of MSM process of the second phase.	45	
Table (9)	Means, Standard Deviations and estimated level of the current practices of MSM process of the third phase.	47	
Table (10)	Means, Standard Deviations and estimated level of the current practices of MSM process of the fourth phase.	48	
Table (11)	Means, Standard Deviations and estimated level of the current practices of MSM process of the fifth phase.	49	
Table (12)	Means, Standard Deviations and estimated level of the current practices of MSM process of the phases and the total degree.	49	
Table (13)	Frequencies and percentages for the adopted methods for the material order	50	
Table (14)	Frequencies and percentages for the used criteria/s for supplier selection	52	
Table (15)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the first phase.	53	
Table (16)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the second phase.	54	
Table (17)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the third phase.	55	

No.	Table	
Table (18)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the fourth phase.	56
Table (19)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the fifth phase.	57
Table (20)	Means, Standard Deviations and estimated level of the problems through the MSM Process of the phases and the total degree.	58
Table (21)	Means, Standard Deviations and estimated level of the challenges of implementing MSM practices.	59
Table (22)	Frequencies, Means and Standards Deviations of the implementation of MSM according to company classification.	60
Table (23)	Results of One Way ANOVA of the implementation of MSM according to company classification.	60
Table (24)	Results of LSD Test for Post Hoc Comparisons of the implementation of MSM according to company classification.	61
Table (25)	Frequencies, Means and Standards Deviations of the implementation of MSM according to employees' perception of MSM.	62
Table (26)	Results of One Way ANOVA of the implementation of MSM according to employees' perception of MSM.	62
Table (27)	Pearson correlation matrix between the current practices of MSM and problems that face suppliers in providing materials.	63
Table (28)	Pearson correlation matrix between implementation of MSM and suppliers participation in planning and establishing project objectives.	64
Table (29)	Pearson correlation matrix between implementation of MSM and suppliers selection criteria.	64
Table (30)	Pearson correlation matrix between implementation of MSM and company performance.	65
Table (31)	Percentage responses for MSM problems that face contractors in WB.	66

xi **List of Figures** 

No.	Figure	Page
Figure (1)	Architecture of the thesis.	8
Figure (2)	Typical supply chain configuration in manufacturing.	14
Figure (3)	Construction Supply Chain Process.	17
Figure (4)	The challenges of construction.	26
Figure (5)	Methodology flowchart of the research.	30
Figure (6)	A framework of best practices in MSM for construction projects in WB.	80

xii List of Appendices

No.	Appendix	Page
Appendix (A)	Questionnaire	103
Appendix (B)	Questionnaire in Arabic	114
Appendix (C)	Interview Questions	126
Appendix (D)	Interview Questions in Arabic	127

### Building a Framework for Material Supply Management for Construction Projects in West Bank By Shomoo Fawaz Badawi Badawi Supervisor Dr. Riyad Awad

#### Abstract

Construction industry sector is considered as one of the most important sectors in the world economy for its broad and intense overlap with other sectors of industry. As construction industry is facing a significant growth in construction projects it becomes necessary to focus on improving this sector.

Construction sector in West Bank faces many serious challenges that cause performance- related problems which refers to the complexity of construction projects, that make it necessary to search for modern management approaches for construction industry.

The supply chain management approach is a new field, which its techniques had been successfully implemented by various construction companies around the world. The application of supply chain management on construction projects include labor, materials, equipments, subcontracting, and a finished project and profitability. This study focuses on the process of construction materials supply for construction projects in West Bank. that starts with producing designs and plans and ends with a set of activities in the construction site.

xiii

In accordance with ultimate goal of material supply chain management, this study aims to adopt the material supply chain management concepts, and assess and investigate the current practices of these concepts in construction project management in West Bank, as well as building a conceptual framework for material supply chain management for construction projects in West Bank.

Mixed methodology of both qualitative and quantitative research approaches are used to conduct this study. Qualitative data were collected by conducting interviews with CEO's, project managers, site engineers, or contractors. A survey is done by distributing questionnaires to contracting companies in West Bank to gather the quantitative part of the data.

The analysis of the collected data indicates that there are problems in material supply that affect the companies' performance, material supply chain management is not effectively applied, and certainly there is a need for adopting new management approaches for material supply in construction projects to handle these problems. This was confirmed by the results which show that implementing material supply chain management will positively affect companies' performance.

# Chapter One Introduction

1

## Chapter One Introduction

#### **1.1 Overview**

Supply Chain Management (SCM) is defined as the management of flow of goods and services which pass through several stages from the raw materials that start with storage, work in-process inventory and finished goods, from point of origin to point of consumption. These linked networks and channels provide products and services required by end customers in Supply Chain (SC). The objective of SCM is to be able to have the right products in the right quantities at the right place at the right moment at minimal cost.

The basic supply chain management techniques have been extensively researched and applied in the manufacturing industry to enhance their level of quality and performance, while construction work was based on the traditional techniques of management which led to supply chain deficiencies and high rate of defects in labor and materials.

The construction industry is considered to be an engine in the national economy. It is a large, mature business and it has many important links to the rest of the economy. There has been significant growth in construction projects in domestic markets and in emerging free market economies throughout the world, Horizontal and vertical construction projects are increasing at an impressive rate. Therefore, projects are becoming increasingly more complex and thus it is extremely difficult to control the project's materials delivery, quality standards, budget costs and time. In these conditions, an appropriate management system for building materials management will lead to benefits for construction.

Many researchers show that 30% of construction cost is due to inefficiencies, mistakes, delays and poor communication especially in developing countries (Khutale and Kunkari, 2013). Koushki and Kartam (2004) identified the main factors that negatively affect the cost and time as inefficient equipment, tools and plants; unreliable sources of materials and site accidents. Also, Majid and McCaffer (1998), mentioned that construction project suffers from material shortages which refers to the poor planning, inefficient communication, unreliable suppliers and late delivery. These problems become too much costly, where a Significant percentage of materials and equipment are imported and time delays may render projects especially those susceptible to currency risks and inflationary factors.

As a result of the all mentioned challenges that face the construction sector nowadays, and as management of construction projects requires knowledge of modern management as well as an understanding of the design and construction process and the inefficiency of the traditional project management principles to rival with these challenges, it becomes necessary to apply the new concepts of management which adopt the integration of material supply chain management concepts, which is an operational and strategic cycle that plays a key role for the success of the project. The present research will investigate the current practices of materials SCM (MSCM) in construction projects in West Bank, address the importance of applying the MSCM concepts, and will also develop a conceptual framework for MSCM.

#### **1.2 Problem statement**

Construction sector in Palestine face many serious challenges that cause a performance- related problems such as delays of material supply, low productivity, low quality, high cost and time waste. Inas Shweiki, 2013 in her study concluded that the construction sector in WB facing many problems and obstacles, which limit its economical achievement and ability.

These are attributed to the inadequacy of the traditional management concepts to manage the material flow of the projects and the highly fragmentation of the construction projects that comes from the separation of the design and construction processes and the lack of coordination and communication between the various disciplines. (Tucker et al, 2001)

As a result, a new trend must be considered in order to achieve the successful completion of the projects.

This study will adopt the supply chain management tools and investigate the current practices of these tools in construction project management focusing on material supply processes.

#### **1.3 Research statement**

The importance of this research is to have better understanding of the current practices of material supply management and evaluate these practices in order to develop a framework for material supply management in construction project that highlights a set of the best supply chain management strategies that play a key role in project success for construction companies in West Bank.

#### **1.4 Research Objectives**

This research aims to achieve the following objectives:

- Assess and investigate the current practices of the MSCM in the local construction industry.
- Build a framework for MSCM practices.
- Identify the most occurring problems facing contractors in the MSCM through the project phases.
- Study key factors that may contribute in integrating the phases of MSCM in construction project management.
- Study the importance of implementing the MSCM on construction industry and its effects on companies' progress.

#### **1.5 Research Questions**

This research aims to answer the following questions:

- Q1: What is the degree of the current practices of material supply chain process?
- **Q2**: What is the adopted methods for the material order?
- **Q3**: What is the used criteria/s for supplier selection?
- **Q4**: What is the degree of the problems that face contractors through the material supply chain process?
- **Q5**: In what level company is facing challenges when implementing current practices of material supply chain process?

#### **1.6 Research Hypothesis**

- **H** 1: There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the implementation of material supply management in the construction sector in West Bank attributed to the variables of company classification.
- **H** 2: There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the effective implementation of material supply management in the construction sector in West Bank attributed to the variables of employees' perception of material supply chain management.

- **H 3**: There is significant statistical relationship at ( $\alpha = 0.05$ ) between the current practices of material supply management in the construction sector in West Bank and obstacles that face suppliers in providing materials.
- **H** 4: There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply management in the construction sector in West Bank and suppliers participation in planning and establishing project objectives.
- **H 5**: There is significant statistical differences at ( $\alpha = 0.05$ ) between implementation of material supply management in the construction sector in West Bank and suppliers selection criteria.
- **H** 6: There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply management in the construction sector in West Bank and company performance.

#### **1.7 Thesis structure**

The thesis is organized into 5 chapters as shown in figure (1).



#### Figure (1): Architecture of the thesis

Chapter one, presents the introduction of the research with a brief illustration of the study. It also covers the importance and objectives of this research.

In chapter two, an intensive literature review is conducted from the supply chain management and construction material supply management then the definition of supply chain management is explained. In addition, a broader view is taken to look into the current practice of the traditional project management and material supply management for construction companies.

The research methodology which consists of the research problem, data collection method and data analysis techniques are outlined in Chapter three. In Chapter four, the results of the data collected through questionnaires and interviews are presented using data display and analysis techniques that are described in the 'Methodology' section. This chapter illustrate the results of the surveys and interviews which include answers for the research questions and hypothesis.

Discussion about the current practices of material supply management and how to adopt the material supply management strategies and practices for construction projects and challenges that contractors face in material supply management process are done in chapter five according to the results in chapter four. Furthermore a framework is produced for material supply management.

Finally, chapter six abstracts the thesis results through conclusions. Also, this chapter presents research contribution, recommendations for the research, and includes suggestions for future studies.

# Chapter Two Literature Review

## Chapter Two Literature Review

#### **2.1 Construction Industry**

Construction industry sector has been always considered as one of the most important sectors in the world economy for its broad and the intense overlap with other sectors of industry, which affect the economic development in the country as it is a major generator of jobs and constitutes which is an important component of gross domestic product (GDP) in addition to its added-value. Also it is considered as the second largest industry in the world, with a contribution of 13% of the world GDP of developed countries in 2013 according to industry tap statistics.

Contradictious in construction industry is represented in being the largest industry, but the vast majority of its hundreds of thousands of participants are small business (Barrie & Paulson, 1992). It is becoming increasingly more complex, large, and diverse and covers a wide range of business interests and activities, united by their common usage and development of land (Corporate watch, 2004). As construction project process itself is complex, time is consumed and process is highly fragmented through a diverse group of participants including clients, contractors, subcontractors, architects, engineers, surveyors, laborers, and developers, whom are linked hierarchically to possess differentiated skills and knowledge, which results in a complex relationships within the project teams that, if not managed effectively, can adversely affect a project's performance (Walker, 1994).

So that Clough and Sears (1994) saw that in order to mitigate the complexity; the structure must be designed according to an applicable codes and standards, culminating in working in drawings and detailed specifications for work accomplishment.

The construction industry is inherently an uncertain industry for several reasons such as the competitive tendering process, the company's turnover, site production rates and the weather itself (Harris and McCaffer, 1998).

As a result of the above, Barrie and Paulson (1992) mentioned that there is no clear definition for the construction industry. And the definition must include the hundreds of thousands of general and specialty construction contractors. According to this and for more clear understanding for the definition of construction industry (Ahmed, 2008) subjoin to Barrie & Paulson definition the importance of including designers of facilities, material suppliers, and equipment manufactures.

#### 2.1.1 Analysis of the Construction Sector in West Bank

Construction sector has a significant impact on Palestinian economy and it became one of the key economic sectors and the main force that motivate the Palestinian national economy, it also has played a crucial role in extending job opportunities for Palestinian labor force throughout Palestinian cities and towns. In 1994, the construction sector has witnessed noticeable expansion and became the leading industry sector in attracting new investments and offering new job opportunities (PCU, 2008). In West Bank construction sector completed approximately 5 million m<sup>2</sup> in 2014 and it contributed about 8 % of the GDP with gross value added totaling 547.3 million \$ in 2014, and expansion in construction projects in West Bank has generated a lot of jobs for skilled, semiskilled and unskilled workers. In 2015 construction sector employed about 15.5% of laborers directly and a higher percentage indirectly. (Palestinian Central Bureau of Statistics, and Engineers Association 2015)

According to Inas Shweiki research study during the past few years, many of construction projects in West Bank suffers from the delay of project, the high cost and other obstacles in the contracting process for many reasons such as conflicts and claims (Inas Shweiki, 2013).

#### 2.2 Supply Chain Management

SCM is a concept that has originated and grows up in the manufacturing industry. The first signs of SCM were perceptible in the JIT (Just in Time) delivery system as part of the Toyota Production System (Shingo 1988). The main goal of this system was to deliver the right quantities at the right time in order to minimize inventories cost and effectively regulate the suppliers with the production line.

The supply chain has been defined as the collaboration of key business processes (individuals, organizations, resources, activities information and technology) to create and sell of a product that adds value for customers and other stakeholders, from the delivery of raw materials from the supplier to its eventual delivery to the end user. The supply chain segment involved with getting the finished product from the manufacturer to the consumer is known as the distribution channel, Figure (2) below shows the typical supply chain configuration in manufacturing systems.



Figure (2): Typical supply chain configuration in manufacturing (Christopher, 1992).

Definitions of a "supply chain" include three functions: 1. supply of raw materials to a manufacturer; 2. manufacturing process; and, 3. distribution of finished goods through a distribution channel through several stages that are linked to gather (Canadian Supply Chain Sector Council, 2014).

As can be seen from the figure above in order to facilitate the flow of products, information must be shared up and down the supply chain, i.e. with suppliers and clients. Deming suggested that working with the supplier as a partner in a long-term relationship of loyalty and trust will improve quality and decrease the costs of production (Deming, 1982).

This sharing of information is important for all parties to plan appropriately to meet the current and future needs and to effectively manage the supply chain to achieve the set of goals like:

- 1. Inventory minimizing
- 2. Cost reduction
- 3. Improving product time to market
- 4. Enhancing flexibility
- 5. Optimizing the flow of goods from supplier to customer
- 6. React efficiently to changes in demand

Table (1) summarizes some definitions of the supply chain concepts that have been mentioned in previous studies.

Table (1): Defini	tions of su	pply chain
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Supply chain management definitions		
Definition	Reference	
Set of organizations that are linked together through upstream and downstream interconnections, in the different stages that seek to produce value in the form of products and services and represent them to the end user.	(Christopher, 1992)	
A network that starts with the suppliers and ends with the customers to achieve the production and delivery of goods and services.	(Lee and Ng, 1997)	
SCM is a set of beliefs and principles that affects the performance of all the other supply chain members and the overall supply chain whether directly or indirectly.	(Cooper et al.,1997)	
"It is an integrative approach that deals with planning and control of the total flow of materials from suppliers through end users"	(Jones and Riley, 1985)	
"The objective of supply chain management is to synchronize customer requirements with the flow of materials from suppliers in order to achieve the balance between the customer's and supplier's goals.	(Stevens, 1989)	
SCM requires separate materials functions and also requires joint relationships with suppliers through multiple tiers. SCM is a concept that aims to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers."	(Monczka et al., 1998)	

#### **2.2.1**Construction Supply Chain Management (CSCM)

The basic Supply Chain Management (SCM) techniques have been widely implemented in manufacturing industry, but recently these techniques found its way in construction industry as well and it has been tried with varied degree of success (Tiwari et al, 2014). The SCM approach of projects is a new field having tremendous scope for further research and experimentation. SCM techniques have been successfully implemented by various construction companies around the world. Some of the Indian companies have also applied SCM technique in construction of airport runways in some central Asian countries. (Tiwari et al, 2014).

Agapiou et al (1998) mentioned that no studies have defined the SCM in the construction process. However construction supply-chain can be defined as all the construction processes that pass through multiple stages and comes from multi organizational decisions, which starts with the demand by the client. From this point of view it is obvious that CSC is not only a chain of business with business to business relationship and that can be described as in Figure 2 below. (Xue, et al., 2007). The construction supply chain is an operational and strategic cycle that includes labor, materials, equipments, subcontracting, and a finished project and profitability. Technology, safety, and communications are the three elements that connect all of the components of the chain (Khutale, 2013).



Figure (3): Construction Supply Chain Process. (Xue, et al., 2007)

Based on that, construction supply chain management can be defined as integration of key construction business processes, from the demands of client, design to construction, and key members of construction supply chain, including client/owner, designer, contractor, subcontractor and supplier to achieve the objectives of reducing the cost of and increasing the reliability and speed of facility construction.

Limited studies in construction recommended that project cost may increase by 10% when applying poor supply chain management practices, duration also may be similarly affected (Bertelsen, 1993)( O'Brien, 2008), and as the subcontractor and supplier production comprise the largest value of project cost the applications of supply-chain management techniques in construction industry will strongly improve this field.

As suggested according to Alaa Al-Shorafa thesis "A Framework For Construction Materials Supply Chain Process in the Local Construction Industry" The implementation of SCM tools in construction projects will help contractors to have the materials needed, in the quantities needed, with the quality required on time, and he recommended future studies on: factors that hinder the application of the SCM and management of inventories. (Al-Shorafa, 2009)

#### 2.2.2 Material Supply Management in construction

Many studies have manifested that effective management of construction materials plays a significant part in the performance of construction projects. Some studies concluded that materials account for around 50%-60% of the project cost (Bernold and Treseler, 1991).

18

Scholman(1997) mentioned that according to the statistics more than 65% of a construction project budget is spent on procurement of materials.

Agapiou et al. (1998) also stated that in the process of the flow of materials from suppliers to construction sites, the focus should be on coordination and communication between project participants. The process of construction materials management starts with design and engineering follow at manufacturers' workshop, and ends with a set of activities that starts in factories and ends at the construction site. Planning of supply chain needs a deep study for all stages that include purchasing, expediting, and inventory control of the construction process considering the time and cost; in order to achieve the best practice and to avoid material shortages, loss, and theft which might result in loss of productivity and delay of activities.

Finally, to summarize, vision for future trend improves the traditional practices of planning, controlling and contracting within each subcontractor and supplier for projects to achieve the best practice by using construction material supply chain management tools that offers opportunities for improving coordination, costing, and control, and promises an engineering basis to design, plan, and manage construction projects in a collaborative manner.

#### **2.3 Traditional Construction project management**

The common project management practices have recently been stated as inadequate for controlling the progress of construction projects, for example Koskela and Howell (2002) argued that the theory of project management is ancient and cannot be applied effectively anymore and there is no explicitly stated theory exists on project management, also they argued that planning, execution, and control processes are not applied as suggested by PMBOK Guide of Project Management Institute.

Johnston and Brennan (1996) also have argued that project management is a "management-as-planning", and this is due to the strong connection between generating a plan and the resulting operational activity. Also they concluded that this connection is not feasible, as no plan can ever be detailed enough to execute the work effectively without the need of feedback from the environment. Koskela and Howell (2002) noted that reliance on a general out-of-date plan leads to poor short-term planning, and maintaining the plan is problematic and tasks cannot be performed as they lack inputs.

Also Justin Palasty (2014) discussed the problems with the traditional project team model used in the construction industry and pointed that these problems are due to:

- 1. A standard service and lack of promotion of ideas
- 2. Inefficient scheduling and programs
- 3. A lack of identifying risks
- 4. Interval business relationships

Therefore obviously there is a need for a new management practices as Ballard (2000) and Chua and Shen (2001) developed the flexible project management practices that is based on a flow view focuses on the control of the total flow of production (Koskela, 1992) to overcome the challenges of traditional project management; which is based on a conversion view on production were each stage is managed independently according to (Cooper, 1993).

#### 2.4 Supply Chain Management Concepts

Supply chain management (SCM) is a mix of art and science that goes into improving the way your company finds the raw components that is needed to make a product or service and deliver it to customers. It mainly includes three activities: sourcing and procurement, conversion, and all logistics management activities which integrate supply and demand management within and across companies. And these three activities passes through several stages that includes: marketing, planning, sourcing, manufacturing, delivering and returns which traditionally operate independently. Min and Mentzer (2004), identified the concept SCM as including agreed vision and goals, information sharing, risk and award sharing, cooperation, process integration, long-term relationship and agreed supply chain leadership.

Generally supply chain management revolved around a core idea that aims to maximize customer value and to achieve a sustainable competitive advantage through the cumulative effort for the whole supply chain. Which subsequently increase the transparency and alignment of the supply chain's coordination and configuration (Cooper, 1993).

Based upon literature reviews organizations that adopt supply chain management concepts as a management philosophy has the following characteristics:

- A systems view of the production activities that manage the total flow of goods from the supplier to the ultimate customer and seeks global optimization of these activities
- 2. A strategic orientation through cooperative efforts to achieve a unified unit by synchronizing and converging intrafirm and interfirm operational and strategic capabilities.
- 3. A customer focus to create unique and individualized sources of customer value, leading to customer satisfaction.

These concepts are linked together through three main flows: physical flows, information flows and financial flows. The first one involves the transformation, movement, and storage of goods and materials. as just as the important of physical flows information flows are also important which allows the various supply chain partners to coordinate their long-term plans and share any information related, and to control the day-to-day flow of goods and materials up and down the supply chain. The financial flow consists of credit terms, payment schedules, and consignment and title ownership arrangements, to meet current and future
needs to achieve the projected goals that summarizes in minimizing inventory, cost and time reduction and increasing flexibility.

Supply chain is not only about physical, information and financial flows; it is also used to describe strategic, inter-organizational issues to discuss an alternative organizational form to vertical integration in order to identify the relationships developed by a company with its suppliers.

#### 2.5 Supply Chain Management Practices

SCM practices have been defined as the set of activities that is performed in an organization to promote effective management of its supply chain (Donlon, 1996). Different perspectives for SCM practices have been reviewed in this literature review, for example Donlon (1996) describes the latest evolution of SCM practices, which include supplier partnership, outsourcing, cycle time compression, continuous process flow, and information technology sharing. Alvarado and Kotzab (2001), suggested many practices for SCM implementation such as concentrating on core competencies, using inter-organizational systems such as EDI, and eliminating excess inventory levels. A six aspects of SCM Practices were identified by Tan et al. (2002), through factor analysis as follow:

- 1. Supply chain integration
- 2. Information sharing
- 3. Supply chain characteristics
- 4. Customer service management

- 5. Geographical proximity
- 6. JIT capability.

Chen and Paulraj (2004), tend to use supplier base reduction, longterm relationship, communication, cross-functional teams and supplier involvement in the measure of buyer–supplier relationships. Wong and Kanji (1998) mentioned that it is important to include total quality management in construction SCM to successfully highlight major problems of the industry, and this will give a clearer view of project partnering and this was emphasized by Wong and Fung (1999). They recommended to develop an efficient communication system for effective relationship management to achieve total quality objective of a general contractor.

Suhong et al (2004) suggested five distinctive dimensions to measure SCM practices, including strategic supplier partnership, customer relationship, level of information sharing, quality of information sharing and postponement. The five dimensions cover upstream (strategic supplier partnership) and downstream (customer relationship) sides of a supply chain, information flow (level of information sharing and quality of information sharing), and internal supply chain process (postponement). Despite of that there is still a need for more factors to consider that SCM practices are complete. These factors include geographical proximity, JIT/lean capability (Tan et al, 2002), cross-functional teams, logistics integration (Chen et al, 2004), agreed vision and goals, and agreed supply chain leadership (Min and Mentzer, 2004).

#### 2.6 Challenges

Construction industries around the world suffer from many challenges that affect the performance and hinder the achievement of economic prosperity, sustainable environments and healthy fulfilled populations.

A construction project in general is highly fragmented through a diverse group of participants including clients, contractors, subcontractors, architects, engineers, surveyors, laborers, and developers, whom are linked hierarchically to possess differentiated skills and knowledge.

As a result, complex relationships exist within project teams and that leads to a numerous problems that if not managed effectively adversely affect a project's performance (Walker, 1994).

There are many challenges that face construction managers. Most of them are centuries old and can be classified as direct (construction operation problems) and indirect challenges (marginal or non –construction activities). In order to insure the project success managers have to deal with all types of challenges.

Some of the construction challenges include workforce considerations, safety, lack of identifying risks, time constraints and inefficient scheduling, and the changing nature of the work. Nonconstruction challenges that managers face and that are part of the business landscape include legal issues, government regulations, environmental concerns, and socio-political pressures. It is critical that the CM understands the demanding realities that he or she faces in the planning and control of construction operations. (Barrie and Paulson, 1992)



These challenges are detailed in figure 4 below.



These problems in construction projects make it challengeable to exploit and benefit from the SCM and this leads to many barriers for implementing an effective SCM. One of the barriers is the poor cooperative relationship between construction related entities, and this refers to the fear from sharing and exposing elements such as the necessary information, strategy, planning and goals to other firms, fearing of loss of control, lack of top management commitment, inappropriate organization structure to cope with the concept and difficulty in accomplishing the interfirm collaboration effectively, which adversely affect the level of awareness of all participants. Furthermore there is a real problem of identifying a one mutual goal for the supply chain rather than many individual goals for all partners. Other significant barriers for implementing supply chain management are represented in the lack of understanding of the project owner, communication gaps, a lack of understanding of the true supply chain, the large number of participants in the supply chain, a lack of effective leadership, and finally, a deficiency of mutuality. (W.C. Benton, 2007, Jr. & Linda F. McHenry, 2010 and Khutale, 2013)

Based on the above barriers it is obvious that implementing SCM concepts is a difficult task for many firms which are not ready and there is no willing to integrate to the chain. Though it is a vision for supply chain management concepts remains a critical engine for the long-term success of construction firms. As construction firms cannot apply the complete supply chain management; applying its concepts will improve their competitive advantage, project quality, completion times, and work methods while decreasing costs. For this reason, efficient construction supply chain management is a critical element for positioning operational efficiency which lead to a competitive advantage, and achieve a desirable goal for leadership in the construction industry. (W.C. Benton, Jr. & Linda F. McHenry, 2010)

### Chapter Three Methodology

### Chapter Three Methodology

#### **3.1 Introduction**

After identifying the goal of this research in the previous chapters, it is necessary to identify the research type and illustrate the research methodology.

This study will rely on descriptive analytical approach, which serves as the most suitable methodology for this type of research.

#### 3.2 Research approach

To achieve the objectives of this study, a Statistical Package for Social Sciences (SPSS) software was used to analyze the collected data. Figure (5) describes the overall methodology which was used in this research.

The following summarizes the main steps that were followed:

#### Data was collected from several direction which includes

**First**, literatures and publications about the concepts of material supply management and construction project management were reviewed.

**Secondly**, data about construction industry and contractors companies in West Bank were also collected by conducting interviews with different experts and agencies such as "Nablus Engineers Association", "Palestinian Contractors Union" & "The Palestinian Central Bureau of Statistics". Field observations for construction companies have been conducted through interviews and questionnaires in order to gather specific data about the current practices of applying material supply management for construction projects.

The second step in the methodology of this research after data collection, is data processing and analyzing for interviews and using SPSS software for questionnaires.

Finally a framework for material supply management have been developed and evaluated by experts, and Based on that conclusions and recommendations was included. Figure (5) below illustrates the process of methodology.



Figure (5): Methodology flowchart of the research

#### 3.3 Questionnaire Design

Based on literature review, the researcher conducted a questionnaire to examine the current practices of MSCM in Palestinian construction companies by achieving the following objectives:

- 1. Collect quantitative data to check the research hypotheses.
- 2. Examine and identify the relations between all dependent and independent variables.
- 3. Analyze data statistically and generalize the results to all population.

The questionnaire is composed of four parts, these are:

- 1. **Demographic or general information:** This part contains general information about the construction companies, classification of the company, number of employees, the participant roles in the team, etc.
- 2. Evaluate the level of applying material supply management: This section was about gathering general information about the level of applying the material supply management in construction projects.
- 3. Current practices of material supply management: in this part the objective is to examine the application of material supply management practices in construction projects, the methods for contacting with suppliers and the criteria used to choose suppliers. The 5 stages of the project were examined which include the bidding stage, vendor selection, material procurement, construction, and post-construction.

4. Identification of the challenges and barriers that face the contractors through the Material Supply Chain Process: in this section questions of 5 phases (bidding, vendor selection, material procurement, construction, and post-construction) were answered to identify the most occurring problems that face contractors while material supplying and the barriers that face contractors when trying to adopt material supply chain management practices.

Each part consists of many questions designed based on a Likert scale, question in the Likert scale were grouped and analyzed in each part.

Likert ranked from 1 (strongly disagree) to 5 (strongly agree) as shown in Table 7.

No	Corresponding Remark	Score
1	Very low	1 - 1.80
2	Low	1.8 - 2.60
3	Moderate	2.6 - 3.40
4	High	3.4 - 4.20
5	Very high	4.2-5

 Table (2): Likert Scale classifications

#### **3.4 Research Population**

The main goal of this research is to assess and evaluate the current practices of material supply management for construction projects in West Bank. Therefore the research population was all classified contracting construction companies in West Bank from class 1 to class 5.

#### **3.5 Sampling Instrumentation and Procedure**

According to the Palestinian Contractors Union 302 contracting company are classified in West Bank for five classifications, a sample size of 169 company based on population size with 95% confidence interval and 5% significance level were considered using the equation shown below, and questionnaires were distributed based on location and classification either by hand or email.

$$n = \frac{N \cdot Z^2 \cdot p \cdot (1-p)}{(N-1) \cdot e^2 + Z^2 \cdot p \cdot (1-p)}$$

The response rate for the questionnaire survey was 60% (100 companies in construction sector in West Bank). The background of the study sample is different locations which were varied in terms of Year of Establishment which is from 1955 to 2015, number of employees which range from 10 to 1500 individuals with a mean of (74) and classification according to the contractor union as shown in Tables (1) and (2) below.

 Table (3): Distribution of Sample According to company status

Variable	Class	Frequency	Percentage %
	Tulkarem	10	10.0
	Hebron	18	18.0
	Jenin	10	10.0
	Nablus	18	18.0
T	Bethlehem	13	13.0
Location	Ramallah	22	22.0
	Jerusalem	2	2.0
	Qalqilia	5	5.0
	Tubas	1	1.0
	Selfeet	1	1.0
	Total	100	100.0

Variable	Class	Frequency	Percentage %
Commony	First class	46	46.0
company	Second	19	19.0
classification	Third	16	16.0
contractor union	Fourth	9	9.0
contractor union	Fifth	10	10.0
	Company	48	48.0
	Droioot Monogor	15	15.0
Respondent	Project Manager	15	13.0
Position	Site Engineer	9	9.0
	Supervision Engineer	21	21.0
	Other	7	7.0
D 1 (	High studies	11	11.0
Respondent	Bachelor	74	74.0
Scientific	High School	5	5.0
Quanneation	Diploma	10	10.0
	5 years and less	16	16.0
Respondent	5-10 years	23	23.0
Years of	10- 15 years	17	17.0
Experiance	15 years and	44	44.0
1 ) 1 0		70	70.0
I. Number of	10 and below	/8	/8.0
executed projects	21.20	13	13.0
during the last	21-30	5	5.0
nve years	31-40	3	3.0
T1 D. 11 V. 1	more than 40	1	1.0
The Dollar Value	Less than I	25	25.0
Projects	than 5	33	33.0
Performed within the Last five	From 5 to less than 10	12	12.0
Years (Million Dollar)	More than 10	30	30.0
Type of Droigota	Building	35	35.0
in the Company	Infrastructure	7	7.0
in the Company	Building &Infrastructure	58	58.0
То	tal	100	100.0

Table (4): Distribution of Sample According to Study Independent Variables

#### **3.6 Instrumentation**

In order to achieve the goal of this study, the researcher used a 68item questionnaire, the questionnaire was conducted through the researcher's experience. The questionnaire is composed of four sections; the first section focused on primary profile such as company location, establishment year, average of workers, company classification, position, qualification, years of experience of the respondent, executed project number and project value of the executed projects. The second section consisted of thirteen questions about evaluating the current level of the implementation of material supply chain management in the construction sector in West Bank. The third section is 34 items that test the current practices of material supply chain process in addition the adopted methods for materials order and criteria/s used for supplier selection. The final section is a 27 items of Identification of the challenges that face the Contractors through the Material Supply Chain Process in addition to 7 items of barriers of implementation material supply chain management in the construction sector in West Bank.

The scores of responses of the questionnaire items were calculated according to a five-point Likert scale for the responses in which always =5 points, often =4 points, sometimes = 3, seldom = 2 points and never = 1 point. On the other hand , (5 Serious problem ,4 Significant problem,3 Some problem,2 Little problem and1 for No problem at all) for Importance degree.

#### 3.7 Validity of the Questionnaire

The validity of the questionnaire has been ensured through rating it by a jury of experts at An-Najah National University. The respondents' notes and the jury's suggestions were considered to modify and improve the questionnaire's content and wordings by omitting, adding or rephrasing bringing the questionnaire of a 68 item.

#### 3.8 Reliability of the Questionnaire

Reliability of the questionnaire is calculated through using Cronbach Alpha formula for the total degree. It was found that the total degree is (0.937) and the following table shows the details:

 Table (5) : Cronbach Alpha formula for the study tool

Domain	Items	Cronbach Alpha
Current Practices of Material Supply	1 3/	0.805
Chain Process	1-34	0.895
Identification of the challenges that		
face the Contractors Through the	35-61	0.936
Material Supply Chain Process		
problems of implementation material		
supply management in the	62-68	0.729
construction sector in West Bank		
Total Degree	68	0.937

#### **3.9 Procedure**

The final draft of the questionnaire was distributed to contracting construction companies in West Bank. It took about eight weeks for the questionnaire to be distributed, collected, and returned to the researchers. The respondent number of questionnaires was 100 questionnaire, 46 hard copy and 54 were gathered by the internet. No questionnaire has been excluded.

#### 3.10 Data Analysis

Collected data were analysed using (SPSS-17) to answer the questions of the study. Means, frequencies, standard deviations and Pearson correlation matrix. To analyze the results, the researcher used the following scale to represent the estimation level of employees' responses.

4.20 and more - 84.0 % and more	Very High
3.40-4.19 -68.0 - 83.8%	High
2.60-3.39 - 52.0 - 67.8 %	Moderate
1-80- 2.59 - 36.0 - 51.8 %	Low
Less than 1.8 – 35.9% and less	Very Low

#### **3.11 Interviews**

#### **3.11.1 Interviews design**

Interviews with some local contractors, top managers, projects managers and site engineers were held randomly, so as to survey the current situation of contractors companies by adopting the semi-structured approach for interviews.

Ten interviews were held in this research, five interviews included contracting companies in Ramallah including first class contracting companies who have a valid membership in the Palestinian Contractors Union. The other five interviews were held in Nablus city also included the contracting companies in Ramallah including first class contracting companies who have a valid membership in the Palestinian Contractors Union.

Fourteen interview questions have been asked and these questions are shown in Appendices C and D.

#### 3.11.2 Interviews analysis

Data collected from the semi-structured interviews were analyzed using a qualitative method for analyzing, this approach analyze and identify the data, and describes it in details and explains the main factors of the topic of research.

### Chapter Four Data Analysis

### Chapter Four Data Analysis

#### 4.1 Introduction

This study aimed at identifying implementation of material supply management in the construction sector in West Bank. It also aimed at identifying the effect of several variables on the responses.

After data collection the researcher analysed it based on the methodology that was mentioned in the previous chapter. The researcher used mixed quantitative and qualitative methods of analysis. The quantitative part is consisted of a questionnaire and the qualitative part is consisted of semi-structured interviews to improve and increase research validity and reliability.

#### 4.2 Questionnaires analysis

To accomplish the aims of the study, the researcher analyzed the data in accordance with the study questions and hypothesis and the results were as follows: Section One: Results related to section two of questionnaire

Variable	Class	Frequency	Percentage %
	Material procurement	12	12.0
1. What is your	purchasing raw materials	7	7.0
perception of	Suppliers relationships	3	3.0
material supply management?	A Tool to control inventories	1	1.0
C	Project management	16	16.0
	Customer Satisfaction	1	1.0
	All of the above	60	60.0
2. Does your	Yes	25	25.0
Company have	No	42	42.0
material supply management department?	Partially Existing	33	33.0
3. Does your	Yes	10	10.0
company have	No	90	90.0
quality control of materials?	Partially Existing		
4. Does your	Yes	92	92.0
company have	No	1	1.0
inventories?	Partially Existing	7	7.0
5. Are	Yes	78	78.0
materials	No	14	14.0
stored in places suitable for their safety?	Don't Know	8	8.0
6. Has your	Yes	3	3.0
Company got	No	87	87.0
the ISO Certificate?	Don't Know	10	10.0
7. Does the	Yes	92	92.0
Contractor's	No	4	4.0
Engineer Exist at the Site Permanently?	Don't Know	4	4.0

Table (6): Distribution of study Sample for the implementation of MSM.

Variable	Class	Frequency	Percentage %
8. Does your	Yes	82	82.0
company have	No	17	17.0
suppliers	Don't Know	1	1.0
9 Do vou use	Ves	74	74 0
special forms	No	24	24.0
for material	Dent Vere	21	2.0
management?	Don't Know	2	2.0
10. Is there any	Yes	50	50.0
recorded cases	No	44	44.0
for complains			
from the			
construction	Don't Know	6	6.0
team for late			0.0
delivery of			
materials?			
11. Do you	Yes	71	71.0
have any	No	27	27.0
partnership			
agreements	Don't Know	2	2.0
with any of		2	2.0
your suppliers?			
12. Do these	Yes	56	56.0
partnerships	No	34	34.0
include any			
contractual	Don't Know	10	10.0
agreements?			
13. How do	Important	75	75.0
you value	Unimportant	2	2.0
partnership			
with your	Normal	23	23.0
suppliers?			
	Total	100	100.0

This table illustrates the percentages of responses for section two of the questionnaire which talk about general assessment for the current material supply management in construction projects.

42

Section Two: Results related to Study Questions

# 1. Results related to the First Question. What is the degree of the quality of current practices of material supply chain process?

To answer this question, means, standard deviations, and estimation level were used as shown in following tables:

Questionnaire Percentage % standard deviations No. in the Estimated Means level N0. Item Estimating the quantity of the Very 4.75 2 0.53 95.0 1 needed materials per each item High software computer Using or Very 2 6 applications such as Microsoft 4.57 0.84 91.4 High Excel for preparing the estimates the needed materials Identifying for each item once you receive the Very 3 1 4.53 0.79 90.6 project's drawings High and specifications Involving the project manager or Very 4 7 construction team in the estimation 4.33 0.89 86.6 High process Depending on the prices of Very 5 10 suppliers and manufacturers 4.27 0.61 85.4 on High preparing the project estimate Scheduling a meeting with the project manager and the 4.10 82.0 6 11 construction team to re-estimate the 1.10 High project quantities after you win the bid Defining any special requirements 7 4.08 4 0.73 81.6 High for the project Identifying the materials according 8 5 the availability or the need for 4.00 0.99 80.0 High making them Establishing a schedule for material requisition according the type of 9 3.90 12 1.02 78.0 High material, the quantity needed and dates to be on site Establishing historical prices database for the materials in order 9 10 3.75 1.08 75.0 High to be used for preparing the estimate for the future projects Include your key suppliers in Moder 3.22 11 3 1.05 64.4 planning and goal setting activities ate There is coordination between the Moder 12 8 3.21 1.24 64.2 functional disciplines and stages ate Total 4.05 0.90 81.0 High

Table (7): Means, Standard Deviations and estimated level of the current practices of MSM process of the first phase.

Table (7) shows that the total degree of the quality of current practices of material supply chain process of the first domain (Bidding Phase: Estimate, preparation & Submission) was (81.0%) which suggests high levels of estimation. The highest mean was given to the item (Estimating the quantity of the needed materials per each item). The lowest was for the item (There is coordination between the functional disciplines and stages).

Table (8): Means, Standard Deviations and estimated level of the current practices of MSM process of the second phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	<b>Estimated</b> level
13	19	Negotiating the prices directly with the suppliers	4.67	0.47	93.4	Very High
14	14	Verifying that the supplier is capable to deliver the right materials with the right quantity at the right time to the right place	4.51	0.75	92.0	Very High
15	16	Recruitment offers from different suppliers	4.41	0.65	88.2	Very High
16	15	Purchasing the materials from previous suppliers with previous project	4.24	0.47	84.8	Very High
17	13	Pre-qualify the suppliers and make documentations for qualified suppliers	4.02	1.05	80.4	High
18	17	Selecting the winner supplier based on the lowest prices	3.77	1.01	75.4	High
19	18	Considering suppliers with higher prices for quality issues	3.65	1.04	73.0	High
		Total	4.18	0.38	83.6	High

Table (8) shows that the total degree of the quality of the current practices of material supply chain process of the second domain (Vendor Selection) was (83.6) which suggests high levels of estimation. The highest mean was given to the item (Negotiating the prices directly with the suppliers), and the lowest was given to the item (Considering suppliers with higher prices for quality issues).

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	<b>Estimated</b> level
20	28	Check the materials to make sure that the delivered materials meets the specifications, quantities and the timeframe specified	4.65	0.55	93.0	Very High
21	27	Specify for the suppliers the release dates of and the exact location for materials delivery to avoid materials re-handling	4.47	0.75	89.4	Very High
22	23	Issuing purchase order to the winner supplier in order to organize the relationship between the contractor and the supplier	4.23	0.98	84.6	Very High
23	22	Requesting a material sample from the supplier for testing it before the material is ordered	4.19	0.87	83.8	High
24	20	Obtaining the material requisition schedule that prepared by site staff	4.14	0.98	82.8	High
25	24	Requesting materials directly by the field staff	3.83	0.89	78.6	High
26	26	Ordering 100% of the estimated items quantities at once	3.27	1.30	65.4	Mod erate
27	25	Using JIT (Just in Time) delivery system	3.21	0.90	64.2	Mod erate
28	21	Using technological systems such as bar codes, EDI, RFID etc. for material control	2.31	1.29	46.2	Low
		Total	3.81	0.54	78.2	High

Table (9): Means, Standard Deviations and estimated level of the current practices of MSM process of the third phase.

Table (9) shows that the total degree of the quality of current practices of material supply chain process of the third domain (Material

Procurement) was (78.2) which suggest high levels of estimation. The highest mean was given to the item (Check the materials to make sure that the delivered materials meets the specifications, quantities and the timeframe specified), and the lowest was for the item (Using technologies such as bar codes, EDI, RFID etc. for material control).

 Table (10): Means, Standard Deviations and estimated level of the current practices of MSM process of the fourth phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	Estimated level
29	29	Keep generating the material requisition forms in which the material description, quantities needed, dates when the materials are needed and locations	4.56	0.62	91.2	Very High
30	30	Verifying the material received against the material ordered by tests	4.41	0.87	88.2	Very High
31	32	Keeping a track record of the supplied materials, remaining balance and the installed materials	3.89	1.03	79.8	Very High
32	31	Recording any problems in the delivered materials	3.84	1.12	78.8	High
33	33	The distributer or supplier provides an on-site truck	3.04	1.31	60.8	Mod erate
		Total	3.94	0.70	78.8	High

Table (10) shows that the total degree of the quality of current practices of material supply chain process of the fourth domain (Construction) was (78.8) which suggest high levels of estimation. The highest mean was given to the item (Keep generating the material requisition forms in which the material description, quantities needed, dates when the materials are needed and locations). The lowest was for the item (The distributer or supplier provides an on-site truck).

Table (11): Means, Standard Deviations and estimated level of the current practices of MSM process of the fifth phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	Estimated level
34	34	Conducting comprehensive assessment for the material supply chain process through the mentioned phases to avoid the mistakes and develop this process in the future projects	3.75	1.08	75.0	High
		Total	3.75	1.08	75.0	High

Table (11) shows that the total degree of the quality of current practices of material supply chain process of the fifth domain (Post-Construction) was (75.0) which suggest high levels of estimation.

Table (12): Means, Standard Deviations and estimated level of the current practices of MSM process of the phases and the total degree.

No.	No. in the Questionnaire	Domain	Means	standard deviations	Percentage %	Estimated level
1	2	Sourcing (Vendor Selection)	4.18	0.38	83.6	High
2	1	Bidding Phase (Estimate, preparation & Submission	4.05	0.50	81.0	High
3	4	Construction	3.94	0.70	78.8	High
4	3	Material Procurement	3.81	0.54	78.2	High
5	5	Post construction	3.75	1.08	75.0	High
		Total	3.99	0.45	79.8	High

Table (12) shows that the total degree of the current practices of material supply chain process of total degree was (79.8) which suggest high levels of estimation. The highest mean was given to the second domain (Sourcing (Vendor Selection)). The lowest was for the fifth domain (Post-construction).

### 2. Results related to the Second Question. What is the adopted methods for the material order?

To answer this question, the researcher used frequencies and percentages as shown in following table.

No.	Method	Frequency	Percentage %	Rank			
1	Telephone	6	6.0	4			
2	Fax	2	2.0	7			
3	Personal meeting	8	8.0	2			
4	E-mail	2	2.0	7			
5	Internet, Tel, Personal meeting	2	2.0	7			
6	All	46	46.0	1			
7	Tel, P. personal meeting E-mail	5	5.0	5			
8	Tel, Fax, personal meeting, E-Mail	7	7.0	3			
9	Tel and E-mail	6	6.0	4			
10	Internet, Tel, Fax and personal meeting	4	4.0	6			
11	Tel, Fax and personal meeting	8	8.0	2			
12	Tel and personal meeting	2	2.0	7			
13	None	2	2.0	7			
	Total	100	100.0				

 Table (13): Frequencies and percentages for the adopted methods for

 the material order

Table (13) shows that the highest frequency of an adopted methods for the material order according to the respondents was (All) which got (46.0%) then Personal meeting and Tel, Fax and personal meeting . The lowest were Fax, E-mail, Internet, Tel, Personal meeting, Tel and personal meeting and none of any method.

## 3. Results related to the Third Question. What is the used criteria/s for supplier selection?

To answer this question, the researcher used frequencies and percentages as shown in following table:

Percentage Frequency Method Rank N0. % Availability, Good Quality, Competitive pricing- Cost, Reliable delivery, Flexibility in 1 4 4.0 6 accommodating contractor's changes/request Good Quality, Competitive Availability, pricing- Cost, Reliable delivery, Financial 23 2 23.0 1 facilitations Availability, Good Quality, Competitive pricing- Cost, Reliable delivery, Flexibility in accommodating contractor's changes/request, 3 2 2.07 relationship Financial Personal and facilitations Availability, Good Quality, Competitive pricing- Cost, Reliable delivery, Sign long 4 16 16.0 3 term agreement/enter into partnership and Mutual interests All 18.0 2 5 18 Good Quality, Competitive pricing- Cost, 6 6 6.0 4 Reliable delivery and Financial facilitations. Competitive pricing- Cost 7 4 4.0 6 Good Quality 2 7 8 2.0 Reliable delivery 9 4 4.0 6 2 Mutual interests 10 2.0 7 **Financial facilitations** 2 7 11 2.0 Availability, Good Quality and Reliable 4 12 4.0 6 delivery Good Quality, Competitive pricing- Cost and 13 6 6.0 4 Reliable delivery Competitive pricing- Cost and Financial 5 14 5.0 5 facilitations 15 None 2 2.0 7 100 100.0 Total

Table (14): Frequencies and percentages for the used criteria/s for supplier selection

Table (14) shows that the highest frequency of the used criteria/s for supplier selection were (Availability, Good Quality, Competitive Pricing-

Cost, Reliable delivery, Financial facilitations) which got (23.0%) then (All) which got (18.0%) according to the study sample responses.

4. Results related to the Fourth Question. What is the degree of the problems that face the contractors through the material supply chain process?

To answer this question, means and standard deviations and estimation level were used as shown in following tables:

 Table (15): Means, Standard Deviations and estimated level of the problems through the MSM Process of the first phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	Estimated level
35	35	The misunderstanding between the owner or consultant and contractor	4.08	0.73	81.6	High
36	37	Incomplete drawings and details	4.02	1.09	80.4	High
37	39	Ambiguities between plans and specifications	3.98	1.06	79.6	High
38	36	Lack of communication between the parties involved	3.86	1.02	79.2	High
39	37	Using specifications different from those commonly used	3.62	1.17	72.4	High
		Total	3.91	0.79	78.2	High

Table (15) shows that the total degree of the problems that face the Contractors through the Material Supply Chain Process of the first domain (Bidding Phase (Material Takeoff and identification) was (78.2) which suggest high levels of estimation. The highest mean was given to the item (The misunderstanding between the owner or consultant and contractor). The lowest was for the item (Using specifications different from those commonly used).

 Table (16): Means, Standard Deviations and estimated level of the problems through the MSM Process of the second phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	Estimated level
40	41	Incomplete proposals (Suppliers did not include all the documents with the proposal)	3.64	0.92	72.8	High
41	40	Lack of information about the suppliers	3.57	1.04	71.4	High
42	42	Time waste of investigating non-qualified suppliers	3.36	1.11	67.2	Mode rate
		Total	3.52	0.90	70.4	High

Table (16) shows that the total degree of the problems that face the contractors through the material supply chain process of the second domain (Sourcing (Vendor Selection) was (70.4) which suggest high levels of estimation. The highest mean was given to the item (Incomplete proposals (Suppliers did not include all the documents with the proposal)). The lowest was for the item (Time waste of investigating non-qualified suppliers).

Ouestionnaire Percentage No. in the Estimated deviations standard Means Item level No. % Late approval of submittal by 46 3.99 0.95 43 79.8 High the Supervisor Engineer communication Lack of 3.80 47 44 1.05 76.0 High between the parties involved Unavailability of required 43 3.75 45 1.20 75.0 High material Incorrect submittals by the 45 3.66 46 0.96 73.2 High suppliers submittals Late by the 47 44 contractor to be approved by 72.4 3.62 0.97 High the Supervisor Engineer Lack of coordination and 48 48 misunderstanding 3.43 68.6 High between 1.19 contractor and supplier 3.70 Total 0.80 74.0 High

Table (17): Means, Standard Deviations and estimated level of the problems through the MSM Process of the third phase.

Table (17) shows that the total degree of the problems that face the contractors through the material supply chain process of the third domain (Material Procurement) was (74.0) which suggest high levels of estimation . The highest mean was given to the item (Late approval of submittal by the Supervisor Engineer). The lowest was for the item (Lack of coordination and misunderstanding between contractor and supplier).

Questionnaire Percentage % No. in the Estimated deviations standard Means Item level No. 79.8 49 49 3.98 0.89 High Late deliveries Material does not meet 50 3.75 50 1.09 75.0 High specifications Re-handling of materials-Materials have to be moved 51 51 3.73 0.88 74.6 High from one place to another before being installed Poor communication between 3.62 52 56 0.94 72.4 High the parties involved Receiving, handling and storage 57 3.57 1.09 71.4 53 High of the unused materials Materials damaging 54 55 3.44 68.8 High 1.09 Warehouses are insufficient or 3.42 55 52 68.4 1.02 High too far from the site Mod 56 53 Materials waste 3.30 1.25 66.0 erate Mod 57 54 Theft 3.27 1.30 65.4 erate Total 3.56 0.76 71.2 High

Table (18): Means, Standard Deviations and estimated level of the problems through the MSM Process of the fourth phase.

Table (18) shows that the total degree of the problems that face the contractors through the material supply chain process of the fourth domain (Construction) was (71.2) which suggest high levels of estimation. The highest mean was given to the item (Late deliveries). The lowest was for the item (Theft).

Table (19): Means, Standard Deviations and estimated level of the problems through the MSM Process of the fifth phase.

No.	No. in the Questionnaire	Item	Means	standard deviations	Percentage %	Estimated level
58	59	No possibility that surplus materials can be returned to the supplier	3.54	0.94	70.8	High
59	58	No storage for the surplus materials	3.49	1.12	69.8	High
60	61	Salvage losses for the surplus materials	3.46	1.05	69.2	High
61	60	Charging penalties by the suppliers for the returned materials	3.19	1.06	63.8	Mod erate
Total			3.42	0.79	68.4	High

Table (19) shows that the total degree of the problems that face the contractors through the material supply chain process of the fifth domain (Post-Construction) was (68.4) which suggest high levels of estimation. The highest mean was given to the item (No possibility that surplus materials can be returned to the supplier). The lowest was for the item (Charging penalties by the suppliers for the returned materials).

Table (20): Means, Standard Deviations and estimated level of the problems through the MSM Process of the phases and the total degree.

No.	No. in the Questionnaire	Domain	Means	standard deviations	Percentage %	Estimated level
1	1	Bidding Phase (Material Takeoff and identification)	3.91	0.79	78.2	High
2	3	Material Procurement	3.70	0.80	74.0	High
3	4	Construction	3.56	0.76	71.2	High
4	2	Sourcing (Vendor Selection)	3.52	0.90	70.4	High
5	5	Post-Construction	3.42	0.79	68.4	High
		Total	3.62	0.64	72.4	High

Table (20) shows that the total degree of the problems that face the contractors through the material supply chain process of total degree was (72.4) which suggest high levels of estimation. The highest mean was given to the first domain (Bidding Phase (Material Takeoff and identification)). The lowest was for the fifth domain (Post-Construction).

# 5. Results related to the Fifth Question. In what level company is facing challenges when implementing current practices of material supply chain process?

To answer this question, the researcher used means and standard deviations and estimation level as shown in following tables.
% Ouestionnaire No. in the deviations Estimated Percentage standard Problem Means level N0. 65 Hidden cost 3.52 1.43 70.4 High 61 62 64 Insufficient vendor support 3.50 1.41 70.0 High Resources shortages e.g. no Mod 62 63 3.46 1.49 69.2 maintenance and update erate Resistance to change from Mod 3.19 64 61 63.8 1.55 employees erate Integration with supplier's Mod 65 67 3.11 1.45 62.2 system erate Skills shortages e.g. Mod 66 63 Computer illiteracy within 2.93 58.6 1.64 erate the company Integration with existing 2.46 67 66 1.50 49.2 Low system Mod 0.92 63.2 Total 3.16 erate

Table (21): Means, Standard Deviations and estimated level of the challenges of implementing MSM practices.

Table (21) shows that the total degree of the problems that the company face when implementing current practices of material supply chain process was (63.2) which suggest moderate level of estimation. The highest mean was given to the problem (Hidden cost). The lowest was for the problem (Integration with existing system).

Section Three: Results related to Study Hypothesis

1. Results related to the First Hypothesis. There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the implementation of material supply management in the construction

## sector in West Bank attributed to the variables of company classification

To test this hypothesis, One Way ANOVA test was used and the tables below show the results.

Table	(22):	Frequencies,	Means	and	Standards	Deviations	of	the
implen	nentat	ion of MSM a	ccording	to co	ompany clas	sification.		

company classific	N	Mean	S.D	
	First class	46	3.94	0.47
implementation of material	Second	19	4.04	0.26
supply management in the	Third	16	4.08	0.59
construction sector in West	Fourth	9	4.37	0.21
Bank	10	3.71	0.33	
	Total	100	3.99	0.45

Table (23): Results of One Way ANOVA of the implementation ofMSM according to company classification.

implementation of material supply	Source of variance	Sum of Squares	df	Mean Square	F	Sig.
management in the	Between Groups	2.402	4	0.600	3 167	0.017*
construction sector in West	Within Groups	18.012	95	0.190	5.107	0.017
Bank	Total	20.414	99			

\* The mean difference is significant at the 0.05 level.

Table (23) shows statistical significant differences at ( $\alpha = 0.05$ ) on the implementation of material supply management in the construction sector in West Bank attributed to the variable of company classification. The significant value was (0.017) which is less than (0.05) so the alternative hypothesis was accepted.

In order to explore the differences between the means of company classification, LSD test for post hoc comparisons was used and the results are shown in table (20).

 Table (24): Results of LSD Test for Post Hoc Comparisons of the implementation of MSM according to company classification.

implementation of material supply management in the	company classification Level s	Third	Fourth
construction sector in	First		-0.43525*
West Bank	Fifth	-0.37094*	-0.66163*

\* The mean difference is significant at the 0.05 level.

Table (24) shows that between (First class) and (fourth class) in favor of (Fourth class). And between (Fifth class) and (Third and fourth class) in favor of (Third and fourth class).

2. Results related to the Second Hypothesis. There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the effective implementation of material supply management in the construction sector in West Bank attributed to the variables of employees' perception of material supply management.

To test this hypothesis, One Way ANOVA test was used and the tables below show the results

implementation of Mishi according to employees perception of Mishi				
employees' perc m	eption of material supply anagement	Ν	Mean	S.D
·	Material procurement	12	3.98	0.47
Implementation	purchasing raw materials	7	3.95	0.40
of material	Suppliers relationships	3	4.20	0.26
supply management	A Tool to control inventories	1	4.14	
in the	Project management	16	3.91	0.50
sector in West	Customer Satisfaction	1	3.44	
Rank	All of the above	60	4.02	0.45
DallK	Total	100	3.99	0.45

Table (25): Frequencies, Means and Standards Deviations of the implementation of MSM according to employees' perception of MSM.

Table (26): Results of One Way ANOVA of the implementation ofMSM according to employees' perception of MSM.

implementation	Source of	Sum of	df	Mean	F	Sig
of material	variance	Squares	ui	Square	Ľ	Big.
supply	Between	0.638	6	0 106		
management	Groups	0.058	0	0.100		
in the	Within	10.77(	02		0.500	0.807
construction	Groups	19.770	93	0.213		
sector in West	Tatal	20/11/	90			
Bank	IUtal	20.414	<i>)</i> )			

\* The mean difference is significant at the 0.05 level.

Table (26) shows no statistical significant differences at ( $\alpha = 0.05$ ) on the implementation of material supply management in the construction sector in West Bank attributed to the variable of employees' perception of material supply management. This means that the alternative hypothesis was rejected as the significant value was (0.807) which is more than (0.05).

3. Results related to the Third Hypothesis. There is significant statistical relationship at ( $\alpha = 0.05$ ) between the current practices of material supply chain management in the construction sector in

## West Bank and problems that face suppliers in providing materials.

To test this hypothesis, Pearson correlation matrix was used and the tables below show the results:

Table (27): Pears	on correlation <b>a</b>	matrix between	the current practices
of MSM and prob	lems that face s	suppliers in prov	iding materials.

The problems that face the Contractors	Current practices of material supply chain management in the construction sector in West Bank		
Through the	Pearson Correlation	0.235*	
Material Supply Process	Sig. (2-tailed)	0.018	

\*. Correlation is significant at the 0.05 level (2-tailed

Table (27) shows that the alternative hypothesis was accepted and that there is a statistical significant relationship at ( $\alpha = 0.05$ ) between the current practices of material supply management in the construction sector in West Bank and problems that face suppliers in providing materials; the correlation was (0.235) and significant value was (0.018) which is less than (0.05).

4. Results related to the Fourth Hypothesis. There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply management in the construction sector in West Bank and suppliers participation in planning and establishing project objectives.

To test this hypothesis, Pearson correlation matrix was used and the tables below show the results:

Table (28): Pearson correlation matrix between implementation of MSM and suppliers participation in planning and establishing project objectives.

suppliers participation in	implementation of material supply management in the construction sector in West Bank			
planning and	Pearson Correlation	0.891*		
establishing project objectives	Sig. (2-tailed)	0.000		

\*\*. Correlation is significant at the 0.01 level (2-tailed

Table (28) shows that the alternative hypothesis was accepted and there is a statistical significant relationship at ( $\alpha = 0.01$ ) between implementation of material supply management in the construction sector in West Bank and suppliers participation in planning and establishing project objectives; as the correlation was (0.891) and significant value was (0.000) which is less than (0.01) which is accepted.

5. Results related to the Fifth Hypothesis. There is significant statistical differences at ( $\alpha = 0.05$ ) between implementation of material supply chain management in the construction sector in West Bank and suppliers selection criteria.

To test this hypothesis, Pearson correlation matrix was used and the tables below show the results:

Table (29): Pearson correlation matrix between implementation ofMSM and suppliers selection criteria.

Suppliers selection criteria	implementation of material supply chain management in the construction sector in West Bank				
	Pearson Correlation	0.694*			
	Sig. (2-tailed)	0.000			

\*\*. Correlation is significant at the 0.01 level (2-tailed

Table (29) shows that the correlation was (0.694) and significant value was (0.000) which is less than (0.01); which means the alternative hypothesis was accepted and there is a statistical significant relationship at ( $\alpha$  =0.01) between implementation of material supply chain management in the construction sector in West Bank and suppliers selection criteria.

Results related to the Sixth Hypothesis. There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply chain management in the construction sector in West Bank and company performance.

To test this hypothesis, Pearson correlation matrix was used and the tables below show the results:

Table (30): Pearson correlation matrix between implementation ofMSM and company performance.

company performance	implementation of material supply chain management in the construction sector in West Bank			
	Pearson Correlation	0.869*		
	Sig. (2-tailed)	0.000		

\*\*. Correlation is significant at the 0.01 level (2-tailed

Table (30) shows that the correlation was (0.869) and significant value was (0.000) which is less than (0.01) which is accepted and means that there is a statistical significant relationship at ( $\alpha = 0.01$ ) between implementation of material supply chain management in the construction sector in West Bank and company performance.

## 4.3 Interview Analysis

Interviews conducted as supplementary tool to obtain more information that reflected the situation of material supply chain management practices in contracting companies.

Semi-structure interviews were conducted by the researcher with the interviewee in administrative levels that are distributed for Contractors, General Manager, Team Leader, CEO and Project Manager.

Questions of interview was analysed and results are shown in table (28) below.

Table (31): Percentage responses for MSM problems that face contractors in WB.

Issue	Positive responses	Negative responses
Project completion delays	100	0.00
Financial losses	70.0	30.0
Price changes through execution	80.0	20.0
Inventories unavailability	60.0	40.0
Material supply problems	70.0	30.0
Material import problems	100	0.00

The results of these interviews will be discussed in chapter five ( Discussion).

# Chapter Five **Discussion**

## Chapter Five Discussion

## 5.1 Overview

This chapter discusses and evaluate the results obtained from this research by analyzing interviews, and using "SPSS" program for questionnaire analysis. Also it presents the current practices for MSCM for construction projects in West Bank.

Furthermore a framework for applying MSCM practices on construction projects is developed from the best practices that have been consensuses from contractors.

## **5.2 Results Discussion**

## 5.2.1 Interviews Discussion:

According to the analysis that have been done in chapter four and the results that was summarized in table (31), it was shown that the majority of responses agreed on the existence of real problems in material supply process, which need to be solved. These problems can be summarized as project completion delays, financial losses, price changes through execution, inventories availability, and material supply problems.

## **Project completion delays**

It was found that 100% of the sample interviews agreed that they have problems which affect the project completion date and cause delays due to several reasons such as: political issues, change orders from the owner, inefficient safety issues in the site, project type itself, scarcity of skilled labors, late approval of submittal by the supervisor engineer, suppliers can't meet the current demand.

### **Financial losses**

According to table (31) it is shown that 70% of companies faced big financial losses due to the project delays which include operational and overhead expenses, and penalties.

## Price changes through execution

80% of companies suffers from the price changes through project execution, especially when the materials prices increase (eg. steel prices are not stable), thus it will increase the cost of the project and may lead to losses.

## **Inventories unavailability**

60% of companies do not have warehouses and this is due to their perception that inventories increase the cost of handling, transportation, and facilities, which sometimes lead to material shortage for some activities of the project.

On the other hand 40% of companies do have warehouses either for equipment, excess materials, or materials needed for the whole project, and this warehouses are distributed according to the project sites and company's geographical location.

### Material supply problems

Material supply in construction projects suffers from many problems such as late deliveries, quality and quantity are not as required and unavailability of materials. And 70% of companies agreed on these problems.

#### Material import

100% of companies manifested that materials importing is considered as a difficult process due to the long process and the complexity of procedures that Israeli occupation government forced on Palestinians, which usually cause a late delivery of materials, and increase the cost of material.

## 5.2.2 Questionnaire Discussion

This part express a discussion for the results that have been mentioned in the previous chapter which explore and assess the current practices for material supply chain management, and the problems and challenges in applying these practices.

This study is done through answering the five questions of the study and check the validity of the hypothesis that have been set for this research. General assessment for material supply process in construction projects:

Results for this section of questionnaire are shown in table (6) in chapter four. Questions of this part concern about the term of material supply chain management, general practices of material supply management, and quality issues for services and material.

According to table (6) it was found that 60% of employees have the right perception about the MSCM which seems to be moderate level and need for improvement. Statistics also shows that 42% of companies don't have a material supply chain management department, which negatively affect the process of material supply. This means that there is a weakness in the management, and top managers are not aware of the importance of this trend of management for construction projects.

87% of companies ensure that they do not have ISO certificate and this may affect companies' performance, decrease the opportunity of the company to expand in foreign markets, and reduce international competitiveness; as Implementing International Standards in construction not only provides technical advantages, but also social, economic and environmental gains for construction industry, regulators and consumers which support project management life cycle as a whole. On the other hand a high percentage of contracting companies (90%) cares about checking materials quality once they deliver and this improve the quality of the project. For inventories 92% of companies have their own inventories; this may contradict with the result from interviews due to the fact that there are two types of inventories for construction projects: inventories in site (temporary) which is used for projects equipment and day to day materials, and permanent inventories for company assets, material inventory and excess materials. Also results shows that materials are stored efficiently in inventories.

#### **Discussion related to research question**

## 1. What is the degree of the current practices of material supply chain process?

As table (12) shows that the total degree of the quality of current practices for material supply chain management was (79.8) which conclude that contractors companies are in a high level of applying the practices of MSCM, especially during the second phase (vendor selection) which was (83.6). But the fifth phase (post-construction) had the lowest mean for applying MSCM practices.

As a result, attention must be given to the fifth phase of the project, which concentrate on conducting comprehensive assessment for the material supply chain process through the mentioned phases to avoid the mistakes and improve this process in future projects.

The best practices that most companies agreed on was estimating the quantity of the needed materials per each item, negotiating the prices

directly with the suppliers, checking the materials to make sure that the delivered materials meets the specifications, quantities and the timeframe specified, and keep generating the material requisition forms in which the material description, quantities needed, dates when the materials are needed and locations.

On the other hand using technological systems such as bar codes, EDI, RFID etc. for material control gained the lowest response from contractors. This may be due to the lack in skilled labors, not following the technological updates and unawareness to the importance of these systems.

### 2. What is the adopted methods for the material order?

Methods for material order from suppliers can be personal meetings, telephone, fax, internet, and e-mail.

Table (13) shows the frequency of adopting methods that contractors prefer and it shows that contractors prefer mostly personal meetings, as this method can provide contractors more accurate information about the suppliers and materials status. The other method that came after this method can be Telephone for dealing with approved suppliers.

Internet, fax and e-mail was the least using by contractors. This may refers to the fact that the direct speech is more effective and offer more Persuasion and this is agreed with Arnold study (The Persuasive Style of Debates in Direct Speech in Thucydides, 1992).

### 3. What is the used criteria/s for supplier selection?

Results shows that the common adopted criteria's for suppliers selection was given to the combination of availability, good quality, competitive pricing-cost, reliable delivery, and financial facilitations.

## 4. What is the degree of the problems that face contractors through the material supply chain process?

Problems that face contractors during material supply were studied through the five phases of the project (bidding phase, vendor selection phase, material procurement phase, construction phase, and postconstruction phase). And it was appeared that the bidding phase take the highest level in facing material supply problems.

Through the bidding phase there have been obviously problems that face contractors and make the material supply process ineffective, and these are represented in misunderstanding between owner or consultant and contractor, incomplete drawings and details, ambiguities between plans and specifications, lack of communication between the parties involved; Deming suggested that working with the supplier as a partner in a longterm relationship of loyalty and trust will improve quality and decrease the costs of production (Deming, 1982), and using specifications different from those commonly used. Thus the problems that face contractors through the material supply process will lead to increasing in project by 10%, duration also may be similarly affected as Bertelsen mentioned in his study. (Bertelsen, 1993)

## 5. In what level company is facing challenges when implementing current practices of material supply chain process?

As shown in table (21) in the previous chapter, the total degree of the problems that the company face when implementing current practices of material supply chain process was moderate. The most occurring challenges represents in the hidden cost and insufficient vendor support.

This illustrate that the application of MSCM practices is a critical engine for the long-term success of construction firms as Benton & McHenry mentioned. (W.C. Benton, Jr. & Linda F. McHenry, 2010)

## **Discussion related to Study Hypothesis**

H• 1: There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the implementation of material supply management in the construction sector in West Bank attributed to the variables of company classification.

It is approved that there is a significant strong relationship between the company classification and implementation of MSCM practices.

And it is shown that the third and fourth classes of contractors companies are the most applying for MSCM practices. The researcher attributed this to the size of the organization as it is small companies and their relationships are specific and this will ease the follow up and control for all parties involved in the supply chain. Also these companies tend to improve their system and practices continuously to reach to high classes by adopting new trends.

H• 2: There are significant statistical differences at ( $\alpha = 0.05$ ) in the responses degree of the effective implementation of material supply chain management in the construction sector in West Bank attributed to the variables of employees' perception of material supply chain management.

The results show that there are no statistical significant differences in the implementation of material supply chain management in construction sector in West Bank attributed to the variable of employees' perception of material supply chain management. This can be attributed to the importance of all terms of material supply chain management definition.

Material procurement, purchasing raw materials, suppliers relationships, a tool to control inventories, project management, and customer Satisfaction are all main components of the MSCM definition and the perception of one of them will affect the implementation of MSCM practices as a whole.

H• 3: There is significant statistical relationship at ( $\alpha = 0.05$ ) between the current practices of material supply chain management in the construction sector in West Bank and obstacles that face suppliers in providing materials.

Table (27) in chapter four shows that there is statistical significant relationship between the current practices of material supply chain management in the construction sector in West Bank and problems that face suppliers in providing materials.

This conclude that the current practices of material supply chain management are insufficient and can't exceed the problems that occurs in material supply process, this is due to the fact that contracting companies are not applying MSCM practices completely and this may refers to the absence of the material supply chain department in companies (as 42% of companies answered that they do not have MSCM department). And this lead to the importance of the effectively implementation of material supply chain management.

H• 4: There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply chain management in the construction sector in West Bank and suppliers participation in planning and establishing project objectives.

According to table (28) there is strong statistical significant relationship between implementation of material supply chain management in the construction sector in West Bank and suppliers' participation in planning and establishing project objectives. Contractors are aware of the importance of building relationships with suppliers and 71% of companies ensured that they have partnership agreements with suppliers; this confirms the importance of this step. Deming in his book suggested that working with the supplier as a partner in a long-term relationship of loyalty and trust will improve quality and decrease the costs of production (Deming, 1982), and this agree with the result obtained from the sixth hypothesis.

## H• 5: There is significant statistical differences at ( $\alpha = 0.05$ ) between implementation of material supply chain management in the construction sector in West Bank and suppliers selection criteria.

Table (29) shows that there is a statistical significant relationship between implementation of material supply chain management in the construction sector in West Bank and suppliers selection criteria, which means that the criteria for selecting suppliers positively affect the application of MSCM.

## H• 6: There is significant statistical relationship at ( $\alpha = 0.05$ ) between implementation of material supply chain management in the construction sector in West Bank and company performance.

As can be seen from table (30) there is statistical significant relationship between implementation of material supply management in the construction sector in West Bank and company performance. And this appointed that the effective management of material supply chain for construction projects will improve companies' performance, and will be reflected on the financial status of the company and its competiveness advantage in the market.

## 5.3 A Framework for material supply chain management for construction projects

The smooth flow of material across the construction supply chain is considered as a major factor for the successful completion of construction projects; because it determines the time for materials delivery, the quantity, the price and the quality needed.

Through literature reviews, interviews, and questionnaire surveys the researcher developed a framework for material supply chain management for construction projects in West Bank, this can help contractors to adopt the material supply chain management for better services and successful completion of projects.

This framework consists of two main parts, the organizational orientation and the process orientation which include the best practices of applying material supply chain management that have been identified by the questionnaires. The framework is combined from the five phases of the project (bidding phase, sourcing phase, material procurement phase, construction phase, and post-construction phase).

The general framework of this paper is depicted in Figure below.



Figure (6) A framework of best practices in MSM for construction projects in WB.

## **Organizational Orientation**

#### Cultural Change

Based on the previous results it is seen that it is important to apply the cultural change in order to make the suggested framework applicable. This type of change includes five types of changes:

- a. Changes in Companies' Culture: one of the most important changes.
- b. Changes in Management Style: it includes change from command and control management to "team management" style.
- c. Changes in Knowledge Management Strategies: Changes to the knowledge assets of an organization.
- d. Changes in technology: Changes to technology infrastructure, systems, automations and tools.
- e. Changes in Development Processes.

These five types of changes are reflected in cultural change and covered by leadership style and decentralization and communication.

The researcher noticed that the change in management style is vital when applying new concepts and practices of material management.

### **Change Management**

Change management is necessary for implementation of MSCM framework. This can be done through the involvement of the people affected by the changes, and by achieving personal change.

It is important to build awareness to the change process that makes team work to be able to achieve effectiveness and efficiency. There are many challenges that will appear through transforming from traditional project management to material supply chain management as mentioned in the survey. Hence, change management is important for the successful application of MSCM practices, and this is a responsibility of the top management to raise the awareness of employees about the importance of these practices.

## **Process Orientation**

## **Bidding Phase**

All projects, whether they involve new construction or expansion of an existing structure, require the preparation of contract documents after getting the bid documents.

This phase is composed of Estimation, preparation & Submission. It is considered as critical phase and requires to be accurate as it contains a lot of decisions that will affect the success of the project.

This phase is composed from many practices that can be summarized as below:

1. Estimating the quantity of the needed materials per each item

 Using software or computer applications such as Microsoft Excel for preparing the estimates.

- Identifying the needed materials for each item once you receive the project's drawings and specifications.
- 4. Involving the project manager or construction team in the estimation process.
- 6. Scheduling a meeting with the project manager and the construction team to re-estimate the project quantities after you win the bid
- 7. Defining any special requirements for the project.
- Identifying the materials according the availability or the need for making them.
- Establishing a schedule for material requisition according the type of material, the quantity needed and dates to be on site.
- 10. Establishing historical prices database for the materials in order to be used for preparing the estimate for the future projects.
- 11. Include key suppliers in planning and goal setting activities.

## **Vendor Tendering Phase**

Vendor tendering phase is one of the most important issues that face companies. The selection of suppliers is done by using a variety of mechanisms, and it should be based on total cost of using a supplier not only the purchase price.

## Practices of this phase include the following:

- 1. Negotiating the prices directly with the suppliers.
- 2. Verifying that the supplier is capable to deliver the right materials with the right quantity at the right time to the right place.
- 3. Recruitment offers from different suppliers.
- 4. Purchasing the materials from previous suppliers with previous project.
- 5. Pre-qualify the suppliers and make documentations for qualified suppliers.
- 6. Selecting the winner supplier based on the lowest prices.
- 7. Considering suppliers with higher prices for quality issues.

## **Material Procurement Phase**

Once suppliers have been selected, contracts are in place, and the products has been designed and specified, the suppliers engage in procurement transactions that begin with the buyer placing the order and end with the buyer receiving and paying for the orders. Processes include:

- 1. Check the materials to make sure that the delivered materials meets the specifications, quantities and the timeframe specified.
- Specify for the suppliers the release dates of and the exact location for materials delivery to avoid materials re-handling.

- 3. Issuing purchase order to the winner supplier in order to organize the relationship between the contractor and the supplier.
- 4. Requesting a material sample from the supplier for testing it before the material is ordered.
- 5. Obtaining the material requisition schedule that prepared by site staff.
- 6. Requesting materials directly by the field staff.

## **Construction Phase**

As bidding phase is finished, and material procurement is done it's time now for start with construction phase, which include:

- Keep generating the material requisition forms in which the material description, quantities needed, dates when the materials are needed and locations.
- 2. Verifying the material received against the material ordered by tests.
- 3. Keeping a track record of the supplied materials, remaining balance and the installed materials.
- 4. Recording any problems in the delivered materials.

## **Post-construction Phase**

Conducting comprehensive assessment for the material supply chain process through the mentioned phases is critical step to avoid the mistakes and develop these processes in the future projects.

## Chapter Six Conclusions and Recommendations

## **Chapter Six Conclusions and Recommendations**

## 6.1 Overview

This chapter briefly overview the research results where the main conclusions are explained. It also focuses on recommendations for adopting the MSCM. In addition, this chapter discusses the research contributions to current literature and the suggestions for future studies.

## **6.2** Conclusions

Based on the information presented in this thesis, the following are the main research conclusions:

- Contractors in West Bank face problems that cause late deliveries, delays in project completion, financial losses, hidden cost, and material losses.
- The results show up problems in communication between all participants in the construction industry which appears in misunderstanding between owner or consultant and contractor, incomplete drawings and details, and ambiguities between plans and specifications.
- Traditional project management principles are not enough for project success as it doesn't consider all participants in construction projects.

- Due to the problems that appeared in material supply process; the need arises for implementing new trends of management, as applying the material supply chain management.
- 60% of contractors have the right perception of MSCM concepts; which is considered moderate level that need to be improved in order to increase the awareness toward the importance of such concepts.
- 42% of contracting companies do not have material supply management department, and 33% partially have departments for material supply management; this indicate that a high percentage of companies do not have the attention for applying MSCM. This also refers to weakness in perception toward MSCM.
- Companies are not aware of the importance of using technological systems such as bar codes, EDI, RFID etc. for material control, as the percentage of using these technologies was low (46.2). This may be due to lack of technological skills, shortage in financial and technical resources, and lack of knowledge.
- There is an urgent need for adopting a material supply chain management framework by contracting companies in West Bank to improve their performance.
- Change management is a basic process for applying the MSCM framework, in order to avoid challenges that may appeal in business environment during the implementation of MSCM framework.

## **6.3 Recommendations**

Based on the outcome of this research, the following can be recommended:

- Build up communication channels between suppliers, contractors, consultants, owners and any other participants in construction projects.
- Strengthen the relationship with suppliers and build up long term relationships.
- Conduct training courses to develop employees' skills, knowledge and perceptions.
- Raise the awareness for the importance of using technology for inventories management and material control, through holding workshops for managers.
- Encourage managers to adopt "Team Management" style, to increase the coordination between functional disciplines and stages.
- Get rid of surplus materials in lowest possible losses, as building up reverse logistic systems with suppliers or reselling the material.
- Adopt quality management concepts and apply ISO certificate requirements.
- Adopt the conducted material supply management framework.

## 6.4 Research Contributions

The importance of this research is derived from its contribution to solve material supply problems in contracting companies in West Bank, by studying the practices of MSCM and conducting MSCM framework.

So the results of this research are of great importance to the academic field and researchers, and contracting companies that seeks to improve their performance. Therefore the research is considered to have a significant contribution in the following areas:

- Giving a clear assessment for the current practices of material supply in construction projects.
- Determine problems that contractors face in material supply process.
- Determining challenges that affect the implementation of MSCM practices in construction projects.
- Developing a framework for MSCM which increase the adopting of MSCM in construction projects in West Bank.

### 6.5 Recommendations for Future Studies

The following are some of the key recommendations for further research, which may contribute in developing the MSCM in West Bank:

• Study warehouses management and its effect on the material supply chain management.

- Other research may explore the importance of reverse logistics in construction industry and its effect on MSCM.
- Clarify and study the importance of horizontal and vertical integrations in CSCM.
- Develop MSCM researches from the owner perspective.

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## Appendices

## **Appendix** (A): **Questionnaire**

#### (English Form)

## **Implementation of Material Supply Management in the Construction Sector in Palestine.**

#### Introduction

Material Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, material supply chain management integrates supply and demand management within and across companies.

#### **Objectives**

This research plans:

- To investigate the current practices of supply chain management of construction companies in Palestine.
- To develop a framework that can be implemented for material SCM in the construction companies.

This questionnaire is considered as a part of the supplementary research to achieve master degree in the Engineering Management program at An-Najah National University–Nablus.

Please take a look at the following questions and try to answer correctly and accurately, as many questions as possible. All the information gathered here will be kept strictly confidential and will be used only for research and analysis purposes without mentioning the person or company names. If you require clarification and any further information, please do not hesitate to contact me.

#### Thanks for your assistant and cooperation

#### Shomoo Badawi

Email: shomoo.badawi@hotmail.com

**Section One** 

General information about the person who is filling the questionnaire											
1. Co	1. Company Location in the West Bank:										
2. Year of Establishment for the Company:											
3. Average number of employees within the last five years:											
4. Company classification according to the contractor union for the											
following sectors											
(	) First class (	) Second cla	ass ( ) Third class								
(	) Forth class (	) Fifth class									
5. Re	espondent Position:										
(	) Company Manager	(	) Project								
(	) Manager	(	) Site Engineer								
(	) Supervision Engineer										
6. Tł	ne person or section in ch	arge of the	material procurement is								
(	) Company Director	(	) Project Manager								
(	) Site Engineer	(	) Procurement Section								
(	) Other										
7. Re	espondent Scientific Qual	ification:									
(	) Higher Studies	(	) Bachelor								
(	) Diploma	(	) High School								
8. Re	espondent Years of Expe	riance:									
(	) 5 years and	(	) 5-10 years								
(	) 10- 15 years	(	) 15 years and above								

9. Number of executed projects within the last five years								
(	) 10 and below	(	) 11 -20	(	) 21-30			
(	) 31-40	(	) more than 40	)				

# 10. The Dollar Value of Construction Projects Performed During the Last five Years (Million Dollar)

(	) Less than 1	( ) From 1 to less than 5
· /	,	

( ) From 5 to less than 10 ( ) More than 10

## **11. Type of Projects in the Company**

- ( ) Building ( ) Infrastructure
- ( ) Building &Infrastructure

### Section Two

Evaluate the current level of the implementation of material supply management in the construction sector in West Bank

### 1. What is your perception of material supply management?

(	) Material procurement	(	) purchasing raw materials
(	) Suppliers relationships	(	)A Tool to control inventories
(	) Project management	(	) Customer Satisfaction

( ) All of the above

# 2. Does your Company have material supply management department?

( ) Yes ( ) No ( ) Partially Existing

## 3. Does your company have quality control of materials?

( ) Yes ( ) No ( ) Partially Existing

4. Does your company have inventories? ) Yes ) No ) Partially Existing ( ( ( 5. Are materials stored in places suitable for their safety? ) Yes ( ) No ( ) Don't Know ( 6. Has your Company got the ISO Certificate? ( ) Yes ( ) No ( ) Don't Know 7. Does the Contractor's Engineer Exist at the Site Permanently? ( ) Yes ( ) No ( ) Don't Know 8. Does your company have suppliers documentation? ) Yes ( ) No ( ) Don't Know ( 9. Do you use special forms for material management? ( ) Yes ( ) No ( ) Don't Know 10. Is there any recorded cases for complains from the construction team for late delivery of materials? ) Yes ) No ) Don't Know ( ( ( 11. Do you have any partnership agreements with any of your suppliers? ( ) Yes ( ) No ( ) Don't Know 12. Do these partnerships include any contractual agreements? ( ) Yes ( ) No ( ) Don't Know 13. How do you value partnership with your suppliers? ) Important ( ) Unimportant ) Normal ( (

107

### **Section Three**

## **Current Practices of Material Supply Chain Process**

# **3.1** Please tick the appropriate cell for your current practice for each statement below.

NI.			Usag	ge De	gree	
INO.	Material Supply Chain Process	1	2	3	4	5
	Phase 1: Bidding Phase (Estimate, prepar	ation	1 & S	ubm	issioi	1)
1.1	Identifying the needed materials for each item once you receive the project's drawings and specifications					
1.2	Estimating the quantity of the needed materials per each item					
1.3	Include your key suppliers in planning and goal setting activities					
1.4	Defining any special requirements for the project					
1.5	Identifying the materials according the availability or the need for making them					
1.6	Using softwares or computer applications such as Microsoft Excel for preparing the estimates					
1.7	Involving the project manager or construction team in the estimation process					
1.8	There is coordination between the functional disciplines and stages					
1.9	Establishing historical prices database for the materials in order to be used for preparing the estimate for the future projects					
1.10	Depending on the prices of suppliers and manufacturers on preparing the project estimate					
1.11	Scheduling a meeting with the project manager and the construction team to re- estimate the project quantities after you win the bid					
1.12	Establishing a schedule for material requisition according the type of material, the quantity needed and dates to be on site					

No	Motorial Supply Chain Dragons		Usage Degree					
190.	Material Supply Chain Process	1	2	3	4	5		
	Phase 2: Sourcing (Vendor Selection)							
2.1	Pre-qualify the suppliers and make documentations for qualified suppliers							
2.2	Verifying that the supplier is capable to deliver the right materials with the right quantity at the right time to the right place							
2.3	Purchasing the materials from previous suppliers with previous projects							
2.4	Recruitment offers from different suppliers							
2.5	Selecting the winner supplier based on the lowest prices							
2.6	Considering suppliers with higher prices for quality issues							
2.7	Negotiating the prices directly with the suppliers							
	Phase 3: Material Procurement							
3.1	Obtaining the material requisition schedule that prepared by site staff							
3.2	Using technology systems such as bar codes, EDI, RFID etc. for material control							
3.3	Requesting a material sample from the supplier for testing it before the material is ordered							
3.4	Issuing purchase order to the winner supplier in order to organize the relationship between the contractor and the supplier							
3.5	Requesting materials directly by the field staff							
3.6	Using JIT (Just in Time) delivery system							
3.7	Ordering 100% of the estimated items quantities at once							
3.8	Specify for the suppliers the release dates of and the exact location for materials delivery to avoid materials re-handling							

No.	Material State Decom	Usage Degree					
	Material Supply Chain Process	1	2	3	4	5	
	Phase 4: Construction						
4.1	Keep generating the material requisition forms in which the material description, quantities needed, dates when the materials are needed and locations						
4.2	Verifying the material received against the material ordered by tests						
4.3	Recording any problems in the delivered materials						
4.4	Keeping a track record of the supplied materials, remaining balance and the installed materials						
4.5	The distributer or supplier provides an on- site truck						
	Phase 5: Post-Construction						
5.1	Conducting comprehensive assessment for the material supply chain process through the mentioned phases to avoid the mistakes and develop this process in the future projects						

## **3.2 Please check the method/s you adopt for material order:**

1.	Internet	(	)
2.	Telephone	(	)
3.	Fax	(	)
4.	Personal meeting	(	)
5.	E-mail	(	)

## **3.3 Please check the criteria/s you use for supplier selection:**

1.	Availability	(	)
2.	Good Quality	(	)

3. Competitive pricing- Cost ( ) Reliable delivery ( 4. ) Flexibility in accommodating contractor's changes/request ( 5. ) Sign long term agreement/enter into partnership ( 6. ) Personal relationship 7. ( ) Mutual interests 8. ( ) **Financial facilities** 9. )

# Section four - Identification of the challenges that face the Contractors through the Material Supply Chain Process

Use your experience to determine the degree of occurrence of the following problems by ticking the appropriate cell.

NT -	Material Chaire Descent	Usage Degree						
INO.	Material Supply Chain Process	1	2	3	4	5		
	Phase 1: Bidding Phase - Material Ta	keoff	and id	entific	cation			
1.1	The misunderstanding between the owner or consultant and contractor							
1.2	Lack of communication between the parties involved							
1.3	Incomplete drawings and details							
1.4	Using specifications different from those commonly used							
1.5	Ambiguities between plans and specifications							
	Phase 2: Sourcing (Vendor Selection)	)						
2.1	Lack of information about the suppliers							
2.2	Incomplete proposals (Suppliers did not include all the documents with the proposal)							
2.3	Time waste of investigating non- qualified suppliers							

No	Madarial Samuela Chaita Davad		Usage Degree						
NO.	Material Supply Chain Process	1	2	3	4	5			
	Phase 3: Material Procurement								
3.1	Unavailability of required material								
3.2	Late submittals by the contractor to be approved by the Supervisor Engineer								
3.3	Incorrect submittals by the suppliers								
3.4	Late approval of submittal by the Supervisor Engineer								
3.5	Lack of communication between the parties involved								
3.6	Lack of coordination and misunderstanding between contractor and supplier								
	Phase 4: Construction								
4.1	Late deliveries								
4.2	Material does not meet specifications								
4.3	Re-handling of materials- Materials have to be moved from one place to another before being installed								
4.4	Warehouses are insufficient or too far from the site								
4.5	Materials waste								
4.6	Theft								
4.7	Materials damaging								
4.8	Poor communication between the parties involved								
4.9	Receiving, handling and storage of the unused materials								
	Phase 5: Post-Construction								
5.1	No storage for the surplus materials								
5.2	No possibility that surplus materials can be returned to the supplier								
5.3	Charging penalties by the suppliers for the returned materials								
5.4	Salvage losses for the surplus materials								

In	what	level	your	company	is facin	g the	problems	below	when	using
th	ese syst	tems?								

Problem / Rate	No problem at all (1)	Little problem	Some problem	Significant problem	Serious problem
Resistance to change	(1)	(=)	(3)	(1)	(0
from employees					
Resources shortages					
e.g. no maintenance					
and update					
Skills shortages e.g.					
Computer illiteracy					
within the company					
Insufficient vendor					
support					
Hidden cost					
Integration with					
existing system					
Integration with					
supplier's system					
Integration with					
customer's system					
Other (specify)					

#### **Appendix (B): Questionnaire Arabic**

#### استبيان حول

مدى تطبيق إدارة توريد المواد في قطاع الإنشاءات في فلسطين

السادة الكرام – تحية طيبة وبعد

إدارة المواد هى الإدارة المتكاملة المسئوله عـن تخط يط الحصـول علـى المـواد والإحتياجات وتوفيرها وتخزينها والرقابه عليها والتصرف فيها بشكل يحقق أفضل إستخدام لها لتحقيق نجاح الشركة.

وقد أظهرت العديد من الدراسات مدى أهمية تطبيق مبادئ إدارة توريد المواد والآثار الجانبية التي تنعكس على نجاح المشروع من خلال تسليم المشروع في الوقت المناسب وضمن الميزانية المحددة له، والقيام بفعاليات المشاريع بصورة صحيحة وضمن المواصفات المطلوبة.

يهدف هذا الاستبيان إلى تقييم مستوى تطبيق مبادئ ادارة توريد المواد في قطاع الإنشاءات في فلسطين، وأبرز التحديات التي تواجه تنفيذها وتحديد العوامل المؤثرة في تحسينها. يعتبر هذا الاستبيان جزءاً من البحث التكميلي لنيل درجة الماجستير في تخصص الإدارة الهندسية /جامعة النجاح الوطنية – نابلس

إن هذا الاستبيان موجه إلى الجهات المسؤولة عن تنفيذ المشاريع الإنشائية ومن يمثلها من مديري مشاريع وشركات مقاولات.

أرجو من حضرتكم تعبئة هذا الاستبىان بالحقائق المناسبة والدقىقة قدر الإمكان، حيـث أن جميع المعلومات الواردة في هذا الاستبيان ستستخدم فقط لأغراض هذا البحث وسيتم نشـر النتائج على شكل نتائج إحصائية لمجموع شركات عينة البحث.

إن المعلومات التي ستساهمون بها ستساعد في إثراء البحث العلمي وتطوير قطاع الإنشاءات في فلسطين.

#### شاكرين لكم حسن تعاونكم،،،

الباحثة: م.شموع بدوي

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القسم الأول :معلومات أولية 1. مقر الشركة (المدينة): 2. سنة تأسيس الشركة: 3. معدل عدد العاملين في الشركة خلال الخمس سنوات الماضية:...... .4 تصنيف الشركة حسب تصنيفات اتحاد المقاولين: ) درجة ثالثة ) درجة أولى ( ) درجة ثانية ) ) درجة خامسة ( ) درجة رابعة ) 5. الموقع الوظيفي ( ) مدیر شرکة ) مدیر مشروع ) ) مهندس موقع ( ) مهندس إشراف ) غير ذلك ) ) 6. المؤهل العلمي ) بكالوريوس ) در اسات عليا ) ثانوية عامة ) ) ( ) دبلوم 7. عدد سنوات الخبرة )10–15 سنة ( )5–10سنو ات ) أقل من خمس سنوات ) ) ( ) أكثر من 15 سنة 8. عدد المشاريع التي نفذت خلال السنوات الخمس الماضية: (بقيمة مليون دولار أو أكتر) مشاريع نفذت أو اشرف على تنفيذها وليس تصميم 30-21 ( ) ( ) 11–20ض ( ) 10 أو أقل ) اکثر من 40 31-40 ( ) )

9. قيمة المشاريع التي نفذت خلال السنوات الخمس الماضية: (مليون دولار) مشاريع نفذت أو اشرف عليها وليس تصميم ( ) من 1 إلى أقل من 5 ( ) أقل من (1) ( ) أكثر من (10) ( ) من 5 إلى أقل من10 10. مجالات عمل الشركة (أرجو كتابة التصنيف الحاصلة عليه الشركة) ) الاثنان معا ( ) بنية تحتية ( ) أبنية القسم الثاني: تقييم مستوى تطبيق إدارة توريد المواد فى قطاع الإنشاءات الرجاء اختيار إجابة واحدة فقط 1. ما هو تصوركم عن مفهوم ادارة توريد المواد؟ ) شراء المواد الخام adují a limenta ) ) أداة للتحكم بالمخزون ( ) العلاقات مع الموردين ) ) رضا العميل ( ) إدارة المشروع ) ( ) جميع ما ذکر ٤. هل يوجد لدى شركتكم قسم خاص لإدارة توريد المواد؟ ) موجود بشكل جزئي ) ע () צ ( ) نعم 3. هل شركتكم حاصلة على شهادة الجودة ISO؟ ( ) لا ( ) نعم 4. هل يتم التحقق من جودة المواد الموردة الى شركتكم؟ ) لیس دائما ( ) نعم ) ( ) لا .5 هل يتوفر فى شركتكم مخازن لتخزين المواد؟ ( ) لا ) أحياناً ( ) نعم )

6. هل يتم تخزين المواد في أماكن ملائمة لها وتضمن سلامتها؟ ( ) نعم ( ) لا أعلم 7. هل يتواجد مهندس المقاول بشكل دائم في الموقع؟ () لا () أحيانا ( ) نعم 8. هل يوجد لديكم توثيق لكافة التعاملات مع الموردين؟ () لا أعلم ( ) نعم 9. هل يوجد لديكم نماذج خاصة لعملية توريد المواد؟ ( ) نعم ( ) لا أعلم 10. هل يوجد حالات مسجلة لشكاوي فريق الانشاء عن تأخر في المواد المطلوبة؟ ( ) نعم ( ) لا أعلم 11. هل يوجد اتفاقيات شراكة حالية مع موردين؟ ( ) لا أعلم ( ) لا ( ) نعم 12. هل هذه الاتفاقيات اتفاقيات تعاقدية؟ () لا أعلم ( ) צ ( ) نعم 13. ما هو تقييمك لهذه الشراكات مع الموردين؟ ( ) غير مهمة ( ) عادية ( ) مهمة

117

القسم الثالث

الممارسات الحالية لعملية إدارة توريد المواد في المشاريع الإنشائية.

3.1 الجدول التالي يحدد المارسات المتوقعة لعملية إدارة توريد المواد. من فضلك حدد نسبة تطبيقك لهذه الممارسات أمام كل خطوة

نسبة التطبيق			نس			
5	4	3	2	1	عملية توريد المواد	No.
مطلقا	نادرا	احيانا	غالبا	دائما		
					لة الأولى: التسعير، إعداد المناقصة والتسليم	المرحا
					تحديد المواد المطلوبة لكل بند بمجرد الحصول على وثائق العطاء	1.1
					تقدير الكميات المطلوبة من المواد	1.2
					إشراك الموردين الرئيسيين في إعداد الخطط ووضع الأهداف	1.3
					تحديد أي متطلبات خاصة لبعض المــواد و/ أو أي مواد خاصة مراد استخدامها في المشروع	1.4
					تصنيف المواد الى مواد متوفره او مواد تحتاج الى التصنيع	1.5
					استخدام تطبيقات الكمبيوتر مثل الاكسل أو أي برامج أخرى لإعداد جداول الكميات والأسعار	1.6
					إشراك مدير المشروع أو فريق الإنشـــاء فـــي إعداد جداول الكميات والأسعار	1.7
					يوجد تنسيق بــين الأطــراف المشــاركة فــي التصميم والأطراف التي تقوم بالتنفيــذ خـــلال عملية التسعير وإعداد جداول الكميات	1.8
					إنشاء قاعدة بيانات للمشاريع السابقة تتعلق بالمواد المستخدمة لكل مشروع وأسعارها	1.9
					الاعتماد على أسعار المــوردين فــي تســعير المشروع	1.10

نسبة التطبيق			نس			
5	4	3	2	1	عملية توريد المواد	No.
مطلقا	نادرا	احيانا	غالبا	دائما		
					عقد اجتماع يضم مــدير المشــروع و فريــق	
					الإنشاء بغرض تقييم جداول الكميات في حـــال	1.11
					الحصول على المناقصة	
					إعداد خطة لطلب المواد تبين نوع المواد،	1 1 2
					الكميات المطلوبة والتواريخ المطلوبه فيها	1.12
					لة الثانية: اختيار المورد	المرح
					تأهيل الموردين و توثيــق بيانـــات المــوردين	2.1
					الموصىي بهم	
					التأكد من أن المورد لديه القدرة على تــوفير	
					المواد المطلوبة بالكمية والتاريخ المطلوبين والى	2.2
					المكان المحدد	
					شراء مواد المشروع من موردين تــم التعامــل	23
					معهم في مشاريع سابقة	2.5
					استقدام عروض أسعار من أكثر من مورد	2.4
					اختيار المورد الفائز بناًءً على أقل الأسعار	2.5
					الاخذ بعين الاعتبار المــوردين ذوو الاســعار	26
					المرتفعة في حال وجود متطلبات خاصة بالجودة	2.0
					التفاوض المباشر مع الموردين على أسعار المواد	2.7
					لة الثالثة: شراء المواد	المرحا
					الحصول على جدول شراء المواد الـــذي يعـــده	
					طاقم الإنشاء و يبين نوع المواد، الكميات المراد	3.1
					شراؤها، تواريخ توفرها في الموقع	
					استخدام التكنولوجيا مثــل نظــم ( EDI, bar	
					codes, RFID, etc) لاتحكم بالمواد	3.2
					والمخزون	

						<u>а</u>
			نس	بة التطب	يق	
No.	عملية توريد المواد	1	2	3	4	5
		دائما	غالبا	احيانا	نادرا	مطلقا
L 2 2	طلب عينة من المواد من المــورد الــذي تـــم					
5.5	اختياره بهدف فحصمها قبل الطلب					
ما إ	إصدار أمر شراء للمورد ( توقيع عقــد ) مـــن					
3.4 أ	أجل تنظيم العلاقة بين الطرفين					
ل ا	طلب المواد مباشره من قبل طاقم العمــل فـــى					
3.5 ال	الموقع					
3.6 ش	شراء الكميات المطلوبة دفعة واحدة					
اس	استخدام نظام تماما في الوقــت (JIT)(شــراء					
3.7 ال	الكميات المطلوبة بناء على سير العمل والحاجة					
Ш	للمادة)					
ت م	تحديد تواريخ توريد المواد ومكان التوريــد					
3.8 لل	للمورد					
	التأكد من وصــول المــواد بالتــاريخ المحــدد					
3.9 و	والمواصفات المطلوبة					
المرحلة	لة الرابعة: الإنشاء					
4.1 ت	تحديد كميات المواد المطلوبة لكل بنــد بشــكل					
مد	مستمر					
4.2	التأكد من المواد المتلقـــاة ومقارنتهـــا بـــالمواد					
L.	المطلوبة من خلال عمل الفحوصات					
ي تو	توثيق أي مشاكل تحدث فـــى عمليــة التوريــد					
4.3 و	وكتابة التقارير بها					
<u>ا</u> [د	إعداد جدول لمتابعة حالة المواد التـــى طلبــت					
4.4 و	ُ والكميات التي نفذت والكميات المتبقية					
4.5 يو	يوفر المورد شاحنة في الموقع					

	يق	بة التطب	نس			
5	4	3	2	1	عملية توريد المواد	No.
مظلقا	نادرا	احيانا	غالبا	دائما		
					المرحلة الخامسة: ما بعد الإنشاء	
					عمل تقييم شامل لعملية توريد المواد على مدار	
					المراحــل الســابقة وذلــك لتجنــب الاخطــاء	5.1
					والاستفادة من التجارب في المشاريع القادمة	

3.2 من فضلك اختار الطرق التي تستخدمها في طلب المواد من الموردين

.1	الانترنت	)	(
.2	الهاتف	)	(
.3	الفاكس	)	(
.4	مقابلات شخصية/ زيارة	)	(
.5	البريد الالكتروني	)	(
3.3 مز	، فضلك اختار المعايير التي تستخدمها في اختيارك للموردين		
.1	الوفرة (توفر المواد لدى المورد)	)	(
.2	الجودة	)	(
.3	الأسعار التنافسية (التكلفة)	)	(
.4	مصدقيه المورد في توريد المواد في المواعيد المحددة	)	(
.5	المرونة في الاستجابة لمتطلبات المقاول بالتغيير	)	(
.6	الدخول بشراكة مع المورد مبنية على أساس الصراحة وتبادل	المعلوم	_ات
ويتم بم	وجبها منح المورد جميع المناقصات التي يفوز بها المقاول مقابل	الحصب	ول
على أد	حار أفضل	)	(
.7	العلاقات الشخصية	)	(
.8	المصالح المتبادلة	)	(

9. التسهيلات المالية

( )

القسم الرابع – تحديد درجة حدوث المشاكل التي تواجه المقاولين خلال مراحل المشروع من فضلك استخدم خبرتك في تحديد درجة حدوث المشاكل التالية بواسطة اختيار العمود المناسب

		نسبة التطبيق					
No.	عملية توريد المواد	1 أو افق بشدة	2 أو افق	3 محايد	4 لا أو افق	5 لا أو افق بشدة	
المرحلة	الأولى: التسعير، إعداد المناقصة والتسلي	م	_				
1.1	سوء الفهم بين المقــاول والمالــك او المشرف						
1.2	ضـــعف الاتصـــال بـــين الأطــراف المشـــاركة: المالـــك، المصـــممين والمقاول						
1.3	نقص فـــي المخططــات والتفاصـــيل المطلوبة						
1.4	استخدام مواصفات للمواد مختلفة عما هو مستخدم و متعارف عليه من قبل المصممين						
1.5	الغمــوض و عــدم التطــابق بـــين المخططات و المواصفات						
	المرحلة الثانية: اختيار الموردين						
2.1	عدم وجود معلومــات كافيــة عــن الموردين المحتملين						
2.2	عدم تقديم معلومات كافية مـــن قبــل الموردين عنـــد اســـتقدام عــروض الاسعار						

		نسبة التطبيق					
No.	عملية توريد المواد	1 أو افق بشدة	2 أو افق	<b>3</b> محايد	4 لا أو افق	5 لا أو افق بشدة	
2.3	هدر الوقت من قبل المقاول في دراسة موردين غير مؤهلين						
1	المرحلة الثالثة: شراء المواد						
3.1	عدم توفر المواد						
3.2 3.2	تأخر المقاول بتسليم عينة من المــواد المراد اســتخدامها فــي المشــروع لاعتمادها من المهندس المشرف						
3.3	تقديم عينة غير مطابقة للمواصــفات من قبل المورد						
) 3.4	التأخر في اعتماد عينات المواد مــن قبل المهندس المشرف						
) 3.5	ضعف الاتصال بين الأطراف المشاركة ( المقـــاول ، المـــوردين والمهنـــدس المشرف)						
3.6	عدم وجــود تنســيق بــين المقــاول والموردين بمــا يتعلــق بــالتواريخ المطلوب تسليم المواد بها						
1	المرحلة الرابعة: الإنشاء						
4.1	تأخر وصول المواد						
4.2	المواد التي وصــلت غيــر مطابقــة للمواصفات						
<sup>1</sup> 4.3	إعادة نقل المواد داخل الموقع أكثر من مرة قبل الاستخدام						

	ζ	التطبيق	نسبا			
5 لا أو افق بشدة	4 لا أو افق	3 محايد	2 أو افق	1 أو افق بشدة	عملية توريد المواد	No.
					عدم كفاية المخازن او بعــدها عــن الموقع	4.4
					فقدان المواد	4.5
					سرقة المواد	4.6
					تلف المواد	4.7
					ضعف الاتصـــال و التنســيق بــين الأطراف المعنية	4.8
					نقل و تخزين المواد الغير مستخدمة	4.9
					المرحلة الخامسة: ما بعد الإنشاء	
					عدم تــوفر مكــان لتخــزين المــواد الفائضة	5.1
					عدم إمكانية إرجاع المواد الفائضة إلى الموردين	5.2
					إرجاع المواد الفائضة إلى المــوردين بخسارة	5.3
					فقدان قيمة المواد الفائضــة (تنــاقص سعرها مع مرور الوقت)	5.4

4.2 المشاكل التي تواجه الشركات في تطبيق مبادئ إدارة توريد المواد في المشاريع الانشائية من فضلك اختر درجة حدوث المشاكل التي تواجهك في تطبيق ممارسات عملية إدارة توريد المواد

لا أعلم	يوجد مشكلة	يوجد مشكلة	يوجد مشكلة	لا يوجد مشكلة	151
5	قليلا	غالبا	حقيقية	إطلاقا	المفاط
5	4	3	2	1	
					مقاومة الموظفين للتغيير
					عجز في الموارد، لا يوجد تطوير
					وإصلاح للموارد
					نقص في المهارات، مثل المهارات
					في استخدام بعض برامج الحاسوب
					عدم وجود الدعم الكافي من
					الموردين
					وجود تكاليف مخفية (غير محسوبة)
					التكامل مع النظام القائم للشركة
					التكامل مع نظام المورد
ئية فــي	يع الانشا	ي المثسار	يد المواد ف	لمية ادارة تور	ما هي اقتراحاتكم من أجل تحسين عم

فلسطين؟

.....

### **Appendix (C): Interview Questions**

- 1. where is the company located in the West Bank?
- 2. What is the classification of your company according to the Palestinian Contractor Union?
- 3. What is the number of executed projects within the last five years?
- 4. What types of projects do your company implement?
- 5. Do you face project delays?
- 6. Does these delays cause financial losses?
- 7. Do you have a system for material supply in company?
- 8. Do you suffer from price changes during the construction phase?
- 9. Do you have inventory facilities? And where?
- 10. What type of material do you usually store?
- 11. Do you import material? And what is the procedure for importing?
- 12. Did you face problems with suppliers?
- 13. What are the problems in material supply?
- 14. Do you prepare contingency plans for material procurement?

#### Appendix (D) Interview Questions Arabic

- ما هو موقع الشركة الجغرافي في الضفة الغربية؟
- ما هو تصنيف الشركة حسب تصنيفات اتحاد المقاولين الفلسطينيين؟
- ما هو عدد المشاريع التي نفذتها الشركة خلال الخمس سنوات الماضية؟
  - 4. ما هي مجالات عمل الشركة؟
  - هل تواجه تأخير في تسليم المشاريع؟
  - هل هذا التأخير يؤدي الي خسائر مالية؟
  - 7. هل لديك نظام قائم لتوريد المواد في الشركة?
  - 8. هل تعاني من اختلاف الاسعار خلال عملية التنفيذ؟
    - هل يتوفر لديك مخازن؟ ما هي مواقعها؟
    - 10. ما هي طبيعة المواد المخزنة في المخازن؟
  - .11 هل تستورد مواد؟ وما هي الاجراءات لهدذه العملية؟
    - 12. هل تواجه مشاكل مع الموردين؟
  - 13. ما هي المشاكل التي تواجهك في عملية توريد المواد؟
    - 14. هل تقوم بتحضير خطط بديلة لعملية شراء المواد؟

جامعة النجاح الوطنية كلية الدراسات العليا

# بناء إطار لعملية إدارة توريد المواد في مشاريع الإنشاءات في الضفة الغربية

## إشراف د. رياض عوض

قدمت هذه الأطروحة استكمالاً لمتطلبات الحصول على درجة الماجستير في الإدارة الهندسية بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.

## بناء إطار لعملية إدارة توريد المواد في مشاريع الإنشاءات في الضفة الغربية إعداد شموع فواز بدوي بدوي إشراف د. رياض عوض الملخص

يعد قطاع الإنشاءات واحد من أهم القطاعات الاقتصادية على مستوى العالم بسبب مجاله الواسع، وتقاطعه مع مختلف القطاعات الصناعية. وكنتيجة للنمو الملحوظ في قطاع الصناعات الإنشائية فقد أصبح هنالك حاجة للتركيز على تطوير هذا القطاع.

فقطاع الإنشاءات في الضفة الغربية يواجه تحديات حقيقية بسبب الطبيعة المعقدة لتلك المشاريع، مما يؤدي إلى مشاكل تتعلق بالأداء، وهذا ما يجعل البحث عن أساليب إدارة جديدة شيئا أساسيا في حل مشاكل قطاع الصناعات الانشائية.

وتعد إدارة سلاسل الإمداد علما جديدا واسع الانتشار في أنحاء العالم وخاصة في مجال الصناعات، وقد تم تبني هذا النظام من قبل عدد من الشركات العالمية في مجال الإنشاءات. إذ إن تطبيق إدارة سلاسل الإمداد على المشاريع الإنشائية يشمل دراسة المواد، والآلات، والعمال، والموردين، والمنتج النهائي، والعوامل الربحية.

فهذه الدراسة تلقي الضوء على عملية توريد المواد في تلك المشاريع من خلال تطبيق مبادئ إدارة سلاسل توريد المواد في الضفة الغربية. والتي تشمل عمليات التصميم وإنشاء المخططات التي تنتهي بعملية التنفيذ في الموقع.

وبالتزامن مع الهدف الرئيس لعملية إدارة توريد المواد في المشاريع الإنشائية، فإن هذه الرسالة تهدف إلى تبني مفاهيم إدارة توريد المواد في هذه المشاريع، وتقييم الممارسات الحالية لتلك المفاهيم من خلال تطبيق مبادئ إدارة توريد المواد في تلك المشاريع في الضفة الغربية. كما تهدف هذه الرسالة إلى بناء إطار افتراضي لعملية إدارة توريد المواد في الضفة الغربية، حيث تم استخدام منهجية مختلطة من كلا المنهجين للبحوث: المنهج الكمي، والمنهج النوعي، حيث تم جمع المعلومات النوعية من خلال إجراء مقابلات مع مدراء تنفيذيين، ومدراء المشاريع، ومهندسي المواقع أو المقاولين، أما المعلومات الكمية فقد تم جمعها من خلال توزيع استبيانات على شركات المقاولات في مختلف المدن الفلسطينية.

ومن خلال تحليل المعلومات التي تم جمعها، أظهرت النتائج وجود مشاكل في عملية توريد المواد في المشاريع الإنشائية، مما يؤثر على أداء الشركات، وقد أكدت على وجود حاجة ملحة لتبني مبادئ جديدة في إدارة المشاريع لحل المشاكل التي تتعلق في توريد المواد. كما أشارت النتائج على أهمية تطبيق عملية إدارة توريد المواد في هذه المشاريع للتأثير على أداء الشركات بشكل إيجابي.