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**كلية التجارة**  
**ماجستير إدارة الأعمال**

## **Evaluation of Construction Materials Supply into Gaza Strip Case Study of Karm Abu Salem Crossing Border**

**تقييم توريد مواد البناء إلى قطاع غزة**  
**دراسة حالة معبر كرم ابو سالم التجاري**

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of the requirements for the degree of  
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## إقرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

# Evaluation of Construction Materials Supply into Gaza Strip Case Study of Karm Abu Salem Crossing Border

## تقييم توريد مواد البناء إلى قطاع غزة دراسة حالة معبر كرم ابو سالم التجاري

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## نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ وسيم شاكر عبداللطيف محمد صادق أبوشعبان لنيل درجة الماجستير في كلية التجارة/ قسم إدارة الأعمال وموضوعها:

تقييم توريد مواد البناء إلى قطاع غزة - دراسة حالة معبر كرم ابو سالم التجاري

Evaluation of Construction Materials Supply into Gaza Strip Case Study of Karm Abu Salem Crossing Border

وبعد المناقشة التي تمت اليوم الاثنين 13 ربيع الأول 1438 هـ، الموافق 2016/12/12م الساعة

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واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق ،،،

نائب الرئيس لشئون البحث العلمي والدراسات العليا

أ.د. عبدالرؤف على المناعمة

## **Abstract**

The research aimed to study and evaluate the supplying process of construction materials into the Gaza Strip through Karm Abu Salem Crossing Border and determining the factors that affect the supplying process.

A survey questionnaire was used to collect the needed data supported by interviews, the population was 120 construction materials traders that works under the Gaza Reconstruction Mechanism.

The research show that the supplying of construction materials into the Gaza Strip consists of two main streams; first stream called Gaza Reconstruction Mechanism (GRM) which brokered through United Nations Special Coordinator (UNSCO) for the Middle East Peace Process, Mr. Robert Serry, and the second stream belongs to Israeli Coordinator of Government Activities in the Territories Unit (COGAT) that allow international organisations to coordinate for construction materials for their projects.

Research results show that the current process of supplying construction materials takes time and cost using Karm Abu Salem crossing border, and the allowed quantities of construction materials is not enough.

The research recommends that the current used mechanisms should be changed or modified to be easier to fit with the high demand. Also the research recommends to open new suitable crossing border and to ask for increase in the allowed quantities.

## Abstract in Arabic

يهدف البحث إلى دراسة وتقييم عملية توريد مواد البناء إلى قطاع غزة من خلال معبر كرم أبو سالم التجاري وتحديد العوامل المؤثرة فيها.

تم اعتماد الإستبانة في منهجية البحث لجمع البيانات اللازمة، وتم إجراء مقابلات شخصية للتعرف عن كثر على الممارسة الحالية في توريد مواد البناء، حيث تمثل مجتمع الدراسة من 120 تاجر مواد بناء يعملون ضمن آلية توريد مواد البناء المستخدمة حالياً لإعادة إعمار غزة.

بين البحث أن توريد مواد البناء إلى قطاع غزة ينقسم إلى آليتين، الآلية الأولى من خلال مكتب تنسيق أعمال الحكومة (الإسرائيلية) في المناطق والذي من خلاله يتم توريد مواد البناء للمشاريع التي يتم تنفيذها من خلال مؤسسات دولية تابعة للأمم المتحدة، والجزء الثاني من خلال آلية إعادة إعمار غزة التابعة للرقابة من الأمم المتحدة والمقترحة من روبرت سيربي مبعوث الامم المتحدة في الشرق الاوسط لعملية السلام والذي يتم توريد مواد البناء من خلالها للمشاريع والمواطنين بعد إتباع إجراءات محددة وأخذ الموافقات اللازمة.

أشارت نتائج البحث أن آليات إدخال مواد البناء من خلال معبر كرم أبو سالم التجاري إلى قطاع غزة مكلفة وتحتاج وقت، وأن كميات مواد البناء المسموح بإدخالها غير كافية.

توصي الدراسة بضرورة تغيير أو تعديل آليات إدخال مواد البناء المتبعة بما يتناسب مع الطلب المرتفع على مواد البناء في قطاع غزة، كما وتوصي الدراسة بفتح معبر جديد مجهز لإستيعاب مواد البناء بحيث يتم المطالبة بزيادة كميات مواد البناء المسموح بإدخالها.

## **Dedication**

This thesis is dedicated to my parents, brothers and friends for their endless love and support. To those who lit my life with their presence, and stood by my side all the way. To those who have shared with me the most beautiful moments, and left a large indelible footprint in my life. It is difficult to mention everyone, but thank you all.

## **Acknowledgment**

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To all those people who have helped me to complete this thesis.

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## **List of Abbreviations**

ABC	Aggregates, Steel Bars, and Cement
COGAT	Coordination of Government Activities in the Territories
GDP	Gross Domestic Product
GoI	Government of “Israel”
GoP	Government of Palestine
GRAMMS	Gaza Requisition and Monitoring Materials System
GRM	Gaza Reconstruction Mechanism
LPI	Logistics Performance Index
MMU	Materials Monitoring Unit
MoCA	Ministry of Civil Affairs
OECD	Organization for Economic Co-operation and Development
PNA	Palestinian National Authorities
SCM	supply chain management
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNDP	United Nation Development Program
UNOPS	United Nations Office for Projects Services
UNRWA	United Nations Relief and Work Agency
UNSCO	United Nations Special Coordinator for the Middle East Peace Process

# **Chapter 1**

## **Introduction**

# **Chapter 1**

## **Introduction**

### **1.1 Background**

Construction is one of the main activities needed for building any country to be able to house their citizens, build suitable infrastructure and manufactories. The supply of construction materials in efficient way can minimize the needed time and maximize the supplied quantities of construction materials.

In recent years Gaza Strip faced several aggressions which led to massive destruction in buildings and infrastructure that makes it need a huge quantities of construction materials estimated about 31 million Tones in October 2016 including 2014 and all previous aggressions and also the quantities needed for the natural growth as it was calculated in this research. Thus, supply of construction materials is important due to its role on building process, also source of construction materials has a core importance in building process, countries that has its potential of materials and own factories and crushers of construction materials have an advantage of those do not, other countries should import construction materials in a suitable quantity to be able to cover the demand. According to United Nations Office for Projects Services (UNOPS) Gaza Reconstruction Mechanism (GRM) system the main construction materials are cement, steel bars and aggregates which are the main materials that included in the construction of the structural elements of any building and the allocated quantities of these materials on their system are 1,046,005 Tones, 3,904,891 Tones and 185,161 Tons of cement, aggregates and steel bars respectively with total of 5,136,057 Tones (Gaza Reconstruction Mechanism, 2016).

#### **1.1.1 Gaza Strip Crossing Borders**

One of the main factors affecting the supply process of construction materials is crossing borders. Gaza Strip had many commercial crossing points, all of them now are closed due to blockade and the remaining is only one which is Karm Abu Salem crossing border, The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) (2015) listed all crossing borders that operated in Gaza Strip:

- a) Karm Abu Salem Crossing Border: Commercial crossing for the entry and exit of goods through a semi "back to back" procedure. Operates five days a week. Requires authorization by, or coordination with "Israeli" Authorities.
- b) Biet Hanoun (Erez) crossing border: Passenger crossing accessible only to permit holders, primarily medical and other humanitarian cases, merchants, and aid workers (permits issued by "Israeli" authorities). Opens six days a week
- c) Rafah (Al Awda) crossing border: Primarily a passenger crossing. Closed by the Egyptian authorities on October 2014, it opened a few times on an exceptional basis for "humanitarian cases".
- d) Karni (Al Montar) crossing: Commercial crossing for the entry and exit of goods through a "back to back" procedure. Closed since June 2007.
- e) Nahal Oz fuel pipeline Closed since January 2010.
- f) Sufa Crossing point used for the transfer of some building materials into Gaza. Closed since September 2008. Figure (1.1) shows the Gaza Strip and crossing borders location.



**Figure (1.1): Locations of Gaza Strip Crossing Borders. Source: OCHA, 2015**

## **1.2 Problem Statement**

As there is a need for about 31 million tons of construction materials in the Gaza Strip, the process of supplying the construction materials has a significant contribution in the construction process. This research will study the factors that affect the supplying process and evaluate the current practice of supplying the construction materials and study main question will be “What is the efficiency of construction materials supply into the Gaza Strip through Karm Abu Salem Crossing Border?”.

## **1.3 Research Objectives**

The main objective of this research is to review and evaluate the supplying process of construction materials into the Gaza Strip through Karm Abu Salem Crossing Border. In addition, this research is carried out for several sub objectives;

1. Study the current practice of construction materials supply into the Gaza Strip.
2. Analyzing the used mechanisms of supply construction materials into the Gaza Strip.
3. Determine the factors that impact on the efficiency of construction materials supply into the Gaza Strip.
4. Provide solutions to help in improving the weaknesses of the current practice of supplying construction materials into the Gaza Strip.

## **1.4 Thesis Importance**

The main contribution of this thesis is to review and evaluate the supplying of construction materials into Gaza Strip through Karm Abu Salem crossing border that will help to determine the impact of supplying mechanism, construction materials demand and materials coordination criteria on the efficiency of construction materials supply to Gaza Strip. Therefore, this thesis is unique because of how important it is, its importance springs from the importance of the construction materials and their supply into Gaza Strip; especially that the demand in Gaza Strip is high and estimated with 31 million tons due to the cumulative quantities of construction materials that did not supplied during the closure. Also, this thesis reviews the current practice of construction materials supply into the Gaza Strip. This practice does not seem to be attempted in any previous studies.

## **1.5 Research Variables**

### **1.5.1 Dependent variable:**

The efficiency of the construction materials supplies into the Gaza Strip through Karm Abu Salem Crossing Border which is measured with the amount of supplied quantities to the amount of demand.

### **1.5.2 Independent variables:**

- a) The construction materials supplying mechanism.
- b) Allowed quantities of construction materials.
- c) Construction materials demand.
- d) Prices of construction materials shipments.
- e) The Crossing Border's infrastructure.
- f) Customs and clearance on construction materials.

## **1.6 Research Hypotheses**

**H.1:** There is a statistically significant differences attributed to used mechanism of supply of construction materials into Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

**H.2:** There is a statistically significant differences attributed to allowed quantities of supply of construction materials into Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

**H.3:** There is a statistically significant differences attributed to the demand of construction materials in Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

**H.4:** There is a statistically significant differences attributed to construction materials shipments' price at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

**H.5:** There is a statistically significant differences attributed to the crossing border's infrastructure at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

**H.6:** There is a statistically significant differences attributed to customs and clearance on construction materials at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

# **Chapter 2**

## **Literature Reviews**

## **Chapter 2**

### **Literature Review**

This chapter includes reviews of previous works, researches, and publications that are related to the topic of this research. There are rare researches conducted on the evaluation of the construction materials supply into Gaza Strip. This section covers the most related previous works.

#### **2.1 Construction Materials**

Construction materials is the main element of construction process, and according to United Nations Office for Projects Services (UNOPS) reconstruction mechanism which is the main tool to import construction materials to Gaza Strip, main construction materials are cement, steel bars and aggregates.

##### **2.1.1 Portland Cement**

Portland cement is a powder, gray or white in color that consists of a mixture of hydraulic cement materials comprising primarily calcium silicates, aluminates and aluminoferrites. More than 30 raw materials are known to be used in the manufacture of Portland cement, and these materials can be divided into four distinct categories: calcareous, siliceous, argillaceous, and ferriferous. These materials are chemically combined and subjected to subsequent mechanical processing operations to form gray and white Portland cement. Gray Portland cement is used for structural applications and is the more common type of cement produced. White Portland cement has lower iron and manganese contents than gray Portland cement and is used primarily for decorative purposes (United States Environmental Protection Agency, 1995). Portland cement is the basic ingredient of concrete which is one of the most widely used construction materials in the world. Cement can be delivered in two ways; bulk or bags, and it depends on the purpose of use. As stated on Pro Glob Media (2016) The largest cement producing country in the world is China, it produces about 2,482.42 million tons of cement each year.

##### **2.1.2 Aggregate**

Aggregates (also known as gravel) are used for many different construction applications. In building construction, they are typically used as subbase support under concrete slabs, foundation and underground drainage, fill around pipes, and as one of the three basic concrete ingredients. Aggregates start out as solid rock in the earth's

crust, and over many thousands of years, are broken down by freeze/thaw cycles and other natural action into pieces of various sizes. The larger pieces of aggregate are called coarse aggregates or gravel; the smaller pieces are usually referred to as sand or fine aggregates (Brown & Dorfmueller, 2013).

### **2.1.3 Steel Bars**

Steel is the most widely used metal in construction, with applications ranging from structural support to reinforcement to decorative uses. Reinforcing steel bars are used for reinforcement of concrete structures, manufacture of anchor bolts, etc. Reinforcing bars (rebars) can be either smooth or deformed. They are produced by hot rolling process with subsequent superficial hardening by heat treatment. The largest steel producing county in the world is China, it produces about 822.7 million tons of steel each year (Brown & Dorfmueller, 2013).

## **2.2 History of Construction Materials Supply into the Gaza Strip**

This section will review the history of construction materials supply since 1994 in the Gaza Strip dividing the time into intervals depending on the borders' situation, also this section will review the current practice of construction materials at Karm Abu Salem Crossing Border which is the only operating border in the Gaza Strip.

### **2.2.1 1994 to 2007**

This time interval is considered due to the arrival of the Palestinian National Authority (PNA) to the Gaza Strip and signing of Oslo Accords and Paris Protocol. After 1994 Gaza's economy moved onto a positive growth trajectory and by the late 1990s per capita GDP was on the rise.

The Palestinian Second Intifada from 2001 to 2005 led to a severe contraction in economic activity, with per capita income falling sharply until 2002. The period 2003-2005 saw a resumption of positive growth in Gaza, with economic performance exceeding that of the West Bank – by the end of 2005 per capita GDP had nearly recovered to be similar to late 1990s levels. In 2006 and 2007 the internal unstable situation between Palestinians had significant negative impacts on the economy culminating in 2007 (Portland Trust, 2014).

Karni crossing border opened in 1994 and it was the main border to serve goods into and out of Gaza Strip. To this day, Karni crossing border is considered the most

suitable border for the transfer of goods to and from the Gaza Strip as it has the capacity to facilitate the transfer of large number of truckloads (estimated by 1,000 truck) of goods per day (Mezan, 2011) especially construction materials. It had special equipment's and pipes for bulk cement, conveyor belt for transferring aggregates and flat rooms for construction steel bars, Karni crossing was close to Gaza City, where most of the industry and consumer markets of the Gaza Strip are located, and it is closer than the other crossings to Ashdod Port and the West Bank. In June 2007, Karni Crossing was closed due to political issues (Gisha, 2015).

### **2.2.2 2008 to 2009**

The unstable situation in 2006, internal division and closure of Karni crossing in 2007 were followed by intensification of restrictions on the movement of people and goods especially construction materials in and out of Gaza. In 2008 Sufa crossing border was also closed. It used to operate to transfer some construction materials such as aggregates, marking the onset of a period of increased economic isolation.

### **2.2.3 2010 – 2013**

In 2010 the inflow of construction materials for approved Palestinian Authority-authorized projects was allowed; those projects were implemented and supervised through international organizations such as the United Nations Relief and Work Agency (UNRWA). The import of materials was through Karm Abu Salem crossing which is a border with a low limited capacity. Gaza's economy entered a period of recovery, driven by both donors who supported reconstruction efforts after the 2008 "Israeli" military operation in Gaza Strip and increased private sector activity. An important way to import and deliver construction materials in this time interval was the tunnels between Gaza and Egypt. The tunnels were used for importation of all types of goods including construction materials with huge quantities. This was essential to satisfy the very high demand for housing (the population of the Gaza Strip increased by about 100,000 between the end of 2006 and 2011).

A new military operation in 2012 in Gaza followed by closure of the trade tunnels between Egypt and Gaza in 2013 left a shortage of construction materials while the demand is still high. In October 2013 construction materials were allowed to enter Gaza Strip without any restriction for only 14 days then it stopped and banned again

due to unstable political situation and the construction materials are only available for projects that implemented through international organization.

#### **2.2.4 2014 – Present:**

In the first half of 2014 the entrance of construction materials to Gaza was banned for the private sector and was only allowed for the projects that were implemented by international organizations through Karm Abu Salem crossing. In October 2014 especially after the 51-day aggressions, Construction materials were allowed to enter for the reconstruction of the destroyed buildings and infrastructure, as well as other private building projects in the framework of the Gaza Reconstruction Mechanism (GRM) which is a temporary agreement between the PNA and the Government of Israel (GoI) brokered by the United Nations in September 2014, through this mechanism traders, some international organizations and residents of Gaza Strip who are interested in rebuilding their houses must be approved by “Israeli” Authorities before they can import construction materials through Karm Abu Salem crossing. In the beginning of 2015 an expansion project of Karm Abu Salem crossing in the “Israeli” side was completed to increase the capacity and serve more trucks per day. The border was then equipped with pipe lines for bulk cement to reduce the number of bagged cement trucks in the border as stated by Koullab S. (Personal Communication, May 1, 2016). The allocated quantities of construction materials on GRM web based system from October 2014 till October 2016 is 4.7 million tons considering that allocating new construction materials was stopped for projects since May 2016. (GRAMMS, 2016).

Karni Crossing Opened	1994	
Palestinian Division	2006	
	2007	Karni Crossing Closed
	2008	Sofa Crossing Closed
	2009	
Inflow Start through Karm Abu Salem for UNRWA and UNDP projects. Tunnels with Egypt Opened	2010	Nahl Oz Crossing Closed
	2011	Karni Convery Belt Closed
	2012	
	2013	Tunnels with Egypt Closed
Sept. Gaza Reconstruction Mechanism started	2014	
	2015	
	2016	

**Figure (2.1): Crossing Borders Timeline**

Source: Assembled by the researcher for the purpose of this study.

## **2.3 Review of Cross-Border Supply**

Economic and Social Commission for Asia and the Pacific (2012) reviewed models for efficient cross-border transportation, which includes Jiegao Border Crossing, China and Petrapole Border Checkpoint, India.

### **2.3.1 Jiegao Border Crossing, China**

The Jiegao border crossing is the most important land border gate between China and Myanmar, accounting for 64 per cent of the total volume of trade between Myanmar and Yunnan Province of China, and 26 per cent of trade between China and Myanmar. In 2011 the border was crossed 1.07 million tons of goods. The main traded products from Myanmar are agricultural and forestry products in addition to mining and industrial finished goods. Products from China consist of capital goods, raw materials and consumer products. Economic activity in the local area has been encouraged through the establishment of border economic zones in both China and Myanmar. China and Myanmar have both signed the GMS Cross-Border Transport Agreement (CBTA). However, the ratification and implementation of the agreement and its annexes is still under way. There is also no bilateral agreement on road transport between China and Myanmar, which prevents free movement of vehicles over the border. There is however a local agreement between the border towns of Ruili and Muse which was signed in 2008. The agreement allows movement of vehicles between Ruili and Muse, beyond which cargo has to be carried by a local vehicle. For vehicles staying within Jiegao border economic zone, there is also an exemption in requirements for insurance, guarantee and visa for drivers. For vehicles moving beyond Jiegao to Ruili no guarantee is required, but an insurance has to be purchased. Residents of Ruili and Muse can also apply for the border pass, which is based on residency and renewed annually. The border pass acts as a passport and allows movement within 7 kilometers of the border in Myanmar and within the Dehong Prefecture, Yunnan Province, China. Because of the limitations to movement of foreign vehicles in both China and Myanmar, trans loading of goods takes place at the border. Containerization of cargo is not common, but semi-trailer trucks are popularly used on the Chinese side. Instead the transport of cargo to the border is arranged by the exporter. Goods are transferred to warehouses in Jiegao from which they are released according to order. Importer arranges onwards transport independently. The

operational practice supports an active local logistics industry, with around 70 logistics companies and 1,514 small transport companies operating in Ruili.

### **2.3.2 Petrapole Border Checkpoint, India**

The Petrapole Land Customs Station is located in the state of West Bengal 95 kilometers from Kolkata, India. It handles 60 per cent of the Bangladesh-India trade and 80 per cent of India's total exports to Bangladesh, making it the busiest land border between the two countries. In 2011/12, the total number of trucks cleared reached 110,370 vehicles. Trade is heavily skewed towards Bangladesh with trade to India totaling USD 324.9 million and trade to Bangladesh USD 1.59 billion in 2011/12. Currently there is no transport agreement between Bangladesh and India to allow vehicles in each other's territory. This makes trans loading of goods necessary either in Petrapole, Indian side, or Benapole, Bangladesh side, within 2 kilometers of the border. Transloading is organized by the exporter/importer or his/her agent, which is normally a customs agent. There is no formal relationship between the transport operators in the two countries for transloading. Cargo is mainly non-containerized and carried by small rigid trucks with one consignment sometimes being carried by several vehicles. Imports to India are manually transloaded in an open area adjacent to the border, with the exception of jute products and fish which are transloaded in the customs warehouse. Exports from India are transloaded in warehouses in Benapole.

### **2.4 Logistics Performance Index (LPI)**

Ojala 2015 stated that Logistics Performance Index (LPI) is an international benchmarking tool was built upon the positive results of pilot surveys in 2000 and 2004 carried out by Prof. Ojala at Turku School of Economics, Finland. LPI used to assess the logistics performance created by the World Bank focusing on measuring the trade and transport facilitation friendliness of a particular country, and helping them to identify barriers and opportunities for improvement. The LPI summarizes the logistics performance of countries through six dimensions shown in figure (2.12).



**Figure (2.2): Dimensions of LPI. Source: Ojala, 2015**

1. Customs; efficiency of the customs clearance process.
2. Infrastructure; quality of trade and transport-related infrastructure.
3. International Shipments; ease of arranging competitively priced shipments.
4. Logistics Quality; competence and quality of logistics services.
5. Tracking and Tracing; ability to track and trace consignments.
6. Timeliness; frequency with which shipments reach the consignee within the scheduled or expected time.

The LPI also known as the” Connecting to Compete” report, provides the most comprehensive international comparison tool to measure the trade and transport facilitation friendliness of countries. Understanding the components of trade and logistics performance can help countries improve their freight transport efficiency and identify their areas of weakness and strength in comparison to competitors. The "Connecting to Compete” report has been published in 2007, 2010, 2012 and 2014.

The LPI has two main parts: The International LPI, where up to 166 countries are benchmarked against each other, and the Domestic LPI, which provides an insight on a set of logistics conditions within each country.

The LPI provides analysis of performance trends which makes it possible to understand trends over time in addition to the comprehensive assessment of logistics performance worldwide. Performance is evaluated using anonymous web-based questionnaire asking respondents to evaluate their country of residence and eight countries they are dealing with on several logistics dimensions using a 5-point scale and the overall LPI is aggregated as a weighted average of the six dimensions of logistics performance.

**Table (2.1): Sample Question of LPI 2014 Survey. Source: Ojala, 2015**

Evaluate the quality of trade and transport related infrastructure in your country of work (Australia)					
	V. Low	Low	Avg.	High	V. High
Port Infrastructure					
Airport Infrastructure					
Road Infrastructure					
Rail Infrastructure					
Warehousing/trading facilities					
Tele. Infrastructure					

The LPI domestic performance indicators which is not included in the overall country score. It is complemented with quantitative information on particular aspects of international supply chains in respondents' countries of work, including import/export, lead time, supply chain costs, customs clearance, and the percentage of shipments subjected to physical inspection.

The overall index is calculated by analyzing the six dimensions. None of these independently guarantee a good level of logistics performance, and their inclusion is conditioned to empirical studies and extensive interviews carried out with specialists in international freight transport. Allowing for comparisons across 166 countries, the LPI is used by companies to identify challenges and opportunities related to a country's transport infrastructure, logistics competence, and availability of tools and resources for efficient management of their supply chains. The LPI score or LPI rank targets have started to show up in strategic development plans of economies.

Shortly after publication of the 2007 LPI report, Indonesia's government officials launched a wide-reaching public private dialogue on transport and logistics issues in the country. This process led to the preparation of an action plan focusing on trade costs in its major ports, and the particular challenges faced by a country made up of over 10,000 islands. Although a number of issues still remain to be resolved, these initial reforms helped to improve the country's LPI rank from 75th in 2010 to 59th in 2012 and eventually to 53rd in 2014.

The compilation of the index is done primarily through an on-line survey that has been responded to by approximately 1,000 professionals in international freight forwarding. It is important to know that evaluations in the International LPI come from respondents outside the country being evaluated. Thus, the responses reflect a country's "logistics friendliness" as it is perceived by logistics professionals from abroad. It is equally important to understand that the LPI relies on freight forwarders' perception of performance along the six pragmatic dimensions. As such it remains a subjective, rather than an objective, assessment of logistics performance. The LPI is a survey, and as such the methodology is subject to sampling error and anchoring bias (which is the act of basing a judgment on a familiar reference point). Benchmarking countries in their geographical or economical reference set may create a perception of inferior or superior performance - a country in a successful anchoring group may be

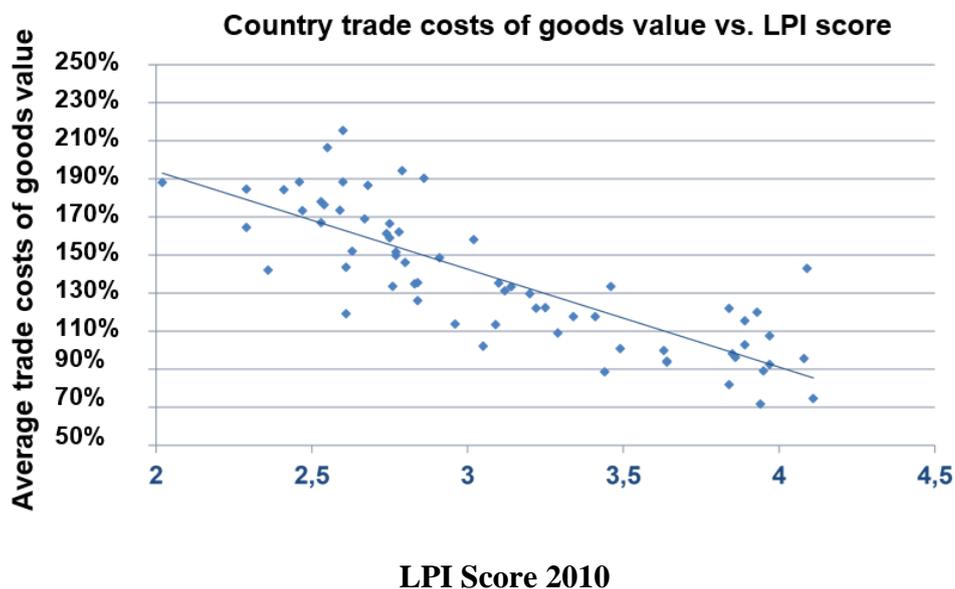
perceived as performing worse than another with a similar performance, only because of their different reference sets. Environmental and geographical constraints create a second potential source of bias. The LPI reflects the perspective of the global private sector on how countries are globally connected through their main trade gateways. So it might not fully capture changes at the country level. For example, a low LPI score might reflect access problems outside the country for landlocked countries and small-island states.

Countries at similar performance levels may have substantially different ranks, especially in the middle and lower country income ranges. To account for potential sampling error and the LPI's limited domain of validity, LPI scores are calculated with approximate 80 per cent confidence intervals over the standard error of LPI scores across all respondents. These confidence intervals must be examined carefully to determine whether a change in score or a difference between two scores is statistically significant. Countries that have been evaluated by a small number of respondents, such as Sweden, Norway, Bahrain, New Zealand, and Ethiopia tend to have large confidence intervals between upper and lower bounds of LPI scores. These may translate into approximately 20 rank places between the upper and lower rank bounds. For example, Finland's decline from ranking 3rd in 2012 to 24th in 2014 remains within confidence intervals of the two years. Thus, it is statistically not significant and cannot be interpreted as a valid change in its logistics performance. Hence, the LPI scores and, in particular, the LPI ranks need to be interpreted with caution as do not provide ready answers to questions usually posed by policymakers such as "how" or "why".

#### **2.4.1 Importance of Logistics Performance**

According to Ojala 2014, Domestically and internationally well-functioning logistics is a necessary precondition of national competitiveness. Global production networks depend on transport operations and this dependency affects a wide array of value-added activities along supply chains, from suppliers of raw materials to the end-user, as well as the recycling of materials after use. Physical, administrative and informal restrictions are big obstacles to the movement of goods and international trade. Removing these barriers would have a greater impact on economic growth and competitiveness than removing tariffs. The combined impact of improving border

administration, and upgrading transport and communications infrastructure would increase global Gross Domestic Product (GDP) by 4.7%, six times more than what would result from a complete and worldwide elimination of tariffs.



**Figure (2.3): Sample Question of LPI 2014 Survey. Source: Ojala, 2015.**  
Supply chain bottlenecks are the primary cause of friction in trade (trade costs). Reducing them by half would raise trade by 15% and production by 5% globally.

In other words, trade and transport facilitation are at the core of stimulating economic development. There is also a strong reciprocity between the two: trade and transport facilitation fosters logistics performance, and better logistics supports growth, enhances competitiveness and enables investments. Political decisions and implemented policies have both direct and indirect effects on the attractiveness of a region or country in terms of business location decisions. A country is attractive when it has the aptitude to attract the foreign investors. In this sense, the volume of foreign direct investment (FDI) present in a territory is a good indicator of its attractiveness. Transportation systems are considered as a production factor and as one of the key determinants of facility location decisions. Transport infrastructure has a significant impact on the productivity and the cost structure of private firms.

A sustained improvement calls for policymakers and private stakeholders to implement comprehensive reforms. To move products to market efficiently and reliably, countries need to reduce trading costs and adopt policies to support trade, thereby helping to improve trade competitiveness. Even good physical connectivity

does not compensate for poor service delivery. Infrastructure development has been essential in assuring connectivity and access to trade and transport gateways.

Transport services are delivered by logistics providers that operate under very different global environments. Usually, the quality of logistics services is better perceived by customers and users of the network than the quality of the corresponding physical infrastructure. This appears to be the case in air and maritime transport. Railroads, on the other hand, tend to receive low ratings throughout the world for both services and infrastructure. It can be inferred then that operational excellence cannot be replaced with good physical ‘hardware’ alone. Reliability of operations is a major concern for traders and logistics providers alike and predictability of supply chains is becoming ever more important. Efficient border crossing is essential in eliminating avoidable delays and enhancing predictability in the clearance process. Coordination among relevant government agencies will play a major role in these efforts, including the need to introduce best practices in automation and risk management. According to The World Bank’s Logistics Performance Index (LPI), customs agencies tend to obtain higher LPI ratings than other related agencies - such as sanitary and phytosanitary control agencies and agencies enforcing standards. More generally, logistics performance is strongly associated with the reliability of supply chains and the predictability of service availability. Supply chains are becoming more and more complex, as they often span many countries. Comprehensive reforms and long-term commitments from policymakers and private stakeholders will be essential to keep up with the changing world. Supply chain sustainability concerns among shippers and logistics providers appear to grow in line with complexity. In the LPI 2014, for example, about 37 per cent of respondents shipping to Organization for Economic Co-operation and Development (OECD) countries recognized a demand for environmentally friendly logistics solutions, compared with just 10 per cent for low-income destinations. Industry practices are fast-changing for these services. Governments will need to make long-term policy-changes that allow the industry to remain competitive while they adapt to cope with new requirements. The quality of services is driving logistics performance, especially in emerging and richer economies. Here, the development of services such as third party logistics providers, trucking and forwarding remains a complex policy area. In logistics-friendly countries, shippers

already outsource much of their logistics – especially transport and warehousing operations - to third party providers. Instead, these logistics users tend to focus on their core business while orchestrating the more complex supply chains issues of aligning their sourcing and production to market demand. Supply chains are becoming ever more complex, and there are no easy gains available for policymakers. Most middle and high income-countries have recognized a growing need for consistent policy actions to tackle the complexity in their trade and logistics preconditions. The notion of “low hanging fruit” for more developed countries to pick up is no longer true. The necessary reforms involve many stakeholders and are often slow to implement. Furthermore, they are sometimes fragile due to governance weaknesses or lack of political continuity. Successful reforms also depend on detailed, accurate data involving information sharing among stakeholders. In summary, countries that have successfully introduced far-reaching changes have combined regulatory reform with investment planning, inter-agency coordination, and incentives for operators.

## **2.5 Previous Studies**

### **1. (Sandhu, Helo & Kristianto, 2013) Steel supply chain management by simulation modelling.**

This paper has considered information sharing in the steel supply chain. The proposed model has been successfully applied and has reduced the Bullwhip effect and has obtained related information on the production and fill rates. Moreover, the adaptive production and delivery rate are used to minimize the inventory level. This thesis uses a quotient of order and demand coefficient of variation, which belong, respectively, to Bullwhip measures and stock and delivery performance, in order to compare the performance of the supply chain with and without information sharing. From observing the results, it appears that the quality of demand information is improved significantly by providing a fill rate according to the demand and by reducing the inventory investment. Thus, the performances of the supply chain with information sharing seems to be better than its performances without information sharing.

Extend simulation software used to identify the relationships between external factors such as variety of customer demand and internal factors such as inventory

levels, and to note the effects of these relationships on system performance indicators such as final inventory level, order completion rate, and production rate, and to investigate the influence of information sharing on reducing the bullwhip effect.

## **2. (Abu El Kass, 2012) A Construction Resources Management System for Gaza Strip Building Contractors.**

This thesis aimed to facilitate the management of construction resources mainly in construction of buildings in Gaza Strip by exploring the local practice of construction resources management and develop a construction management resources system using PHP programming language. The exploration of the practice of the management of construction resources was done by survey questionnaire supported by interviews with contractors. The results of the thesis show that most of contracting companies has a problem with shortage of user friendly interface application that can used to manage the construction resources. Moreover, one of the most important factors of affecting on the productivity is improper cut of material. The recommendations included that the local contractors should be encouraged to have a construction management software package to determine the required quantities of the needed materials in time to minimize errors and cost.

The supplying of construction materials into Gaza Strip is a phase previous to the management of construction resources process, but both can use a software designed especially for them to increase the efficiency of the work and that can be done after studying the current practice either on the building of the case of contractors or the practice of the crossing border that is the main source of the construction materials to all the contractors.

## **3. (Lam et al., 2011) A decision support system to facilitate warehouse order fulfillment in cross-border supply chain**

This paper provided a decision support system (DSS) to enhance the performance of cross-border supply chain to improve order planning and fulfill customer orders within the warehouse. A DSS, namely order picking planning system (OPPS) with the adoption of case-based reasoning, is proposed to support managers in making appropriate order fulfilling decisions when an order involves cross-border activities. The paper recommended to replace the objective decision-making process in cross-

border supply chain with the help of the DSS. The warehouse order planning time has been reduced and useful information from past order records can be applied to solve new problems. the paper also stated that focusing on warehouse operations can increase the efficiency in order delivery by considering cross border requirements.

Supplying construction materials into Gaza Strip can use a decision support system to enhance the performance of supplying the materials, decision makers can use the system to easily make decision for quantities needed from each type of construction materials according to a systematic way, knowing that the materials trucks can be considers as customers' orders and the crossing border itself can be considered as a temporary warehouse.

#### **4. (Vidalakis, et al., 2011) Logistics simulation modelling across construction supply chains.**

An analysis of construction supply chains was provided on this paper from a logistics point of view. Thus, it explored the function of intermediary organizations, in particular builders' merchants, as main coordinators of the logistics activities within construction supply chains. This approach was based on a supply chain management SCM philosophy imposing a shift from the construction project environment to the supply chain and the linkages between its members. The paper identified demand variability as one of the major issues that can hinder the application of logistics management in construction and dealt with the resultant increased complexity by implementing a stochastic simulation modelling approach. The findings established the impact of varying demand on logistics costs identifying the usefulness of alternative strategies in terms of cost efficiency and taking into consideration the need to support construction operations on site. At this point, it has to be acknowledged that in general numeric simulation outputs, will vary according to material type as well as individual company characteristics related to transportation capacity and logistics efficiency. However, the results have indicated the trend between varying demand and logistics costs associated with transportation and inventory holding. Thus, it is believed that the dynamics of construction logistics revealed by this paper can be applicable to other builders' merchant organizations on the condition that model input data is amended accordingly.

In this research the conceptual model was implemented using Simul8 (Visual8 Corporation) commercial off-the-shelf discrete-event simulation package.

#### **5. (Al-Shorafa, 2009) A Framework for Construction Materials Supply Chain Process in the Local Construction Industry**

The thesis created a framework for the best practice of material supply chain process through the project phases that suits the construction industry in Gaza Strip in order to help contractors to optimize the supply of materials by having the right materials in the right quantities (at the right place) at the right moment at minimal cost. Questionnaire for contractors was used to explore the current practices of material supply chain process, identify the important activities that form the material supply chain process, study the contractor/ supplier relationship, study the impact of the “Israeli” closure of the Gaza Strip on the material supply chain process, provide solution to the risks and uncertainties inherent in the construction industry, identify the most occurred problems facing the contractors through the project phases and finally identify the key factors that may contribute in integrating the phases of the material supply chain process. The main result of the thesis was developing Material Supply Chain Process Framework consists of six phases which are: bidding phase, sourcing phase, procurement phase, construction phase, post construction phase and evaluation phase. From researcher point of view, the supplying of construction materials through crossing border should be considered as one of the main phases due to its high importance. Contractors should consider the supply of the materials not only after it is available inside Gaza Strip, also they should consider the previous phase which includes the whole supplying process to help in implementing the projects done in an efficient way with the approved time.

#### **6. (Ng et al., 2009) Enhancing the logistics of construction materials through activity-based simulation approach.**

This research modelled and simulated the process of delivering and handing massive construction materials.

The results obtained clearly indicate that some current practices in managing the logistics of construction materials are not efficient, leading to a large amount of non-productive time. To allow decision-makers to establish the likely impacts of various supply chain management approaches before implementing them in practice, this

research supposed the processes pertinent to the management of construction materials must be streamlined to ensure higher productivity and time/cost savings. By using the activity-based simulation system, the time required to complete the operation and the idling time of resources involved can be analyzed under different scenarios.

The model with a minimum buffer stock would be the most ideal method for the project described in this paper. Not only does it require the least time for the operation, it also provides a buffer to the project just in case the work is ahead of schedule. This approach should be more acceptable to construction planners as the existence of a certain amount of stock will provide a great deal of flexibility to the project.

#### **7. (Ng et al., 2008) Modelling construction material logistics system with stochastic Petri nets.**

This paper has proposed the use of stochastic Petri nets SPN to analyze materials logistics systems with a view to improving the performance of construction organizations. The case illustrates that the deployment of PNs techniques could improve planners or managers' awareness on the potential problems which could be encountered during the system execution. When it is used in construction logistics, it improves the understanding of the system representing it in a more visual form and hence helps formulate a more optimal and realistic materials management plan for construction projects. A reduction in materials wastage due to storage problems and an optimization of space utilization at construction sites could in turn lead to productivity gains and translate to better value for money for construction stakeholders.

This paper demonstrates that PNs can be equally applied to model construction material logistics systems. Acknowledging the deficiencies of basic PNs in modelling the time-evolution behaviors of construction logistics, the improved time-based SPNs discussed in this paper offer more enriched solutions. SPN-based process modelling and analysis can serve as a tool to support planners and manager in making construction logistics management decisions under dynamic situations. Nevertheless, there is clearly a need to investigate further other aspects of materials logistics systems simulation using the PNs.

There are also other areas for further investigation. These include the application of various PNs analysis technologies like collared PNs to construct visual models of

construction logistics system and analyze its properties. In addition, it is essential to develop methods and techniques to quantify the expected benefits from introducing such concepts such as just-in-time, agile supply chains using PNs model. This paper, therefore, contributes to understanding how improved time-based PNs can be used for construction process simulation, and lays the foundation for a better understanding of the complexities engendered by materials logistics management.

#### **8. (Alhaddad, 2006) A Construction Material Management System for Gaza Strip Building Contractors.**

This thesis aimed to explore the local practice of construction material management and develop a construction management material system to facilitate the management of construction material mainly in construction of buildings in Gaza Strip using MS Excel software.

The exploration of the practice of the management of construction resources was done by survey questionnaire supported by interviews with contractors. The results show that the contracting companies are interested in using a tool to manage the construction material but they do not have a friendly interface computer application to do that, and most of them do the management manually.

Study recommendations included that the contractors should use a computer software to management the construction materials such as cement, steel bars and aggregates in order to get materials in time and required quantities efficiently. Both management of construction materials and supplying of construction materials can use a computer software developed for them to get high efficiency of the work.

#### **9. (Dridi et al., 2005) Traffic control in transportation systems.**

This paper presented a model based on colored Petri Nets CPNs and object Petri Nets OPNs that describes the functioning of a multimodal public transport network. This paper has presented also a genetic coding to resolve the public transport scheduling problem; evolutionary algorithms EAs are chosen because classical methods are inadequate to solve such an optimization problem. The algorithm allows finding a good combination of scheduling decisions that allow a good regulation of traffic.

#### **10. (Al Raai, 2005) Evaluation of Gaza Crossing Borders Practice and the Ability to Improve it.**

This study prepared by Palestinian Ministry of National Economic in Gaza Strip to evaluate the practice of commercial crossing borders and to investigate if it is enough and capable to handle the supply of needed goods. Also the study considered the technical side of the crossing borders and considered the ability of development through the Ministry of Economic. The study has five hypotheses which are; (1) there is a relationship between the demand and the practices on the crossing borders, (2) the improvement of the technical facilities in the borders will ease goods supply and this will encase the commercial traffic, (3) conflict of authorities between Palestinian entities is one of the barriers that affect negatively on the commercial traffic, (4) there is a relationship between building a commercial areas and having good technical facilities on the crossing border.

Study methodology was done through using primary and secondary data resources, Primary data collected from the population of the study through a questioner and the collection of the secondary data was through relevant publications related to the crossing borders from governmental, and private sector entities, and other data collected through interviews with traders that deal with crossing borders daily.

Results and recommendations of this study include that: all crossing borders need a development in the infrastructure, Al Montar crossing border is working only with 23% of its efficiency, crossing borders do not have facilities for exporting goods, and 54% of the traders (in the population) considering that Ministry of Economic is the responsible entity for developing the crossing borders.

**Chapter 3**  
**Practice of Construction**  
**Materials Supply into**  
**Gaza Strip**

## Chapter 3 Practice of Construction Materials Supply into Gaza Strip

### 3.1 Karm Abu Salem Crossing Border

#### 3.1.1 Introduction

Karm Abu Salem crossing border is the only commercial crossing border that allow the transfer of all goods, food products, fuel, vehicles, agricultural equipment and humanitarian goods between the Gaza Strip and the outer world. To have full knowledge of how this border is work, filed visit was made to understand carefully the process of goods, also interviews and conversations were conducted with the workers on the border to get full information. The border is located in the southern of the Gaza Strip, near the “Israeli”-Palestinian-Egyptian border, 3.6 km from the Rafah Crossing.

In 2006 Karm Abu Salem crossing was used as an alternative to Rafah border for the transfer of humanitarian goods into the Gaza Strip from Egypt. After Karni crossing was closed in 2007, Sufa Crossing in 2008, Nahal Oz in 2010 and Karni’s conveyer belt in 2011, Karm abu Salem crossing became the only crossing for transfer of goods from “Israel” to the Gaza Strip.

#### 3.1.2 Structure

The structure of Karm Abu Salem crossing border as Koullab S. stated (Personal Communication, May 1,2016) consists of the Palestinian Side, “Israeli” Side and the in between road that crossed the border, figure (3.1) shows the sides.



**Figure (3.1): Map View of Karm Abu Salem Crossing Border. Source: Google Maps and field visit by the researcher.**

### **3.1.2.1 Karm Abu Salem crossing “Israeli” Side**

This part is out of the Gaza Strip and is the part that receive trucks loading goods from the “Israeli” side. All trucks should load goods on pallets and truck cannot pass unless their information is recorded on the border gate from the previous day according to a specific coordination criteria agreed between on PNA and Government of “Israel”. After entering the gates trucks offload their goods in warehouses for the needed check and to be ready to enter Gaza Strip through the in between road.

### **3.1.2.2 In Between Road**

It is a road with the length of about 500-meter that passes through 1948 borders constructed only for the transfer of goods from “Israeli” side to Palestinian side via an approved Palestinian transportation company operates only on this road for this purpose and the trucks are not allowed to go out of this path, the trucks loaded the goods from “Israeli” side and offload on Palestinian side in flat closed warehouses, tucks drivers and borders employees are the only ones who are allowed to enter this area to the Palestinian side.

### **3.1.2.3 Palestinian Side**

This part consists of two parts separated by 3 km road. Flat warehouses are near the border which is the place where the coming goods are offloaded, 3 km road used as a waiting line and exists for customer’s (traders) trucks that will load goods from warehouses, and customs and administration area near Rafah crossing border. Trucks for Palestinian traders (customers) and transportation companies enter warehouses’ area to load the goods and then can go through the 3-km road to reach custom area to make needed check from Palestinian side then to transfer the goods to Gaza Strip.

After the expansion project in 2015 in Karm Abu Salem crossing – Palestinian side, there are 9 warehouses with average area about 10,000 m<sup>2</sup> for each classified according to goods type and one yard for petroleum, warehouses from 1 to 3 for general goods, warehouse number 4 is a flat yard separated into two part for aggregates, warehouse number 5 equipped with 2 conveyor belts for animals’ food, warehouse number 6 steel bars and other special goods, warehouses 7 and 8 for bagged cement, and warehouse 9 is for bulk cement and equipped with pipelines for this purpose.

### 3.1.2.3.1 Palestinian Side Parts:

#### 1- Warehouses (10 warehouse)

Offload yards to offload of the trucks coming from “Israeli” side, with average area about 10,000 m<sup>2</sup> for each.

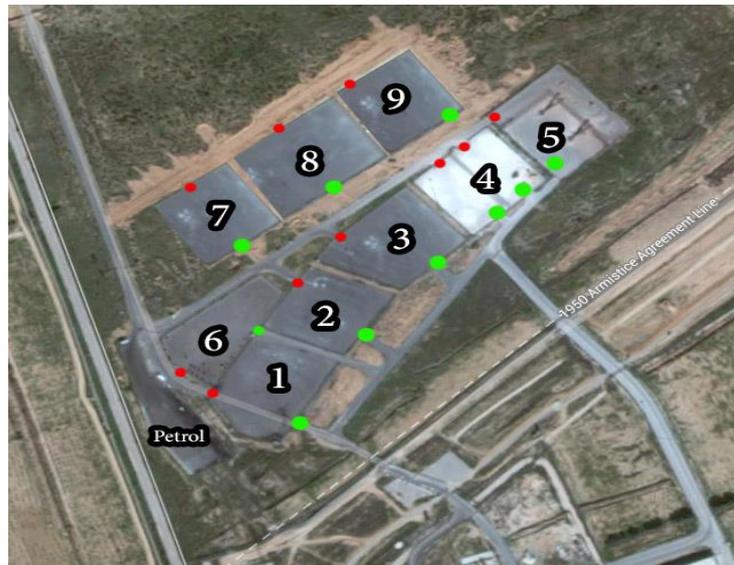
- a) 3 warehouses for general goods.
- b) 1 warehouse for special goods like steel and glass.
- c) 2 warehouses for bagged cement.
- d) 1 warehouse (yard) equipped with pipe lines in a separated wall for bulk cement.
- e) 1 warehouse for aggregates (two parts).
- f) 1 warehouse with conveyer belt for animal’s foods
- g) 1 room for petroleum

#### 2- Waiting Lines inside the Palestinian Side for customers’ trucks:

This is a road between the warehouses and customs (3 km) length (5 m width).

- a) 1 line for aggregates goods
- b) 3 lines for bagged cement and steel and other goods.
- c) 1 line for bulk cement
- d) 1 line for petrol

#### 3- Custom and check.



**Figure (3.2) Map shows the structure of Karm Abu Salem crossing border and offloading warehouses. Source: Google Maps and field visit by the researcher**

### 3.1.2.3.2 Vehicles Inside the Crossing Border Yards

There are many types of vehicles which work inside the yards of the crossing border to facilitate the process of transferring goods.

#### 1- Types

- a) Regular goods trucks (flat back) can be used for Cement
- b) Truck with hydraulic elevator for Steel
- c) Aggregate Trucks with hydraulic elevator
- d) Forklifts
  - Load time for truck: 10 min. using 2 forklifts
  - Offload time for truck 8 min using 2 forklifts

#### 2- Capacity

The capacity of trucks is different from one type to other. The trucks that transfer materials to the warehouses in Karm Abu Salem crossing in Gaza Strip can be called “Supplier Truck” and the trucks that transfer the materials into Gaza Strip can be called “Customer Trucks”, table (3.1) shows the capacity of each type.

**Table (3.1): Capacity of Trucks Inside Karm Abu Salem Crossing Border**

Truck Type	Supplier Truck Capacity (Ton)	Customer Truck Capacity (Ton)
Bagged Cement	36 or 40	36 or 40 or 48 (24+24)
Bulk cement	32 to 42	32 to 42
Aggregate	30 or 50 (25+25)	50 or 80 (40+40)
Steel	32	32 to 50
Forklift	2.5, 3 or 5	

**Source: field visits and interviews with crossing border employees.**

#### 3- Number of Vehicles:

The number of vehicles that work inside the warehouses in Karm Abu Salem Crossing border can be summarized as mentioned on table (3.2).

**Table (3.2): Number of Trucks Inside Karm Abu Salem Crossing Border**

Truck Type	Number
Regular Trucks	35
Bulk Trucks	5
Loaders	4
Forklifts	35

**Source: field visits and interviews with crossing border employees.**

### **3.1.3 Materials Flow**

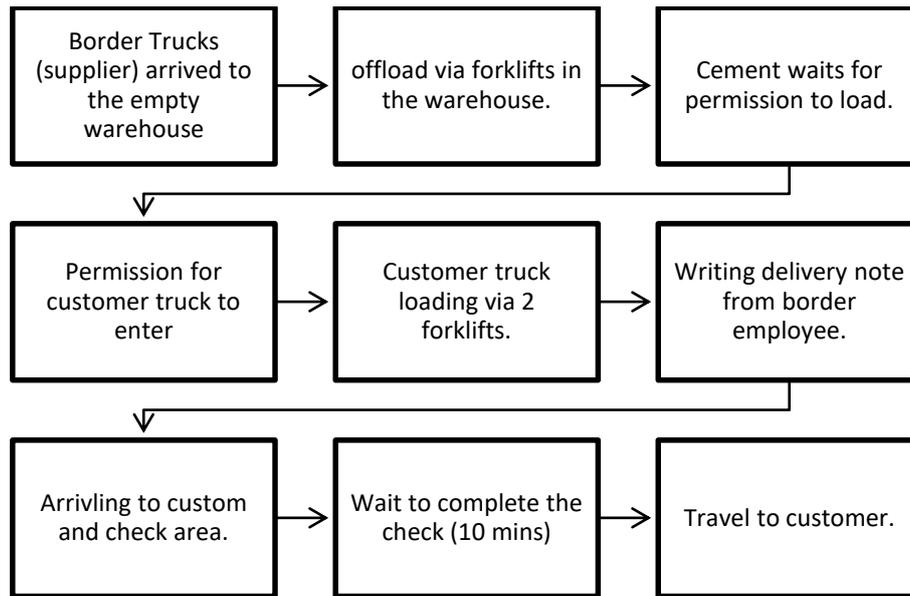
After having all the needed approvals for the materials, the first step for the trucks is to enter Karm Abu Salem crossing border from the “Israeli” side after making the needed checks for driver’s names, IDs and trucks plates’ number and this process known as coordination, after that the trucks is allowed to offload the materials to be ready for the next step. The second step is to load and transfer the materials through the in between area to offload them in the Palestinian side warehouses, and the last step is to load the materials to enter Gaza Strip after completing the needed checks in the Palestinian Side. The Transfer of construction materials through Karm Abu Salem crossing goes through the same steps. However, the difference is the type of used vehicle for each type of materials., figures (2.4),(2.5), (2.6) and (2.7) shows the flow of bagged cement, bulk cement, steel bars and aggregates respectively as stated by Koullab S., Al Shekh Khalel M. and Amasi N. (Personal Communication, May 2016).

#### **3.1.3.1 Bagged cement in the Palestinian side:**

The flow of the bagged cement in the Palestinian side passes through several stages before it reached the Gaza Strip after it is offloaded from the coming trucks from the Israeli side as follow:

- 1- The coming border trucks (supplier trucks) loaded with bagged cement arrived to the empty warehouse in the Palestinian side.
- 2- Offloading cement via forklifts in the warehouses.
- 3- Cement waits a permission to be loaded.
- 4- A permission to customer truck to enter the warehouses to load the cement.
- 5- Loading the bagged cement via 2 forklifts onto customer trucks that will go to Gaza Strip.
- 6- Issuing delivery note from border employee with load details.
- 7- Customers trucks with cement traveling to the customs and check area.
- 8- Trucks wait to complete the check within 10 mins.
- 9- Cement trucks travel to the customer in the Gaza Strip.

Figure (3.3) shows the flow of bagged cement.



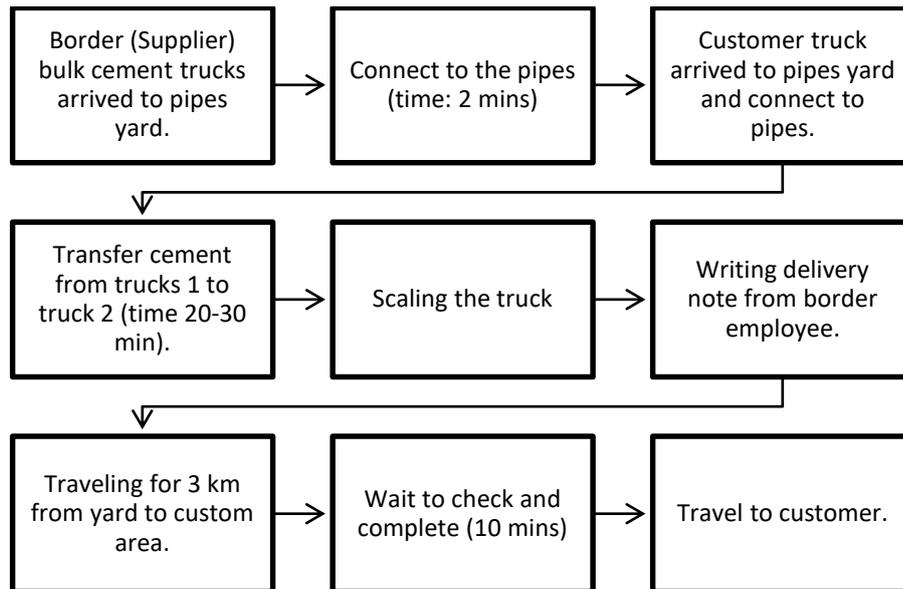
**Figure (3.3): Flow of bagged cement on Karm Abu Salem Crossing Border.**  
**Source: field study by the researcher.**

### 3.1.3.2 Bulk cement:

The flow of the bulk cement in the Palestinian side passes through several stages before it reached the Gaza Strip after arrival of the coming trucks from the Israeli side as follow:

- 1- The coming border trucks (supplier trucks) loaded with bulk cement arrived to the pipe lines yard in the Palestinian side.
- 2- Process of connecting to the pipes to the trucks about 2 mins.
- 3- Customer truck arrived to pipes yard and connect to pipes.
- 4- Permission to transfer cement from trucks 1 to truck 2 about 20-30 min.
- 5- Customer trucks travel to scale to take the weight.
- 6- Writing delivery note from border employee with the details.
- 7- Traveling for 3 km from yard to custom area.
- 8- Wait to check and complete (10 mins)
- 9- Travel to customer inside Gaza Strip.

Figure (3.4) shows the flow of bulk cement.



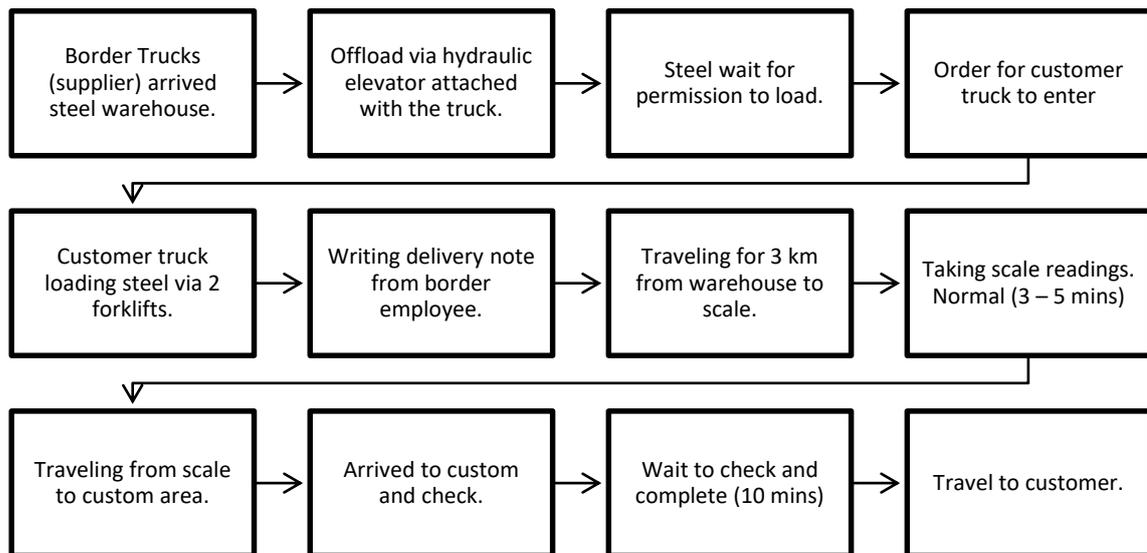
**Figure (3.4): Flow of bulk cement on Karm Abu Salem Crossing Border.**  
**Source: field study by the researcher.**

### 3.1.3.3 Steel bars:

The flow of the steel bars in the Palestinian side passes through several stages before it reached the Gaza Strip after it is offloaded from the coming trucks from the Israeli side as follow:

- 1- The coming border trucks (supplier trucks) loaded with steel bars arrived to the empty warehouse in the Palestinian side.
- 2- Offloading steel bars via hydraulic elevator attached to the trucks in the warehouses.
- 3- Steel bars waits a permission to be loaded.
- 4- A permission to customer truck to enter the warehouses to load the steel bars.
- 5- Loading the steel bars via 2 forklifts onto customer trucks that will go to Gaza Strip.
- 6- Customer trucks travel to scale to take the weight.
- 7- Writing delivery note from border employee with the details.
- 8- Traveling for 3 km from yard to custom area.
- 9- Wait to check and complete (10 mins)
- 10- Travel to customer inside Gaza Strip.

Figure (3.5) shows the flow of steel bars.



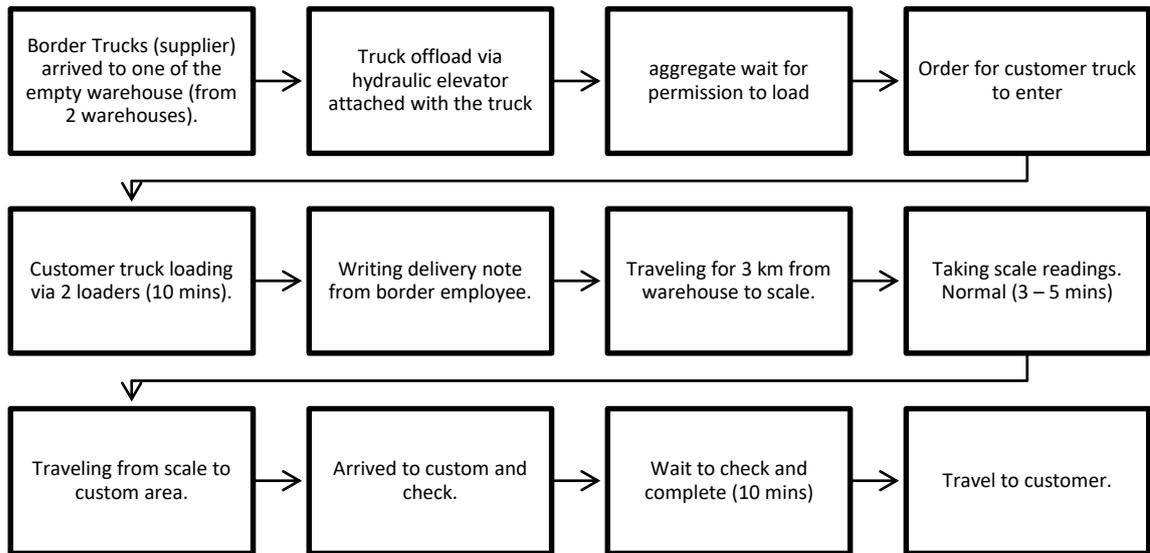
**Figure (3.5): Flow of steel bars on Karm Abu Salem Crossing Border. Source: field study by the researcher.**

#### **3.1.3.4 Aggregate:**

The flow of the aggregates in the Palestinian side passes through several stages before it reached the Gaza Strip after it is offloaded from the coming trucks from the Israeli side as follow:

- 1- Border Trucks (supplier) arrived to one of the empty warehouse which are two flat yards build specially for the aggregates.
- 2- Coming trucks offloaded the aggregates via hydraulic elevator attached with the truck.
- 3- Aggregate wait on the yards for permission to be loaded.
- 4- Order for customer truck to enter the yards and load the aggregates.
- 5- Customer truck loading via 2 loaders (10 mins).
- 6- Traveling for 3 km from warehouse to scale.
- 7- Taking scale readings within 3 – 5 mins.
- 8- Writing delivery note from border employee with truck details.
- 9- Traveling from scale to custom area.
- 10- Arrived to custom and check area to complete needed check about 10 min.
- 11- Trucks travel to customer inside Gaza Strip.

Figure (3.6) shows the flow of aggregates.



**Figure (3.6): Flow of aggregates on Karm Abu Salem Crossing Border. Source: field study by the researcher.**

**Limitations:**

- 7 or 10 trucks of border (supplier) trucks are allowed to be in all warehouses at the same time, with an employee for counting.
- Each warehouse has two gates, one gate for the border trucks (supplier) and the other one is for customer's trucks.
- Customer trucks are not allowed to enter warehouses unless the border trucks (supplier) are out and their gate is closed.

**Notes:**

- All truck should pass on the scale except bagged cement trucks.
- Delay in scale may occur.
- Delay in custom may occur.

**3.1.4 Service Rate**

Estimated service rate of Karm Abu Salem crossing per day is about 1,000 trucks as Alshekh Khaleel M. stated (Personal Communication, May 2, 2016), considering the capacity of construction materials vehicles per day is as shown in table (3.3):

**Table (3.3):Max. Allowed Number of Construction Materials Trucks per Day through Karm Abu Salem Crossing Border**

Material	Trucks/Day
Bagged Cement	120
Bulk cement	30
Aggregate	400
Steel	30
<b>Total</b>	<b>560</b>

Source: Interviews with Alshekh Khaleel M.

Border working hours are from Sunday to Thursday as shown in table (3.4):

**Table (3.4): Working Hours of Karm Abu Salem Crossing Border for Construction Materials**

Material	Open	Close for Supply	Close for Customers
Bagged Cement and steel	7:00 AM	1:30 PM	8:00 PM
Bulk cement	7:00 AM	3:00 PM	8:00 PM
Aggregate	7:00 AM	3:00 PM	8:00 PM

Source: Interviews with Koullab S.

### 3.2 Transportation to the Gaza Strip

The transportation of construction materials from Karm Abu Salem crossing border to Gaza Strip has an important part of the delivery process of the construction materials to its final destination. Either the construction materials have to be transferred from border or from warehouse (inventory) inside Gaza Strip, an efficient and effective transportation system should be built to get the optimal use of the available resource (vehicles) without wasting time and with the minimum cost. Trucks inside Gaza Strip are owned by local family owned transportation companies, they used to transfer goods from crossing border to customer's warehouse. As for the construction materials, some materials transferred directly to concrete factories or construction sites to decrease transportation cost. Due to the limited number of trucks that work from and to Karm Abu Salem crossing border, most trucks make more than one trip each day, and to make it possible, drivers or coordinators of trips put a schedule to send the truck to the destinations near Karm Abu Salem crossing border in the first trip and then to the far ones gradually.

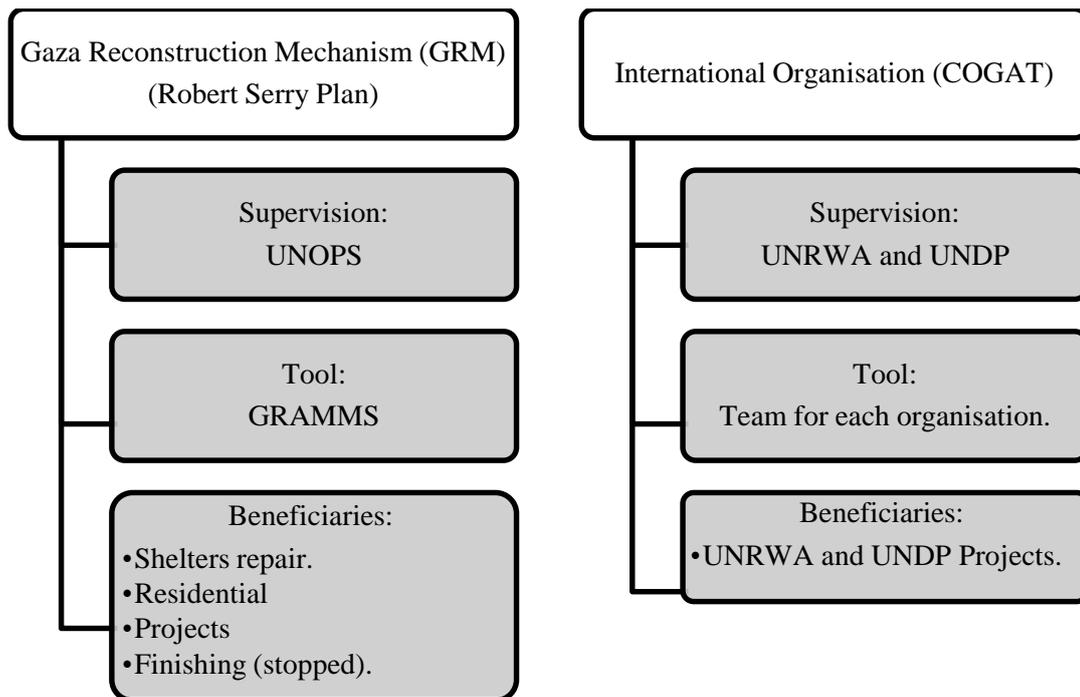
Tseng & Taylor (2005) stated that transportation system is the most important economic activity among the components of business logistics systems. Around one third to two thirds of the expenses of enterprises' logistics costs are spent on transportation. The cost of transportation, on average, accounted for 6.5% of market

revenue and 44% of logistics costs and it could be regarded as a restriction of the objective market. Value of transportation varies with different industries. For those products with small volume, low weight and high value, transportation cost simply occupies a very small part of sale and is less regarded; for those big, heavy and low-valued products, transportation occupies a very big part of sale and affects profits more, and therefore it is more regarded. Construction materials are considered as a big and heavy materials with moderate to high value-products and the transportation cost occupies a relatively big part of selling price and affects the profit that's why most of construction materials traders have their own trailers to transport the construction materials. After field survey by the researcher about construction materials transportation cost inside Gaza Strip without the transportation before enter the border, there is a fixed transportation cost for the transportation of the materials inside the crossing border yards which is 500 ILS/Truck. The cost of transporting construction materials from the crossing border to its final destination inside the Gaza Strip depends on the location but with small difference due to the small area of Gaza Strip. Transporting one ton of construction materials costs on average 12 ILS/ton, comparing the cost of transportation with the cost of materials assuming that each truck load in average 36 ton, transportation cost will be 25 ILS/Ton it means that it will consider about 5% of cement price, 22 % of aggregate price and 1 % of steel price assuming that average price of cement, aggregate and steel are 500 ILS/Ton, 110 ILS/Ton and 2100 ILS/Ton respectively.

### **3.3 Construction Materials Coordinators**

Supplying goods to Gaza Strip specially construction materials has a special circumstance due to the special political situation for Gaza Strip in the region. Having an import permission for materials is known as coordination, which is submitting materials' trucks details to the Palestinian Authorities to have the needed permissions. From 1994 to 2006, the supply of construction materials through Karni crossing border and the other operating borders was a normal import and trade process traders can practice. After 2007 until September 2014 all construction materials that entered Gaza Strip were only for international organizations projects only which are implemented via contractors under the supervision of UNRWA and UNDP. After 2014 war, in

parallel with the previous coordination mechanism for international organizations, a new coordination mechanism called Gaza Reconstruction Mechanism (GRM) was found by United Nations to help in the coordination process to enter Gaza Strip and to make the needed monitoring for construction materials uses. Figure (3.7) summarize the coordination ways and beneficiaries that available to supply construction materials to Gaza Strip.



**Figure (3.7): Ways Supply Construction Materials through Karm Abu Salem Crossing. Source: researcher.**

### 3.3.1 Coordination through International Organizations (COGAT)

After the closure of the Gaza Strip on 2007, a ban on construction materials was imposed. The only way to supply construction materials into Gaza was the coordination through international organization through Israeli Coordinator of Government Activities in the Territories Unit (COGAT) for UNRWA and UNDP. The coordination was only for construction materials and equipment's that would be used in projects that implemented by contractors under the supervision of the international organization, this coordination criterion is still active also after establishment of Gaza Reconstruction Mechanism.

### 3.3.2 Coordination through Gaza Reconstruction Mechanism (GRM)

It is a temporary agreement between the Palestinian National Authority (PNA) and the Government of "Israel" (GoI) brokered by the United Nations (UN) through

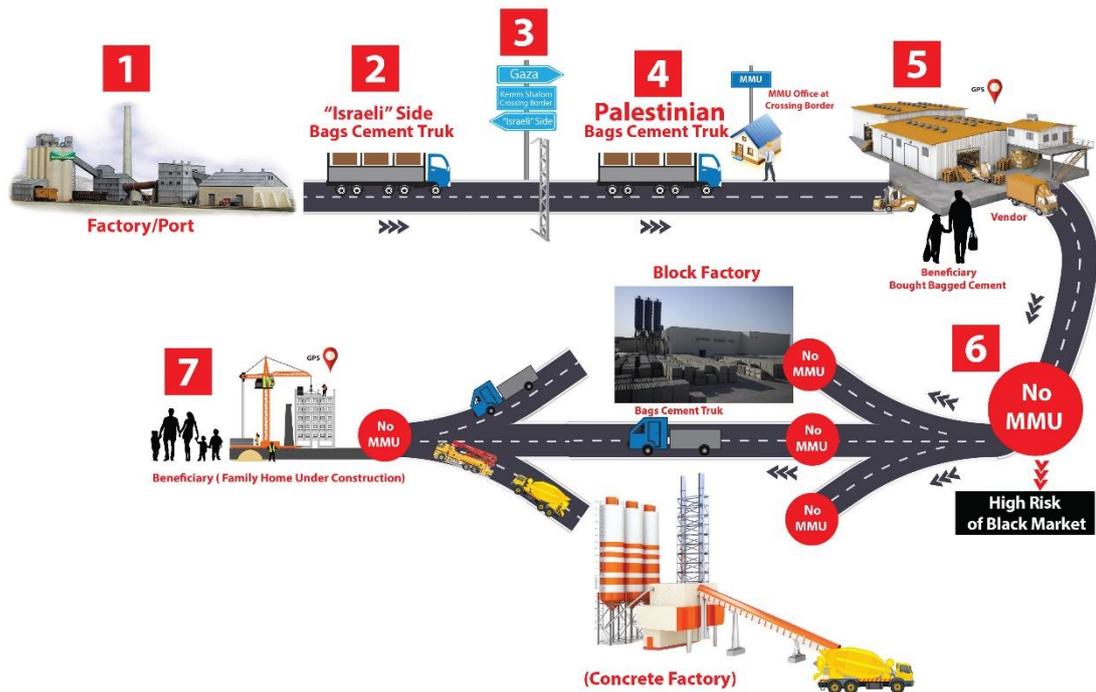
United Nations Special Coordinator (UNSCO) for the Middle East Peace Process, Mr. Robert Serry in September 2014. Its overall objective is to enable construction and reconstruction works at the large scale in the Gaza Strip. Main construction materials under the mechanism are cement, steel bars and aggregates. Noting that aggregates was removed from the system to be available in the private sector market without any restrictions in October 2015. (Gaza Reconstruction Mechanism, 2015).



**Figure (3.8): Parts of GRM System. Source: (GRAMMS, 2016)**

### 3.3.2.1 Beneficiaries

**Individuals:** to repair damaged homes/properties. After a basic assessment of damages sustained and quantities required for repairs by the Government of Palestine and the UN, owners will be able to purchase construction materials; aggregate, bar, cement and other materials from Government of Palestine approved vendors in Gaza. UN-contracted engineers will spot-check a small proportion of these works. This process enabled the rehabilitation of an estimated 80,000 damaged homes and properties. Finishing works stream for individuals is available on the system but it does not work. Individual beneficiaries can receive their allocated materials through any active vendor using their ID number. Figure (3.9) is an example Illustrates the current practice of bagged cement from crossing border to residential beneficiaries and also can be applied to steel bars and aggregates.



**Figure (3.9) Example Illustrates current practice of bagged cement under GRM**  
**Source: researcher field study.**

From researcher point of view, at point 6 where the materials bought from the vendor and went out without monitoring from Materials Monitoring Unit (MMU) that belongs to United Nations Office for Projects Services (UNOPS), this may lead to high risk of appearing black markets of construction materials. Black market not only increase the price of the construction materials but it also slows the process of the reconstruction.

**Projects:** Large scale public and private sector projects will be largely identified based on the GoP National Early Recovery and Reconstruction Plan for Gaza. Following the preparation of basic engineering materials (schematic drawings and bills of quantity), information will be registered in the central database for subsequent approval by GoI. GoP licensed contractors undertaking these works will then be able to procure the needed quantities of building materials, for public infrastructure (e.g. hospitals and schools) and for the private sector (e.g. factories) directly from GoP-approved vendors in Gaza. Projects can receive their allocated materials through any active vendor using project number.

### 3.3.2.2 Vendors Categories

The mechanism sorted vendors (users) into the following categories, each one has its own authorities:

- A. Vendors.
- B. Patching Plants.
- C. Block Makers.
- D. Contractors.
- E. Patching Plants and Block Makers.

The status of the above categories can be one of the following five:

- A. Cleared.
- B. Suspended.
- C. Uploading profile.
- D. Outstanding.
- E. Non Complete.

### **3.3.2.3 Requirements for Vendors to Participate in the GRM (Permanent Storage Facilities)**

There are minimum logistical and security requirements that need to be fulfilled to qualify for the import and sale of Aggregate, Re-Bar and Cement under the Gaza Reconstruction Mechanism. Meeting the requirements does not qualify a vendor for import and sale of construction materials. However, the UN Materials Monitoring Unit (MMU), at the request of the Ministry of Civil Affairs, is assigned to conduct site visits to potential vendors to ascertain compliance or non-compliance with the requirements and report these to the Ministry of Civil Affairs, and the MMU does not possess the authority to approve or reject any vendor;

1. Admin office where vendor will trade with beneficiaries and keep secured hard copy from all transactions (Material invoices, Shipping records and beneficiary receipts),
2. Perimeter fence 2.4 m (high),
3. Secured doors with chains and padlocks,
4. Adequate lighting inside and outside storage area,

5. Closed-Circuit Television (CCTV) with Digital video recorder (DVR), monitor and cameras to cover entire storage area for construction materials, CCTV must be operative 24 hours 7 days per week,
6. External Hard Drive for transfer and storage for 30 days of video data from cameras. The recording is kept on site for 1-month period following which it is held by MoCA for 1 month. The hard disk is then returned to the vendor.
7. Security guards to monitor warehouse after working hours,
8. Main electricity access,
9. Generator not less than 3kw with fuel tank with at least 40kg fuel to act as power reserve,
10. UPS for periods of brief electricity loss,
11. PC or Lap top,
12. Sales and stock recording system,
13. Vendor's storage area is only for Cement, Aggregates and Steel bars and must be separated from all other owner's commercial activities,
14. All imported ABC material must be held in the PA approved storage area. In cases where a vendor needs to separate material over multiple locations the vendor in question needs to meet the above requirements in all locations to qualify.
15. The above requirements are applicable regardless if the vendor in question intends to trade in Aggregate, Cement and Re-bar or only one or two of the commodities.

#### **3.3.2.4 Maximum amounts to be held at any one point in time**

Level 1: 160 Ton per Commodity of Aggregate, Re-Bar and Cement.

Level 2: 1,000 Ton per Commodity of Aggregate, Re-Bar and Cement.

#### **3.3.2.5 Requirements for Materials Temporary Storage Facilities**

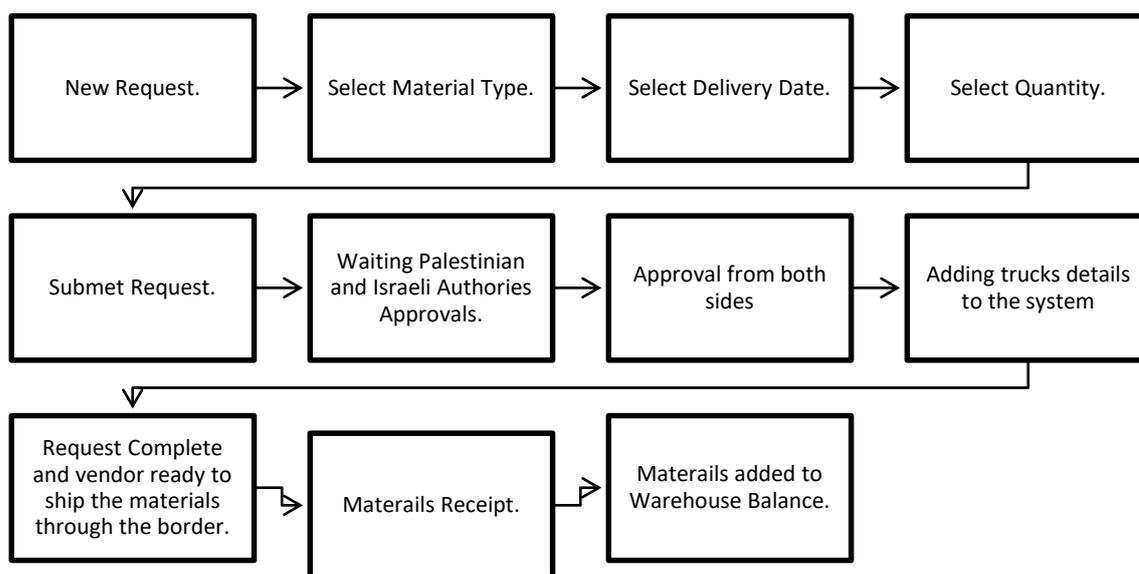
There are minimum logistical and security requirements that need to be fulfilled to qualify for the import of Aggregate, Re-Bar and Cement under the Gaza Reconstruction Mechanism. Temporary sites must be projects sites where construction materials can be stored immediately before its authorized use where the security of the construction materials is under the responsibility of either the projects manager, contractor, on site patching plant or on site block maker who hold that inventory on GRAMMS.

Meeting the requirements does not qualify the responsible representative to import and sale of construction materials, however. the UN Materials Monitoring Unit (MMU), at the request of the Ministry of Civil Affairs, is assigned to conduct site visits to potential vendors to ascertain compliance or non-compliance with the requirements and report these to the Ministry of Civil Affairs, and the MMU does not possess the authority to approve or reject any vendor.

1. Perimeter fence 2.4 m (high),
2. Secured doors or gates with chains and padlocks,
3. Adequate lighting inside and outside storage area,
4. Security guards to monitor storage area after working hours, and
5. A computer connected to the internet for inventory management on GRAMMS, although this may be located away from the temporary site is at the office of the project manager, contractor, batching plant or block maker.
6. All imported construction material must be held in a PA approved storage area. In case where there is a need to separate materials in many locations, the requirements should be met on all locations.

#### **3.3.2.6 Materials Requisition**

Supply of construction materials through Karm Abu Salem crossing process starts with a material requisition on the web based system for the Gaza Reconstruction Mechanism which called Gaza Requisition and Monitoring Materials System (GRAMMS) which can be accessed from any computer with connection to the internet through [www.gramms.org](http://www.gramms.org) for the approved vendors. Any materials requisition should have approval from Palestinian Authority and Government of Israeli, after that the vendor can submit trucks details that will enter Gaza. Vendors cannot make new materials requisitions if they have more than 40% of the materials on their inventory, and they can sell materials only for allowed beneficiaries recorded on the system database to avoid suspension. (Gaza Reconstruction Mechanism, 2015), figure (3.10) shows the steps to create new requisition.



**Figure (3.10): Steps to Make New Construction Material Request on GRM.**Source: field study by the researcher.

### 3.4 Gaza Strip Demand of Construction Materials

Gaza Strip needs a huge quantities of construction materials estimated about 27 million Tones including 2014 and all previous aggressions and also the quantities needed for the natural growth (Abu Hamam, 2015). This quantity can be classified into 3 main types of the construction materials, cement, aggregate and steel bars. As reported on fact sheet issued by Shelter Cluster (2010) construction material required for building an average house in Gaza Strip on an average 150 square meter house, including foundation and for a family of average 7 members is estimated as shown in table (3.5).

**Table (3.5): Construction Materials Required to Build an Average House in Gaza:**

Material	Quantity (Ton)	%
Cement	46	24%
Aggregates	142	73%
Steel Bars	7.6	4%

Source: Shelter Cluster, 2010.

Projection of the same percentages of the required construction materials on the total needed quantities of the construction materials as it was on October 2014 shown in table (3.6).

**Table (3.6): Demand of Construction Materials in 2014**

Material	%	27,000,000 Tones
Cement	24%	6,349,693.25
Aggregates	73%	19,601,226.99
Steel Bars	4%	1,049,079.75

Source: calculated by the researcher for the purpose of this study based on (Abu Hamam, 2015).

Gaza Reconstruction Mechanism(GRM) has a real time website shows all the activities and quantities of the construction materials that entered Gaza Strip. table (3.7) shows the quantities of construction materials that entered Gaza Strip till October 2016, thus we can obtain the remaining of the needed materials that was cumulated from previous aggressions and closure not including the normal demand that comes from the normal growth of population during 2015 and 2016.

**Table (3.7): Entered and Remaining Construction Materials**

Material	Demand 2014	Entered till 10/2016	Remaining
Cement (Ton)	6,349,693.25	693,458.00	5,656,235.25
Aggregates (Ton)	19,601,226.99	2,183,000.00	17,418,226.99
Steel Bars (Ton)	1,049,079.75	113,702.00	935,377.75

Source: calculated by the researcher for the purpose of this study based on data from (Abu Hamam, 2015) and (GRM, 2016)

The population of Gaza Strip is 1,819,982 and 1,881,135 for 2015 and 2016 respectively (PCBC, 2016) and based on the cement consumption per capita that stated on the Global Cement Report (2006) which is 474 Kg per capita per year, table (3.8) shows the needed quantity of construction materials based on the population from October 2015 to October 2016.

**Table (3.8): Needed Quantities of Construction Materials in Gaza Strip**

Material (Ton)	Demand Based on Population		Remaining from Previous Blockage and Aggressions	Total Demand
	2015	2016		
Population (capita)	1,819,982	1,881,135		
Cement	862,671.46	891,657.99	5,656,235.25	7,410,564.70
Aggregates	2,623,959.02	2,697,159.05	17,418,226.99	22,739,345.06
Steel Bars	143,778.58	144,354.99	935,377.75	1,223,511.32
<b>Total Demand of Construction Materials (Ton)</b>				<b>31,373,421.08</b>

Source: calculated by the researcher for the purpose of this study.

# **Chapter 4**

## **Methodology**

## **Chapter 4 Methodology**

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

### **4.1 Research Design**

**The first phase** of the research thesis proposal included identifying and defining the problems and establishment objective of the thesis and development research plan.

**The second phase** of the research included a summary of the comprehensive literature review.

**The third phase** of the research included a field survey which was conducted with construction materials traders in Gaza Strip.

**The fourth phase** of the research focused on the modification of the questionnaire design, through distributing the questionnaire to pilot study, the purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the thesis. The questionnaire was modified based on the results of the pilot study, shown in appendix (A).

**The fifth phase** of the research focused on distributing questionnaire. This questionnaire was used to collect the required data for the research.

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

110 questionnaires were distributed to the research population and 83 questionnaires were received.

### **4.2 Data Collection Methodology:**

In order to collect the needed data for this research, we use the secondary and preliminary resources in collecting data. Secondary resources such as books, journals, statistics, publications and web sites. Preliminary resources which is not available in secondary resources were collected through distribution of questionnaires on study

population in order to get their opinions about the evaluation of construction materials supply to Gaza Strip based on the considered factors.

Pilot study for the questionnaire was conducted with three traders of steel bars, aggregates and cement in Gaza Strip to evaluate if the questionnaire questions are clear to be answered in a way that help to collected the needed data of the thesis. Then the questionnaire was modified based on the results of the pilot study and these three questionnaires was neglected and not included in the final results.

Questionnaires were distributed to collect the required data for the research to 110 traders of population which is 120 traders and 83 questionnaires were received.

Research methodology depend on the analysis of data on the use of descriptive analysis, which depends on the main program Statistical Package for the Social Sciences (SPSS).

Research methodology depend on the analysis of data on the use of descriptive analysis, which depends on the poll and use the main program (SPSS).

### **4.3 Assumptions**

This research will be based on the assumption that Karm Abu Salem Crossing Borders operates normally without closure due to political constraints.

### **4.4 Population and Sampling**

The population was construction materials main traders that works under the Gaza Reconstruction Mechanism (GRM) which operates under the supervision of United Nations Office for Projects Services (UNOPS) which consist of 120 traders which are the only traders that can import construction materials and sell it to the benefices, contractors that import construction materials through COGAT were not included because they can use the materials for their projects only. Questionnaires were distributed to 110 traders of the research population which is 120 traders and 83 questionnaires are received, Appendix (C) illustrate the properties of the samples.

### **4.5 Questionnaire Content**

The questionnaire was provided with a covering letter explaining the purpose of the thesis, the way of responding, the aim of the research and the security of the

information in order to encourage a high response. The questionnaire included multiple choice question: which used widely in the questionnaire, the variety in these questions aims first to meet the research objectives, and to collect all the necessary data that can support the discussion, results and recommendations in the research.

The sections in the questionnaire will verify the objectives in this research related to Evaluation of construction materials supply to Gaza strip as the following:

**Section one:** Personal information include 7 questions

**Section two:** Related to the evaluation of construction materials supply into Gaza strip consist from six fields as follows:

- ✓ The first field: Construction materials supplying mechanism include 14 statement.
- ✓ The Second field: Allowed quantities of construction materials include 8 statement.
- ✓ Third field: Construction materials demand include 5 statement.
- ✓ Fourth field: Prices of construction materials shipments include 4 statement.
- ✓ Fifth field: Crossing border infrastructure include 11 statement.
- ✓ Sixth field: Customs and clearance on construction materials include 3 statement.

The respondent can answer the questionnaire item follows Likert scale by assigning it with a number from 1 to 5 indicating his/her acceptance degree of this item, where (5) represents the highest acceptance degree about an item and (1) represents the lowest acceptance degree about it as illustrated in table No. (4.1).

**Table (4.1): Likert scale**

Level	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Scale	1	2	3	4	5
Weight mean	20%-36%	36%-52%	52%-68%	68%-84%	84%-100%

#### 4.6 Pilot Study

A pilot study for the questionnaire was conducted with three traders of steel bars, aggregates and cement in Gaza Strip before collecting the results of the sample. It provides a trial run for the questionnaire, which involves testing the wordings of

question, identifying ambiguous questions, testing the techniques that used to collect data, and measuring the effectiveness of standard invitation to respondents.

Then the questionnaire was modified based on the results of the pilot study and these three questionnaires was neglected and not included in the final results.

#### **4.7 Validity of the Research**

We can define the validity of an instrument as a determination of the extent to which the instrument actually reflects the abstract construct being examined. "Validity refers to the degree to which an instrument measures what it is supposed to be measuring". High validity is the absence of systematic errors in the measuring instrument. When an instrument is valid; it truly reflects the concept it is supposed to measure. Achieving good validity required the care in the research design and sample selection. The amended questionnaire was by the supervisor and three expertise in the engineering and construction materials field to evaluate the procedure of questions and the method of analyzing the results. The expertise agreed that the questionnaire was valid and suitable enough to measure the purpose that the questionnaire designed for.

##### **4.7.1 Content Validity of the Questionnaire**

Content validity test was conducted by consulting two experts. The first was requested to evaluate and identify whether the questions agreed with the scope of the items and the extent to which these items reflect the concept of the research problem. The other was requested to evaluate that the instrument used is valid statistically and that the questionnaire was designed well enough to provide relations and tests between variables. The two experts did agree that the questionnaire was valid and suitable enough to measure the concept of interest with some amendments.

##### **4.7.2 Statistical Validity of the Questionnaire**

To insure the validity of the questionnaire, two statistical tests should be applied. The first test is Criterion-related validity test (Pearson test) which measure the correlation coefficient between each item in the field and the whole field. The second test is structure validity test (Pearson test) that used to test the validity of the questionnaire structure by testing the validity of each field and the validity of the whole

questionnaire. It measures the correlation coefficient between one field and all the fields of the questionnaire that have the same level of similar scale.

#### **4.7.2.1 Criterion Related Validity:**

##### **1) Internal consistency:**

Internal consistency of the questionnaire is measured by a scouting sample, which consisted of thirty questionnaires, through measuring the correlation coefficients between each question in one field and the whole field. Results shows that the correlation coefficient and p-value for each field item is less than 0.05 or 0.01, so the correlation coefficients of all fields are significant at  $\alpha = 0.01$  or  $\alpha = 0.05$ , so it can be said that the paragraphs of this field are consistent and valid to measure what it was set for, Appendix (D) illustrates the results.

##### **2) Structure Validity of the Questionnaire**

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

Results show that the significance values (p-value) are less than 0.01, so the correlation coefficients of all the fields are significant at  $\alpha = 0.01$ , so it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the thesis, Appendix (D) illustrates the results.

#### **4.8 Reliability of the Research**

Reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring. The test is repeated to the same sample of people on two occasions and then compares the scores obtained by computing a reliability coefficient. For the most purposes reliability coefficient above 0.70 are considered satisfactory. Period of two weeks to a month is recommended between two tests due to complicated conditions that the traders are facing at the time being, it was too difficult to ask them to responds to our questionnaire twice within short period. The statistician's explained that, overcoming the distribution of the questionnaire

twice to measure the reliability can be achieved by using Kronpakh Alpha coefficient and Half Split Method through the SPSS software.

#### **4.8.1 Half Split Method**

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

Consistency coefficient =  $2r/(r+1)$ , where  $r$  is the Pearson correlation coefficient. The normal range of corrected correlation coefficient  $2r/(r+1)$  is between 0.0 and + 1.0. Results show that the general reliability for all items equal 0.852, and the significant ( $\alpha$ ) is less than 0.05 so all the corrected correlation coefficients are significance at  $\alpha = 0.05$ . It can be said that according to the Half Split method, the dispute causes group are reliable. Appendix (E) illustrates the results.

#### **4.8.2 Cronbach's Coefficient Alpha**

This method is used to measure the reliability of the questionnaire between each field and the mean of the whole fields of the questionnaire. The normal range of Cronbach's coefficient alpha value between 0.0 and + 1.0, and the higher values reflects a higher degree of internal consistency. Results show that the general reliability for all items equal 0.884. This range is considered high; the result ensures the reliability of the questionnaire, Appendix (E) illustrates the results.

# **Chapter 5**

## **Data Analysis and Discussion**

## **Chapter 5**

### **Data Analysis and Discussion**

Questionnaire was developed in English, attributed then translated into Arabic consisted of 6 parts, each part discussed one variable of the thesis.

#### **5.1 Analysis and Discussion of Research Hypotheses**

**H.1:** There is a statistically significant differences attributed to used mechanism of supply of construction materials into Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we used a one sample t test for the opinions of the respondent about construction materials supplying mechanism, results are in appendix (F) and can be summarized as follow:

1. In item No. (10) using the internet and computer applications facilitates sales and inventory management the weight mean equal " 88.19%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means using the internet and computer applications facilitates sales and inventory management.
2. In item No. (9) using the internet and computer applications facilitates work and materials' requisitions the weight mean equal " 87.23%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means using the internet and computer applications facilitates work and materials' requisitions.
3. In item No. (11) there is a clear set of requirements for traders to work by the current mechanism the weight mean equal " 75.42%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means there is a clear set of requirements for traders to work by the current mechanism.
4. In item No. (14) the monitoring team answers all vendors' questions the weight mean equal " 73.49%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the monitoring team answers all vendors' questions.
5. In item No. (13) the monitoring team deals with the vendors in a good way the weight mean equal " 71.81%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the monitoring team deals with the vendors in a good way.

6. In item No. (12) there is a known entity to which traders can submit their request, to be able to work by the current mechanism the weight mean equal " 71.33%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means there is a known entity to which traders can submit their request, to be able to work by the current mechanism.
7. In item No. (6) the relationship between stake-holders (Vendors, Patching Plants, Block Makers and beneficiaries) helps in the supplying process the weight mean equal 70.84%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the relationship between stakeholders (Vendors, Patching Plants, Block Makers and beneficiaries) helps in the supplying process.
8. In item No. (1) ease of creating new materials requisitions based on the current mechanism the weight mean equal 67.23 % and positive t value and p-value equal " 0.005" which is less than 0.05, that means ease of creating new materials requisitions based on the current mechanism.
9. In item No. (3) limited creation of new materials requisitions with a specified maximum inventory makes the supplying process easier the weight mean equal " 64.58%" and positive t value and p-value equal " 0.084" which is greater than 0.05, that means limited creating new materials requisitions with a specified maximum inventory may be not make the supplying process easier.
10. In item No. (8) the current supplying mechanism requirements are not expensive due to their use in the work the weight mean equal " 64.10%" and positive t value and p-value equal " 0.123" which is greater than 0.05, that means the current supplying mechanism requirements are expensive due to their use in the work.
11. In item No. (4) specifying the beneficiaries of construction materials makes the supplying process faster the weight mean equal " 60.96%" and positive t value and p-value equal " 0.739" which is greater than 0.05, that means specifying the beneficiaries of construction materials does not make the supplying process faster.
12. In item No. (2) limited creation of new materials requisitions with a specified minimum inventory makes the supplying process easier. the weight mean equal 57.35% and negative t value and p-value equal " 0.336" which is greater than 0.05, that mean limited creation of new materials requisitions with a specified minimum inventory does not make the supplying process easier.

13. In item No. (5) the current mechanism is suitable and every beneficiary can receive his/her needed materials the weight mean equal " 55.18%" and negative t value and p-value equal " 0.079" which is greater than 0.05, that means current mechanism is not suitable and every beneficiary can receive his/her needed materials.
14. In item No. (7) the needed approvals for new materials requisitions are easy the weight mean equal " 51.33%" and negative t value and p-value equal " 0.001" which is less than 0.05, that means needed approvals for new materials requisitions are not easy.

In general, the results for all items of the field Construction Materials Supplying Mechanism show that the average mean equal 3.43 and the weight mean equal 68.50% which is greater than "60%" and the value of t test equal 5.532 which is greater than the critical value which is equal 1.99 and the p- value equal 0.000 which is less than 0.05, that means the used mechanism impact on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$ . From researcher point of view this result is logical because even the used mechanism can affect negatively on the supplying process, the traders in Gaza Strip are going to use it to be able to supply construction materials specially after long closer.

**H.2:** There is a statistically significant differences attributed to allowed quantities of supply of construction materials into Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we used a one sample t test for the opinion of the respondent about Allowed quantities of construction materials, results are in appendix (F) and can be summarized as follow:

1. In item No. (1) the increase in the number of trucks allowed to enter in daily basis positively affects the supply of construction materials. the weight mean equal " 92.05%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the increase in the number of trucks allowed to enter in daily basis positively affects the supply of construction materials.

2. In item No. (7) the number of allowed trucks per day is affected by “Israeli” holydays the weight mean equal " 91.81%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of allowed trucks per day is affected by “Israeli” holydays.
3. In item No. (3) the number of allowed trucks per day is affected by the political situation. the weight mean equal " 87.95%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of allowed trucks per day is affected by the political situation.
4. In item No. (5) the number of allowed trucks per day is affected by the border's working hours the weight mean equal " 83.13%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of allowed trucks per day is affected by the border's working hours.
5. In item No. (2) there is a relation between supplying primary and secondary construction materials the weight mean equal " 82.17%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means there is a relation between supplying primary and secondary construction materials.
6. In item No. (6) the number of allowed trucks per day is affected by Palestinian holydays the weight mean equal " 80.48%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of allowed trucks per day is affected by Palestinian holydays.
7. In item No. (8) the number of allowed trucks per day is affected by the economic situation the weight mean equal " 79.28%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of allowed trucks per day is affected by the economic situation.
8. In item No. (4) the supply of the construction materials is affected by the availability of materials the weight mean equal " 77.59%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the supply of the construction materials is affected by the availability of materials.

In general, the results for all items of the field the Allowed Quantities Of Construction Materials show that the average mean equal 4.22 and the weight mean equal 84.31% which is greater than “ 60%” and the value of t test equal 22.207 which is greater than the critical value which is equal 1.99 and the positive t value and

p- value equal 0.000 which is less than 0.05, that means the allowed materials quantities impact on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$  . From researcher point of view, this result suite with the high demand on the construction materials. The allowed quantities to be supplied in daily basis to Gaza Strip of construction materials has a relatively high weight from all items.

**H.3:** There is a statistically significant differences attributed to the demand of construction materials in Gaza Strip at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we used a one sample t test for the opinion of the respondent about Construction materials demand, results are in appendix (F) and can be summarized as follow:

1. In item No. (3) the closure of the crossing borders increases the demand of the construction materials the weight mean equal " 92.05%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the closure of the crossing borders increases the demand of the construction materials.
2. In item No. (2) the demand on construction materials is affected by the destruction of buildings and infrastructure due to the previous wars the weight mean equal 90.60% and positive t value and p-value equal " 0.000" which is less than 0.05, that means the demand on construction materials is affected by the destruction of buildings and infrastructure due to the previous wars.
3. In item No. (1) The demand on construction materials is affected by the normal growth of the population the weight mean equal " 86.27%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the demand on construction materials is affected by the normal growth of the population.
4. In item No. (5) the demand on construction materials is affected by the economic situation the weight mean equal " 82.89%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the demand on construction materials is affected by the economic situation.

5. In item No. (4) the demand on the construction materials is affected by the seasons of the year which in turn affect the building activity the weight mean equal " 80.72%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the demand on the construction materials is affected by the seasons of the year which in turn affect the building activity.

In general, the results for all items of the field Construction Materials Demand show that the average mean equal 4.33 and the weight mean equal 86.51% which is greater than "60%" and the value of t test equal 26.567 which is greater than the critical value which is equal 1.99 and with positive t value and p- value equal 0.000 which is less than 0.05, that means construction materials demand impact on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$ . From researcher point of view, and as mentioned in the previous factor, due to the high demand after long closer onto Gaza Strip, the demand has high weigh on factors that affect the supply of construction materials.

**H.4:** There is a statistically significant differences attributed to construction materials shipments' price at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we used a one sample t test for the opinion of the respondent about Prices of construction materials shipments, results are in appendix (F) and can be summarized as follow:

1. In item No. (2) shipment prices affect the price of construction materials in the normal market the weight mean equal " 81.45%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means shipment prices affect the price of construction materials in the normal market.
2. In item No. (4) the increase in shipment prices affect the demand on construction materials the weight mean equal " 76.14%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the increase in shipment prices affect the demand on construction materials.
3. In item No. (3) shipment prices affect the price of construction materials in the black market the weight mean equal " 75.18%" and positive t value and p-value equal "

0.000" which is less than 0.05, that means shipment prices affect the price of construction materials in the black market.

4. In item No. (1) the increase in shipment prices affects the supply of construction materials the weight mean equal " 73.01%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the increase in shipment prices affects the supply of construction materials.

In general, the results for all items of the field Prices of construction materials shipments show that the average mean equal 3.82 and the weight mean equal 76.45% which is greater than " 60%" and the value of t test equal 12.529 which is greater than the critical value which is equal 1.99 and with positive t value and p-value equal 0.000 which is less than 0.05, that means construction materials shipments price impact on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$ . From researcher point of view, it's expected that the price of construction materials shipment will effect on the supplying of construction materials but with weight mean less than the demand and the allowed quantities.

**H.5:** There is a statistically significant differences attributed to the crossing border's infrastructure at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we used a one sample t test for the opinion of the respondent about Crossing border infrastructure, results are in appendix (F) and can be summarized as follow:

1. In item No. (2) the development of the infrastructure of Karm Abu Salem Crossing Border will positively affect the supplying of the construction materials the weight mean equal "88.43%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means development of the infrastructure of Karm Abu Salem crossing border will effect positively on supplying of construction materials.
2. In item No. (5) loading and offloading warehouses' area affects the supplying of the construction materials the weight mean equal " 86.27%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means loading and offloading warehouses' area affects the supplying of the construction materials.

3. In item No. (3) increasing the service rate inside Karm Abu Salem Crossing Border (loading and offloading) will positively affect the supplying of the construction materials the weight mean equal " 84.58%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means increasing the service rate inside Karm Abu Salem Crossing Border (loading and offloading) will positively affect the supplying of the construction materials.
4. In item No. (10) Karm Abu Salem Crossing Border is equipped with special equipment for bulk cement the weight mean equal " 77.11%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means Karm Abu Salem Crossing Border is equipped with special equipment for bulk cement.
5. In item No. (9) Karm Abu Salem Crossing Border is equipped with special equipment for bagged cement the weight mean equal " 75.18%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means Karm Abu Salem Crossing Border is equipped with special equipment for bagged cement.
6. In item No. (1) the available infrastructure of Karm Abu Salem Crossing Border affects the supply of construction materials positively the weight mean equal " 73.01%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the available infrastructure of Karm Abu Salem Crossing Border affects the supply of construction materials positively.
7. In item No. (4) the number of queues inside Karm Abu Salem Crossing Border affects the supplying of the construction materials the weight mean equal " 70.84%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the number of queues inside Karm Abu Salem Crossing Border affects the supplying of the construction materials.
8. In item No. (7) Karm Abu Salem Crossing Border is equipped with special equipment's for aggregates the weight mean equal " 69.64%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means Karm Abu Salem Crossing Border is equipped with special equipment's for aggregates.
9. In item No. (8) Karm Abu Salem Crossing Border is equipped with special equipment for steel bars the weight mean equal " 68.43%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means Karm Abu Salem Crossing Border is equipped with special equipment for steel bars.

10. In item No. (11) trucks scaling time positively affects the supplying of the construction materials the weight mean equal " 67.71%" and positive t value and p-value equal " 0.003" which is less than 0.05, that means trucks scaling time positively affects the supplying of the construction materials.
11. In item No. (6) the location of Karm Abu Salem Crossing Border is suitable for the supplying of the construction materials the weight mean equal " 56.87%" and negative t value and p-value equal " 0.211" which is greater than 0.05, that means the location of Karm Abu Salem Crossing Border is not suitable for the supplying of the construction materials.

In general, the results for all items of the field Crossing Border Infrastructure show that the average mean equal 3.72 and the weight mean equal 74.37% which is greater than 60% and the value of t test equal 13.356 which is greater than the critical value which is equal 1.99 and with positive t value and p-value equal 0.000 which is less than 0.05, that means crossing border infrastructure impact on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$ . From researcher point of view, the result is logical. The infrastructure of the border affects the supplying of construction materials and relatively greater than the used mechanism. Also the location of the Karm Abu Salem crossing border is not suitable as it shown on the results and this agree with the previous study for Al Raae (2005).

**H.6:** There is a statistically significant differences attributed to customs and clearance on construction materials at the level of  $\alpha = 0.05$  about the evaluation of the efficiency of construction materials supply.

To test this hypothesis, we use a one sample t test for the opinion of the respondent about Customs and clearance on construction materials, results are in appendix (F) and can be summarized as follow:

1. In item No. (1) the supplying process of construction materials is affected positively by the applied taxes the weight mean equal " 70.12%" and positive t value and p-value equal " 0.000" which is less than 0.05, that means the supplying process of construction materials is affected positively by the applied taxes.

2. In item No. (2) the needed time for clearance from customs positively affects the supplying process of the construction materials the weight mean equal " 63.61%" and positive t value and p-value equal " 0.178" which is greater than 0.05, that means the needed time for clearance from customs may not affect the supplying process of the construction materials positively because it is not more than 10 minutes.
3. In item No. (3) the needed time for new construction materials vendor to be cleared (ready to work) effect positively the supplying process of the construction materials the weight mean equal " 59.76%" and negative t value and p-value equal " 0.931" which is greater than 0.05, that means the needed time for new construction materials vendor to be cleared (ready to work) may not effect positively the supplying process of the construction materials.

In general, the results for all items of the field Customs and clearance on construction materials show that the average mean equal 3.22 and the weight mean equal 64.50% which is greater than "60%" and the value of t test equal 1.985 which is less than the critical value which is equal 1.99 and with positive t value and p- value equal 0.051 which is greater than 0.05, that means customs and clearance on construction materials **does not impact** on the efficiency of construction materials supply to Gaza Strip at significance level  $\alpha = 0.05$ . From researcher point of view, the result is logical and suits with result in shipment prices. Traders and suppliers main aim is to supply construction materials neglecting the cost which includes the customs. Otherwise, customs fees and needed time are fixed and known so that no one can reject it, and any delay or extra money will be reflected directly to the final selling price to the beneficiary and the traders may never mind.

All results of one sample t test for the opinions of the respondents about all questionnaire fields shown in Table No. (5.1) which show that the average mean for all sections equal 3.76 and the weight mean equal 75.19 % which is greater than 60% and the average value of t test equal 16.604 which is greater than the critical value which is equal 1.99 and with positive t value and p- value equal 0.000 which is less than 0.05.

**Table (5.1): Evaluation of construction materials supply to Gaza strip**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	Construction materials supplying mechanism	3.43	0.700	68.50	5.532	0.000
2	Allowed quantities of construction materials	4.22	0.499	84.31	22.207	0.000
3	Construction materials demand	4.33	0.454	86.51	26.567	0.000
4	Prices of construction materials shipments	3.82	0.598	76.45	12.529	0.000
5	Crossing border infrastructure	3.72	0.490	74.37	13.356	0.000
6	Customs and clearance on construction materials	3.22	1.032	64.50	1.985	0.051
	<b>All Sections</b>	3.76	0.417	75.19	16.604	0.000

Critical value of t at df "49" and significance level 0.05 equal 2.01

# **Chapter 6**

## **Conclusion and Recommendations**

## Chapter 6

### Conclusion and Recommendations

This chapter concludes the research with recommendations for development of the construction materials supplying into Gaza Strip and may help in future for new researches. The chapter is divided into two sections; the first section provides a conclusion of the whole research while the second section suggests the recommendations.

#### 6.1 Conclusion

Research results can be concluded by comparing the objectives of research with the results as follow:

**Objective:** Study the current practice of construction materials supply into the Gaza Strip.

**Result:** Practice of supplying construction materials into Gaza Strip through Karm Abu Salem crossing border which is the only operating border passes through many steps inside Israeli and Palestinian crossing yards before it comes to its final destination inside Gaza Strip, which costs money and time in addition to the long and hard process of coordination, following and supervision.

**Objective:** Analyzing the used mechanisms of supply construction materials into the Gaza Strip

**Result:** There are two ways to supply construction materials into Gaza Strip, the first one is for projects that implemented by UNRWA and UNDP via Israeli COGAT, and the second is for projects and individuals which are classified beneficiaries on GRM system that supervised by UNOPS.

**Objective:** Determine the factors that impact on the efficiency of construction materials supply into the Gaza Strip.

**Result:** Results of statistical tests on the collected data from the construction materials traders show that the following factors impact on the supply of construction materials into Gaza Strip:

- Construction materials supplying mechanism.
- Allowed quantities of construction materials.

- Construction materials demand.
- Prices of construction materials shipments.
- Crossing border infrastructure.

And the results also show that the custom and clearance does not impact on the supply of construction materials.

The solutions that can help in improving the weaknesses of the current practice of supplying construction materials into the Gaza Strip will be mentioned on the recommendations.

## **6.2 Recommendations**

Recommendations for this research may not be easy to be accomplish due to the up normal circumstances that the Gaza Strip lives, but it can give priorities to the issues that should be considered first.

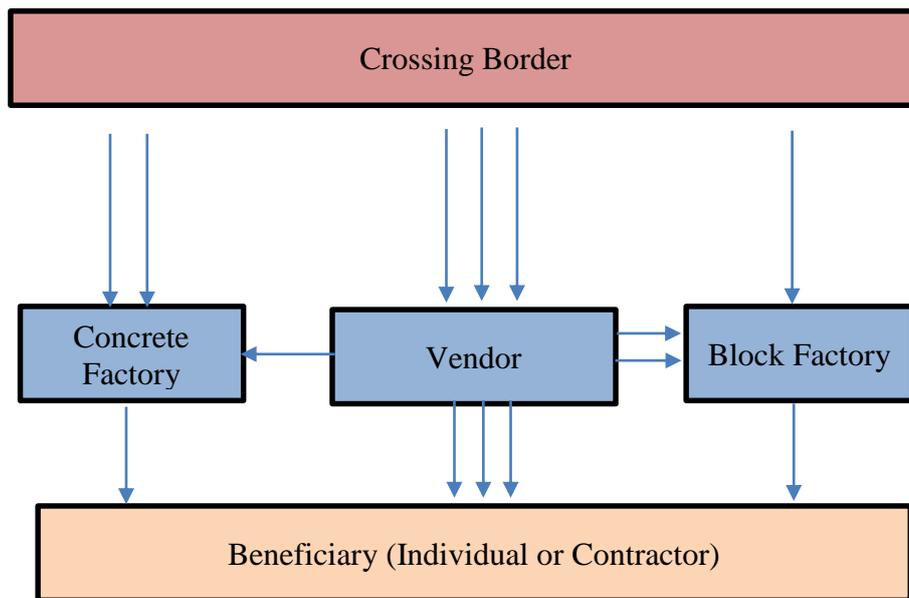
Recommendations for decision makers in the Palestinian national authority:

- 1- Current complex mechanisms that allow the supply of construction materials into Gaza Strip and the long steps on the crossing borders should be changed or be easier.
- 2- Planning and asking for opening new crossing border for construction materials in a suitable location with easy mechanism and special equipment's for construction materials such as Karni crossing border which was the most suitable crossing border for construction materials as mentioned on Al Raai (2005) study. This will lead to increase in the capacity of the supplied construction materials.
- 3- Working on increasing the allowed quantities of the construction materials to ensure that they use the crossing border with its maximum capacity.
- 4- Paying attention to crossing border working hours which should be expanded. This will increase the capacity of the crossing border to be able to cover the up normal high demand without high cost investment, because new investment may be useless after covering the high demand that appears from previous wars.

Recommendations for construction materials supervisor:

- 1- Increasing the limit of the inventory for the vendors that work under the current mechanism, so that they can keep materials on their warehouses to face any closer or holydays.
- 2- Construction Materials Supervisors should modify the relationships between the stakeholders in the used mechanism. Importing construction materials from crossing border should only be for traders of construction materials, contractors or block makers should not take place of the traders. Aggregates and bulk cement can be imported from concrete factories directly. And big block factories that have bulk cement silos may also import the bulk cement directly from the border.

Vendors can sell aggregate, bagged cement or steel bar to beneficiaries, (individual or contractors) but in a limited quantity based on their actual and calculated needs according to their project, for example the beneficiary will not be able to buy all of the allocated cement for his project as bagged cement, because the bagged cement will be used only for finishing works, but the large amount of cement and aggregates will be consumed from the concrete factory as concrete. Aggregate can be sold from vendor to either concrete factory or block factory. Bagged cement should be allowed for each project for the finishing works only, while concrete works should be consuming aggregate and bulk cement through the concrete factory not the vendor. Modifying the relationship between the stakeholders as mentioned above will make the construction goes faster because this will prevent the black market by not giving the materials to the beneficiaries as raw material which can be sold on the black market. The proposed relationship gave the materials to the beneficiaries as concrete or hollow block, while the steel bars cannot be used without concrete. Reverse transactions between stakeholders should be monitored before approval to avoid any conflict. Figure (6.1) shows illustration of the proposed relationship between GRM stakeholders.



**Figure (6.1): Illustration for Proposed Relationship Between GRM Stakeholders**

Future researchers can implement researcher on construction materials and its supply into Gaza Strip specially detailed studies on the flow of the materials inside Karm Abu Salem crossing border by making simulation models which may help in eliminate the wasted waiting time, and helping to use the available resources with its optimal efficiency. New alternative supplying mechanisms can be considered from future researcher to fit with the situation with Gaza Strip, considering a suitable location of new crossing border.

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# Appendices

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

### **Evaluation of Construction Materials Supply into the Gaza Strip**

#### **Problem Statement**

As there is a need for huge quantities of construction materials in the Gaza Strip, the main question of the study is:

- What is the efficiency of construction materials supply into the Gaza Strip through Karm Abu Salem Crossing Border?

The study will also answer the following secondary questions:

1. What is the impact of the used mechanism on the efficiency of construction materials supply into the Gaza Strip?
2. What is the impact of the allowed quantities of construction materials on the efficiency of construction materials supply into the Gaza Strip?
3. What is the impact of construction materials demand on the efficiency of construction materials supply into the Gaza Strip?
4. What is the impact of construction materials shipments' price on the efficiency of construction materials supply into the Gaza Strip?
5. What is the impact of the crossing border's infrastructure on the efficiency of construction materials supply into the Gaza Strip?
6. What is the impact of customs and clearance on construction materials on the efficiency of construction materials supply into the Gaza Strip?

#### **Research Objective**

The main objective of this research is to evaluate the efficiency of the supply of construction materials into the Gaza Strip through Karm Abu Salem Crossing Border. In addition, this research is carried out for several sub objectives; to:

1. Review the current practice of construction materials supply into the Gaza Strip.
2. Determine the impact of the used mechanism on the efficiency of construction materials supply into the Gaza Strip.
3. Determine the impact of the quantities of the allowed materials on the efficiency of construction materials supply into the Gaza Strip.
4. Determine the impact of construction materials demand on the efficiency of construction materials supply into the Gaza Strip.
5. Determine the impact of construction materials shipments price on the efficiency of construction materials supply into the Gaza Strip.

6. Determine the impact of the crossing border's infrastructure on the efficiency of construction materials supply into the Gaza Strip.
7. Determine the impact of customs and clearance on construction materials on the efficiency of construction materials supply into the Gaza Strip.
8. Provide recommendations that can help improve the supply of construction materials into the Gaza Strip.

### General Information

#### Company “Vendor” Information

<b>Name</b>					
<b>Years of Experience</b>			< 2 Y	3 – 6 Y	> 7 Y
<b>Governorate</b>	The North	Gaza	The Middle	Khanyounes	Rafah
<b>Status</b>	Active		Suspended		
<b>Reason of Suspension</b>					

#### Information of questionnaire respondents

<b>Gender</b>	<b>Male</b>		<b>Female</b>		
<b>Age</b>	< 30 Y		31 – 50 Y		>51 Y
<b>Education</b>	High School	Diploma	Bachelor	Postgraduate	
<b>Position</b>	Accountant	Manager	Partner	Owner	

Please read the following and mark X beside the sentence that matches your degree of acceptance:

**First variable: Construction materials supplying mechanism:**

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	Ease of creating new materials requisitions based on the current mechanism.					
2	Limited creation of new materials requisitions with a specified minimum inventory makes the supplying process easier.					
3	Limited creation of new materials requisitions with a specified maximum inventory makes the supplying process easier.					
4	Specifying the beneficiaries of construction materials makes the supplying process faster.					
5	The current mechanism is suitable and every beneficiary can receive his/her needed materials.					
6	The relationship between stake holders (Vendors, Patching Plants, Block Makers and beneficiaries) helps in the supplying process.					
7	The needed approvals for new materials requisitions are easy.					
8	The current supplying mechanism requirements are not expensive due to their use in the work.					
9	Using the internet and computer applications facilitates work and materials' requisitions.					
10	Using the internet and computer applications facilitates sales and inventory management.					
11	There is a clear set of requirements for traders to work by the current mechanism.					
12	There is a known entity to which traders can submit their request, to be able to work by the current mechanism.					
13	The monitoring team deals with the vendors in a good way.					
14	The monitoring team answers all vendors' questions.					

**Second variable:** Allowed quantities of construction materials

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	The increase in the number of trucks allowed to enter in daily basis positively affects the supply of construction materials.					
2	There is a relation between supplying primary and secondary construction materials.					
3	The number of allowed trucks per day is affected by the political situation.					
4	The supply of the construction materials is affected by the availability of materials.					
5	The number of allowed trucks per day is affected by the border's working hours.					
6	The number of allowed trucks per day is affected by Palestinian holydays.					
7	The number of allowed trucks per day is affected by "Israeli" holydays.					
8	The number of allowed trucks per day is affected by the economic situation.					

**Third variable:** Construction materials demand:

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	The demand on construction materials is affected by the normal growth of the population.					
2	The demand on construction materials is affected by the destruction of buildings and infrastructure due to the previous wars.					
3	The closure of the crossing borders increases the demand of the construction materials.					
4	The demand on the construction materials is affected by the seasons of the year which in turn affect the building activity.					
5	The demand on construction materials is affected by the economic situation.					

**Fourth variable:** Prices of construction materials shipments

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	The increase in shipment prices affects the supply of construction materials.					
2	Shipment prices affect the price of construction materials in the normal market.					
3	Shipment prices affect the price of construction materials in the black market.					
4	The increase in shipment prices affect the demand on construction materials.					

**Fifth variable:** Crossing border infrastructure

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	The available infrastructure of Karm Abu Salem Crossing Border affects the supply of construction materials positively.					
2	The development of the infrastructure of Karm Abu Salem Crossing Border will positively affect the supplying of the construction materials.					
3	Increasing the service rate inside Karm Abu Salem Crossing Border (loading and offloading) will positively affect the supplying of the construction materials.					
4	The number of queues inside Karm Abu Salem Crossing Border affects the supplying of the construction materials.					
5	Loading and offloading warehouses' area affects the supplying of the construction materials.					
6	The location of Karm Abu Salem Crossing Border is suitable for the supplying of the construction materials.					
7	Karm Abu Salem Crossing Border is equipped with special equipment's for aggregates.					

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
8	Karm Abu Salem Crossing Border is equipped with special equipment for steel bars.					
9	Karm Abu Salem Crossing Border is equipped with special equipment for bagged cement.					
10	Karm Abu Salem Crossing Border is equipped with special equipment for bulk cement.					
11	Trucks scaling time positively affects the supplying of the construction materials.					

**Sixth variable:** Customs and clearance on construction materials:

#	Statement	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree
1	The supplying process of construction materials is affected positively by the applied taxes.					
2	The needed time for clearance from customs positively affects the supplying process of the construction materials.					
3	The needed time for new construction materials vendor to be cleared (ready to work) effect positively the supplying process of the construction materials.					

**Appendix (B): List of Reference's Names and Titles**

	<b>Names of References</b>	<b>Titles of References</b>
(1)	Dr. Nafez Barkat	The Islamic University of Gaza
(2)	Dr. Mamon Al Qedra	The Islamic University of Gaza
(3)	Dr. Khaled Al Hallaq	The Islamic University of Gaza
(4)	Dr. Arafat Al Af	The Islamic University of Gaza

### Appendix (C): Information of Questionnaire Respondents

Years of Experience	Frequency	Percentages
Less than 2 years	4	4.8
between (3-6) years	9	10.8
more than or equal 7 years	70	84.3
<b>Total</b>	<b>83</b>	<b>100.0</b>
Governorate	Frequency	Percentages
North	9	10.8
Gaza	37	44.6
Middle	10	12.0
Khanyounes	12	14.5
Rafah	15	18.1
<b>Total</b>	<b>83</b>	<b>100.0</b>
Company Status	Frequency	Percentages
Active	71	85.5
Suspended	12	14.5
<b>Total</b>	<b>83</b>	<b>100.0</b>
Gender	Frequency	Percentages
Male	82	98.8
female	1	1.2
<b>Total</b>	<b>83</b>	<b>100.0</b>
Age	Frequency	Percentages
Less than 30 years	45	54.2
Between 31-50 years	33	39.8
More than 50 years	5	6.0
<b>Total</b>	<b>83</b>	<b>100.0</b>
Education	Frequency	Percentages
High School	7	8.4
Diploma	9	10.8
Bachelor	55	66.3
Position	Frequency	Percentages
Accountant	41	49.4
Manager	16	19.3
Partner	26	31.3
Owner	0	0.0
<b>Total</b>	<b>83</b>	<b>100.0</b>

## Appendix (D): Validity of the Research Results

### Internal Consistency Test

**Table (6.1): The correlation coefficient between each question in the field and the whole field (The first field: Construction materials supplying mechanism)**

No.	Question	Pearson coefficient	p-value
1	Ease of creating new materials requisitions based on the current mechanism.	0.460	0.010
2	Limited creation of new materials requisitions with a specified minimum inventory makes the supplying process easier.	0.561	0.001
3	Limited creation of new materials requisitions with a specified maximum inventory makes the supplying process easier.	0.543	0.002
4	Specifying the beneficiaries of construction materials makes the supplying process faster.	0.536	0.002
5	The current mechanism is suitable and every beneficiary can receive his/her needed materials.	0.485	0.007
6	The relationship between stake-holders (Vendors, Patching Plants, Block Makers and beneficiaries) helps in the supplying process.	0.729	0.000
7	The needed approvals for new materials requisitions are easy.	0.414	0.023
8	The current supplying mechanism requirements are not expensive due to their use in the work.	0.645	0.000
9	Using the internet and computer applications facilitates work and materials' requisitions.	0.785	0.000
10	Using the internet and computer applications facilitates sales and inventory management.	0.566	0.001
11	There is a clear set of requirements for traders to work by the current mechanism.	0.630	0.000
12	There is a known entity to which traders can submit their request, to be able to work by the current mechanism.	0.667	0.000
13	The monitoring team deals with the vendors in a good way.	0.600	0.000
14	The monitoring team answers all vendors' questions.	0.714	0.000

**Table (6.2): The correlation coefficient between each question in the field and the whole field (The second field: Allowed quantities of construction materials)**

No.	question	Pearson coefficient	p-value
1	The increase in the number of trucks allowed to enter in daily basis positively affects the supply of construction materials.	0.386	0.035
2	There is a relation between supplying primary and secondary construction materials.	0.598	0.000
3	The number of allowed trucks per day is affected by the political situation.	0.669	0.000
4	The supply of the construction materials is affected by the availability of materials.	0.745	0.000
5	The number of allowed trucks per day is affected by the border's working hours.	0.645	0.000
6	The number of allowed trucks per day is affected by Palestinian holydays.	0.543	0.002
7	The number of allowed trucks per day is affected by "Israeli" holydays.	0.614	0.000
8	The number of allowed trucks per day is affected by the economic situation.	0.597	0.000

**Table (6.3): The correlation coefficient between each question in the field and the whole field (The third field: Construction materials demand)**

No.	question	Pearson coefficient	p-value
1	The demand on construction materials is affected by the normal growth of the population.	0.583	0.001
2	The demand on construction materials is affected by the destruction of buildings and infrastructure due to previous wars.	0.719	0.000
3	The closure of the crossing borders increases the demand of the construction materials.	0.659	0.000
4	The demand on the construction materials is affected by the seasons of the year which in turn affect the building activity.	0.715	0.000
5	The demand on construction materials is affected by the economic situation.	0.605	0.000

**Table (6.4): The correlation coefficient between each question in the field and the whole field (The fourth field: Prices of construction materials shipments)**

No.	question	Pearson coefficient	p-value
1	The increase in shipment prices affects the supply of construction materials.	0.487	0.006
2	Shipment prices affect the price of construction materials in the normal market.	0.393	0.032
3	Shipment prices affect the price of construction materials in the black market.	0.483	0.007
4	The increase in shipment prices affect the demand on construction materials	0.462	0.010

**Table (6.5): The correlation coefficient between each question in the field and the whole field (The fifth field: Crossing border infrastructure)**

No.	question	Pearson coefficient	p-value
1	The available infrastructure of Karm Abu Salem Crossing Border affects the supply of construction materials positively.	0.745	0.000
2	The development of the infrastructure of Karm Abu Salem Crossing Border will positively affect the supplying of the construction materials.	0.715	0.000
3	Increasing the service rate inside Karm Abu Salem Crossing Border (loading and offloading) will positively affect the supplying of the construction materials.	0.595	0.001
4	The number of queues inside Karm Abu Salem Crossing Border affects the supplying of the construction materials.	0.615	0.000
5	Loading and offloading warehouses' area affects the supplying of the construction materials.	0.433	0.017
6	The location of Karm Abu Salem Crossing Border is suitable for the supplying of the construction materials.	0.644	0.000
7	Karm Abu Salem Crossing Border is equipped with special equipment's for aggregates.	0.485	0.007
8	Karm Abu Salem Crossing Border is equipped with special equipment for steel bars.	0.419	0.021
9	Karm Abu Salem Crossing Border is equipped with special equipment for bagged cement.	0.478	0.008
10	Karm Abu Salem Crossing Border is equipped with special equipment for bulk cement.	0.434	0.016
11	Trucks scaling time positively affects the supplying of the construction materials.	0.681	0.000

**Table (6.6): The correlation coefficient between each question in the field and the whole field (the sixth Scope: Customs and clearance on construction materials)**

No.	question	Pearson coefficient	p-value
1	The supplying process of construction materials is affected positively by the applied taxes.	0.585	0.001
2	The needed time for clearance from customs positively affects the supplying process of the construction materials.	0.699	0.000
3	The needed time for new construction materials vendor to be cleared (ready to work) effect positively the supplying process of the construction materials.	0.661	0.000

**Table (6.7) Structure Validity of the Questionnaire**

<b>No.</b>	<b>Section</b>	<b>Pearson correlation coefficient</b>	<b>p-value</b>
1	Construction materials supplying mechanism	0.792	0.000
2	Allowed quantities of construction materials	0.863	0.000
3	Construction materials demand	0.920	0.000
4	Prices of construction materials shipments	0.608	0.000
5	Crossing border infrastructure	0.716	0.000
6	Customs and clearance on construction materials	0.828	0.000

## Appendix (E) Results of the Reliability of the Research

**Table (6.8) Results of Split-Half Coefficient Method**

No.	Section	person- correlation	Spearman-Brown Coefficient
1	Construction materials supplying mechanism	0.712	0.831
2	Allowed quantities of construction materials	0.735	0.848
3	Construction materials demand	0.753	0.859
4	Prices of construction materials shipments	0.817	0.899
5	Crossing border infrastructure	0.706	0.827
6	Customs and clearance on construction materials	0.742	0.852

**Table (6.9) Results of Cronbach's Alpha Test**

No.	Section	Cronbach's Alpha
1	Construction materials supplying mechanism	0.848
2	Allowed quantities of construction materials	0.861
3	Construction materials demand	0.858
4	Prices of construction materials shipments	0.872
5	Crossing border infrastructure	0.892
6	Customs and clearance on construction materials	0.872
	All items	0.884

## Appendix (F) Results of one sample t test for questionnaire

**Table (6.10): One Sample T Test for The Opinion of the Respondents About Construction Materials Supplying Mechanism**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	Ease of creating new materials requisitions based on the current mechanism.	3.36	1.143	67.23	2.881	0.005
2	Limited creation of new materials requisitions with a specified minimum inventory makes the supplying process easier.	2.87	1.247	57.35	-0.968	0.336
3	Limited creation of new materials requisitions with a specified maximum inventory makes the supplying process easier.	3.23	1.193	64.58	1.749	0.084
4	Specifying the beneficiaries of construction materials makes the supplying process faster.	3.05	1.315	60.96	0.334	0.739
5	The current mechanism is suitable and every beneficiary can receive his/her needed materials.	2.76	1.236	55.18	-1.777	0.079
6	The relationship between stake-holders (Vendors, Patching Plants, Block Makers and beneficiaries) helps in the supplying process.	3.54	1.172	70.84	4.215	0.000
7	The needed approvals for new materials requisitions are easy.	2.57	1.128	51.33	-3.502	0.001
8	The current supplying mechanism requirements are not expensive due to their use in the work.	3.20	1.197	64.10	1.559	0.123
9	Using the internet and computer applications facilitates work and materials' requisitions.	4.36	0.708	87.23	17.508	0.000
10	Using the internet and computer applications facilitates sales and inventory management.	4.41	0.663	88.19	19.363	0.000
11	There is a clear set of requirements for traders to work by the current mechanism.	3.77	1.108	75.42	6.341	0.000
12	There is a known entity to which traders can submit their request, to be able to work by the current mechanism.	3.57	0.952	71.33	5.417	0.000
13	The monitoring team deals with the vendors in a good way.	3.59	1.159	71.81	4.642	0.000
14	The monitoring team answers all vendors' questions.	3.67	1.127	73.49	5.452	0.000
	<b>All items</b>	3.43	0.700	68.50	5.532	0.000

Critical value of t at df "82" and significance level 0.05 equal 1.99

**Table (6.11): One Sample t Test for The Opinion of the Respondents About Allowed Quantities of Construction Materials**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	The increase in the number of trucks allowed to enter in daily basis positively affects the supply of construction materials.	4.60	0.492	92.05	29.649	0.000
2	There is a relation between supplying primary and secondary construction materials.	4.11	0.911	82.17	11.087	0.000
3	The number of allowed trucks per day is affected by the political situation.	4.40	0.604	87.95	21.093	0.000
4	The supply of the construction materials is affected by the availability of materials.	3.88	0.916	77.59	8.748	0.000
5	The number of allowed trucks per day is affected by the border's working hours.	4.16	0.930	83.13	11.327	0.000
6	The number of allowed trucks per day is affected by Palestinian holydays.	4.02	0.883	80.48	10.565	0.000
7	The number of allowed trucks per day is affected by "Israeli" holydays.	4.59	0.663	91.81	21.845	0.000
8	The number of allowed trucks per day is affected by the economic situation.	3.96	1.029	79.28	8.530	0.000
	<b>All items</b>	4.22	0.499	84.31	22.207	0.000

Critical value of t at df "82" and significance level 0.05 equal 1.99

**Table (6.11): One Sample t Test for The Opinion of the Respondents About Construction Materials Demand**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	The demand on construction materials is affected by the normal growth of the population.	4.31	0.697	86.27	17.161	0.000
2	The demand on construction materials is affected by the destruction of buildings and infrastructure due to the previous wars.	4.53	0.721	90.60	19.324	0.000
3	The closure of the crossing borders increases the demand of the construction materials.	4.60	0.604	92.05	24.184	0.000
4	The demand on the construction materials is affected by the seasons of the year which in turn affect the building activity.	4.04	0.756	80.72	12.483	0.000

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
5	The demand on construction materials is affected by the economic situation.	4.14	0.964	82.89	10.813	0.000
	<b>All items</b>	4.33	0.454	86.51	26.567	0.000

Critical value of t at df "82" and significance level 0.05 equal 1.99

**Table (6.12): One Sample t Test for The Opinion of the Respondents About Prices of construction materials shipments**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	The increase in shipment prices affects the supply of construction materials.	3.65	0.889	73.01	6.664	0.000
2	Shipment prices affect the price of construction materials in the normal market.	4.07	0.729	81.45	13.402	0.000
3	Shipment prices affect the price of construction materials in the black market.	3.76	0.970	75.18	7.128	0.000
4	The increase in shipment prices affect the demand on construction materials.	3.81	0.833	76.14	8.827	0.000
	<b>All items</b>	3.82	0.598	76.45	12.529	0.000

Critical value of t at df "82" and significance level 0.05 equal 1.99

**Table (6.13): One Sample t Test for The Opinion of the Respondents About Crossing Border Infrastructure**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	The available infrastructure of Karm Abu Salem Crossing Border affects the supply of construction materials positively.	3.65	1.131	73.01	5.241	0.000
2	The development of the infrastructure of Karm Abu Salem Crossing Border will positively affect the supplying of the construction materials.	4.42	0.607	88.43	21.328	0.000
3	Increasing the service rate inside Karm Abu Salem Crossing Border (loading and offloading) will positively affect the supplying of the construction materials.	4.23	0.721	84.58	15.524	0.000
4	The number of queues inside Karm Abu Salem Crossing Border affects the supplying of the construction materials.	3.54	1.119	70.84	4.416	0.000
5	Loading and offloading warehouses' area affects the supplying of the construction materials.	4.31	0.562	86.27	21.307	0.000

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
6	The location of Karm Abu Salem Crossing Border is suitable for the supplying of the construction materials.	2.84	1.131	56.87	-1.261	0.211
7	Karm Abu Salem Crossing Border is equipped with special equipment's for aggregates.	3.48	0.967	69.64	4.539	0.000
8	Karm Abu Salem Crossing Border is equipped with special equipment for steel bars.	3.42	0.798	68.43	4.813	0.000
9	Karm Abu Salem Crossing Border is equipped with special equipment for bagged cement.	3.76	0.774	75.18	8.929	0.000
10	Karm Abu Salem Crossing Border is equipped with special equipment for bulk cement.	3.86	0.977	77.11	7.977	0.000
11	Trucks scaling time positively affects the supplying of the construction materials.	3.39	1.135	67.71	3.094	0.003
	<b>All items</b>	3.72	0.490	74.37	13.356	0.000

Critical value of t at df "82" and significance level 0.05 equal 1.99.

**Table (6.14): One Sample t Test for The Opinion of the Respondents About Customs and clearance on construction materials**

No.	Items	Mean	standard deviation	Weight mean	t-value	P-value
1	The supplying process of construction materials is affected positively by the applied taxes.	3.51	1.130	70.12	4.079	0.000
2	The needed time for clearance from customs positively affects the supplying process of the construction materials.	3.18	1.211	63.61	1.359	0.178
3	The needed time for new construction materials vendor to be cleared (ready to work) effect positively the supplying process of the construction materials.	2.99	1.264	59.76	-0.087	0.931
	<b>All items</b>	3.22	1.032	64.50	1.985	0.051

Critical value of t at df "82" and significance level 0.05 equal 1.99