The Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance

أثر الحيود السداسي الرشيق على أداء أعمال شركات صناعة الأدوية الأردنية

Prepared by:

William Hanna Al Kunsol

Supervised by:

Dr. Abdel-Aziz Ahmad Sharabati

Thesis Submitted in Partial Fulfillment of the Requirements for Master Degree in Business Administration Department

Management Department - Business Faculty

Middle East University

Amman - Jordan

June 2015

Authorization

I hereby grant Middle East University the authorization and the right to provide copies of my thesis and/or distribute it worldwide, in whole or in part, and/or my abstract, in whole or in part, to Libraries, Institutions and other entities requesting it.

Name: William Hanna Al Kunsol

Signature: 

Date: 2/6/2015

Examination Committee's Decision

This thesis of the student William Hanna Al Kunsol, which studied "The Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance" has been defined, accepted and approved on 02/06/2015.

Committee Members:

No.	Name	Title	Signature
1	Dr. Mohammad Abu Zaid	Chief	
2	Dr. Khalil Al-Hiyari	Member	
3	Dr. Abdel-Aziz Ahmad Sharabati	Member & Supervisors	

Acknowledgement

First of all I would like to thank GOD. This work could not have been finished without His help. I ask him to bless all people who supported me to complete this work.

I am sincerely grateful to my supervisor, Dr. Abdel-Aziz Ahmad Sharabati, whose recommendations, devotion, advocacy, patience, encouragement, and support have led me to achieve this work.

In fact, it would not be possible to complete this work without the kind support and help of many individuals and organizations. So, I would like to extend my sincere thanks to all of them. Specially, I am highly indebted to Ms. Mais Dabain for her valuable information, support, to complete the thesis.

Finally, thanks for the examination committee for devoting much of their valuable time reviewing and discussing the material of the study.

William Hanna AL Kunsol

Dedication

This thesis is dedicated to my precious family; my father Hanna, my mother Lames, my sisters Nour and Rana and my brother Hazim, and my lovely friends who helped me in each and every way it was needed and believe in me, for their endless support throughout my life to reach this stage .

No words can make me express my gratitude and thanks, to each of the above, I extend my deepest appreciation.

William Hanna Al Kunsol

Table of Contents

Contents

List of Tables

List of Models

List of Figures

List of Appendices

The Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance

Prepared by:

William Hanna Al Kunsol

Supervised by:

Dr. Abdel-Aziz Ahmad Sharabati

Abstract

The study aimed of investigating the effect of Lean Six Sigma dimensions on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance, from the perception of the managers at the three management levels (top, medium and low).

Descriptive and analytical method was used. The population is the pharmaceutical manufacturing organizations that are registered in Jordanian Association of Pharmaceutical Manufacturers at 2015. The study surveyed managers working at these organizations which consist of 14 organizations. To reach the purpose of this study, data were collected from 120 out of 300 managers during April-May, 2015, by means of questionnaire. The questionnaire was developed and refined by literature review and panel of referees committee. Statistical techniques such as descriptive statistics, correlation, and multiple regressions were used to test the hypotheses.

The results show that there is an agreement on high implementation of Lean Six Sigma variables among Jordanian Pharmaceutical Manufacturing Organizations, also the relationship between total Lean Six Sigma and Business Performance is very strong, finally all Lean Six Sigma variables have an effect on Business Performance of Jordanian Pharmaceutical Manufacturing Organizations except extra processing and waiting time.

Key Words: Lean Six Sigma, Business Performance, Jordanian Pharmaceutical Manufacturing (JPM) Organizations.

أثر الحيود السداسي الرشيق على أداء أعمال شركات صناعة الأدوية الأردنية

إعداد:

وليم حنا القنصل

إشراف:

الدكتور عبد العزيز الشرباتي

الملخص

هدفت هذه الدراسة إلى قياس أثر الحيود السداسي الرشيق على أداء أعمال شركات صناعة الأدوية الأردنية، من خلال دراسة إدراك المدراء العاملين في المستويات الادارية الثلاثة (العليا، والوسطى، والدنيا).

تعتبر هذه الدراسة وصفية تحليلية. حيث أن مجتمع الدراسة هو شركات صناعة الأدوية الأردنية والتي عددها 14 شركة حسب الجمعية الأردنية لمنتجي الأدوية. كانت وحدة المعاينة المدراء العاملين وعددهم 300 مدير. ولغايات الدراسة تم استخدام الاستبانه التي تم وضعها وتطويرها من خلال مراجعة الدراسات السابقة ولجنة التحكيم حيث تم جمع 120 استبانه خلال الفترة ما بين شهر نيسان وأيار من عام 2015م. استخدمت الدراسة عددا من الأساليب الإحصائية مثل الإحصاء الوصفي وتحليل الارتباط وتحليل الانحدار المتعدد لفحص الفرضيات.

أظهرت النتائج أن هناك اتفاقا على تطبيق متغيرات الحيود السداسي الرشيق، مما يدل على أن هناك اتفاقا على وجود هذه المتغيرات في شركات صناعة الأدوية الأردنية. وأظهرت النتائج أن العلاقة بين متغيرات الحيود السداسي الرشيق ككل وأداء الاعمال هي علاقة قوية جدا. وأخيرا أظهرت النتائج أن جميع متغيرات الحيود السداسي الرشيق لها تأثير على أداء أعمال شركات صناعة الأدوية الأردنية باستثناء العمليات الزائدة والوقت الزائد.

الكلمات المفتاح: الحيود السداسي الرشيق، أداء الأعمال، شركات صناعة الأدوية الأردنية.

Chapter One:

Introduction

1.1. Background:

For a long time, quality has been the human being concern. Over the last few decades, companies experienced dramatic changes in business environment such as increasing consumer awareness of quality, rapid technology transfer, globalization and low cost competition. Therefore, many tools and methods were setup to clarify the quality, beginning from Quality Inspection (QI) to Quality Assurance (QA), and Total Quality Management (TQM) that was developed by Japanese companies. As a result of inability of American companies to rival in global market, American companies initiated Strategic Quality Management (SQM) that was adopted by IBM. In fact, Toyota was the first entity to concern about quality, inventory, low cost, and delivery time to maximize customers' satisfaction Desale and Deodhar (2014:286), so it used the Just in Time (JIT) system for production which initiated by Toyota too then developed to Lean Manufacturing (LM). In the early and mid-1980s, Motorola engineers decided that the traditional quality levels of measuring defects in thousands is not accurate, therefore they developed a system that measures the defects per million called Six Sigma system. Consequently, they saved billions as a result of applying the Six Sigma system. As mentioned above when the organizations used either Lean Production or Six Sigma, they were able to improve and develop their Business Performance. The question is if we combine both system (Lean Production and Six Sigma) together what will be the results? Only very limited authors tackled this point, this study is trying to combine both Lean Production with Six Sigma and study their effect on organizations' Business

Performance. With adding a new element to Lean Six Sigma which is sustainable development and study its value added to the Business Performance.

A few years ago new trend was revealed in which companies tried to merge between Lean Production system and Six Sigma system in which called Lean Six Sigma, where Salah, et. al. (2010:250) stated that since 1986 "The George Group" was the first to integrate Lean with Six Sigma. Chinvigai, et. al. (2010:3) said Lean is a philosophy of continuous improvements while Six Sigma is a way to meet quality by measuring ability of enterprise to produce perfectly. The aim of Lean Six Sigma is maximizing shareholders' value (Laureani and Antony, 2010:688). Moreover Muthukumaran, et. al. (2013:98) said that in 1997 BAE Systems tried to combine Lean Management principles with Six Sigma, the company named their program Lean Sigma Strategy to protect market share in aerospace industry. Dey (2013:4) explained that despite their different roots, Lean and Six Sigma share several fundamental common features including a focus on customer satisfaction, continuous improvement, identification of root causes, and comprehensive employee involvement. Jovanovic, et. al. (2013:237) stated using Lean Six Sigma approaches in health care processes is rather a new area for research which it was found very useful for improving health care processes by researchers and practitioners. Muhareb and Graham-Jones (2014:1) stated as a managerial process of continues improvement, Lean Six Sigma considered a process that can improve products continuously in order to achieve high product quality, competitive costs and reduced delivery times, that leads to customers' satisfaction.

The aim of any business is to be profitable and successful but according to global standards and criteria that should be taking sustainable development as a critical standard in any business to maintain the planet and resources for the future generation, from this point sustainable development should be added to Lean

Production, Six Sigma and Lean Six Sigma elements as it is balancing among people, planet and profit (Leonard and Schneider 2014:120-121). Furthermore, Hai and Mai (2014) concluded that there is a relationship between Lean production and Corporate Social Responsibility, where the company might increase its efficiency and minimize environmental effects at the same time.

Therefore, it seems that it is a worthwhile to combine both systems and study their effect on organizations' business performance, so this study will investigate the effect of the combination of both systems on Jordanian Pharmaceutical Manufacturing Organizations' (JPMO) Business Performance.

1.2. Problem Statement

Measuring and managing Business Performance is a worldwide concern; actually it is not limited to organization, industry or country. Yeh, et. al. (2011) said applying Lean Six Sigma improve organizations' processes. Soare (2012:193) stated quality and research within Continuous Improvement displayed a particular interest in recent years. Abu-Hameeda (2013:19) noted that due to the high pressure that the production companies including the pharmaceutical ones faced, and because the Jordanian market now is open for any pharmaceutical products, these companies forced to use the a quality system including Lean Six Sigma to produce a high quality goods that increase customers' satisfaction that can lead these organization to achieve the sustainability and the succeed in the markets. Junankar, et. al. (2014:131) cleared that pharmaceutical industry has to face many major challenges in order to provide best performance. Koripadu and Subbaiah (2014:91) explained how Lean and Six Sigma systems can be successfully used for taking a proactive problem solving management steps with higher profits along with better efficiency and effectiveness.

Therefore the purpose of this research is to investigate the effect of Lean Six Sigma elements on Jordanian Pharmaceutical Manufacturing Organizations' (JPMO) Business Performance.

Problem Questions:

The study problem can be perceived by having detailed and scientific answers to the following questions:

The main question:

1. Do Lean Six Sigma elements (defect, over production, waiting time, transportation, inventory, motion, extra processing, non-utilized talent and sustainability development) affect the Jordanian Pharmaceutical Manufacturing Organizations' business performance?

According to Lean Six Sigma elements the main question can be divided into the following sub-questions:

1.1. Does defect affect the JPMOs' business performance?

1.2. Does over production affect the JPMOs' business performance?

1.3. Does waiting time affect the JPMOs' business performance?

1.4. Does non-utilized talent affect the JPMOs' business performance?

1.5. Does transportation affect the JPMOs' business performance?

1.6. Does inventory affect the JPMOs' business performance?

1.7. Does motion affect the JPMOs' business performance?

1.8. Does extra processing affect the JPMOs' business performance?

1.9. Does sustainability development affect the JPMOs' business performance?

1.3. Study Purpose and Objectives:

This study investigates the effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations (JPMOs') Business Performance. Therefore, the current study aimed to find the effect of Lean Six Sigma elements (defect, over production, waiting time, transportation, inventory, motion, extra processing, non-utilized talent and sustainability development) on JPMO' Business Performance. The main objective of this research is to provide sound recommendations to pharmaceutical organizations, as well as, to other industries and decision makers regarding the influence of Lean Six Sigma indicators on organizations' Business Performance.

1.4. Study Importance:

The current study might be considered as initiative that presents the effect of Lean Six Sigma on Jordanian Pharmaceutical Manufacturing Organizations. A better understanding of the effect of Lean Six Sigma elements on the JPMOs' business performance draws conclusions that can be beneficial not only for JPMOs but also to other organizations, institutions and decision makers. The content also may be of an interest to academic studies related to the reporting and decision making concerning Lean Six Sigma.

Therefore the importance of this study comes from the following scientific and practical considerations:

1. Highlight on the importance of Lean Six Sigma (LSS) and its applications on the Jordanian Pharmaceutical Manufacturing Organizations (JPMO) and its importance in achieving high performance levels that contributes to the achievement of the long run goals.

2. Contribute to the development of the Jordanian Pharmaceutical Manufacturing Organizations (JPMO) which may lead to maintain these organizations work effectively that help on the public benefit.

3. Help other researches to talk about Lean Six sigma, and its importance either on the same industry or for other industries.

4. Help the decision makers to gain the benefits of applying Lean Six Sigma, and give recommendation of using Lean Six Sigma.

1.5. Study Hypotheses:

Based on the above-mentioned problem statement and its elements, and according to the study model, the following hypothesis can be developed:

H_0: Lean Six Sigma elements do not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

The main hypothesis can be divided into nine sub-hypotheses according to the Lean Six Sigma elements (variables) as follows:

$H_{0.1}$: Defect does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.2}$: Over production does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.3}$: Waiting time does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.4}$: Transportation does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.5}$: Inventory does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.6}$: Motion does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.7}$: Extra processing does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

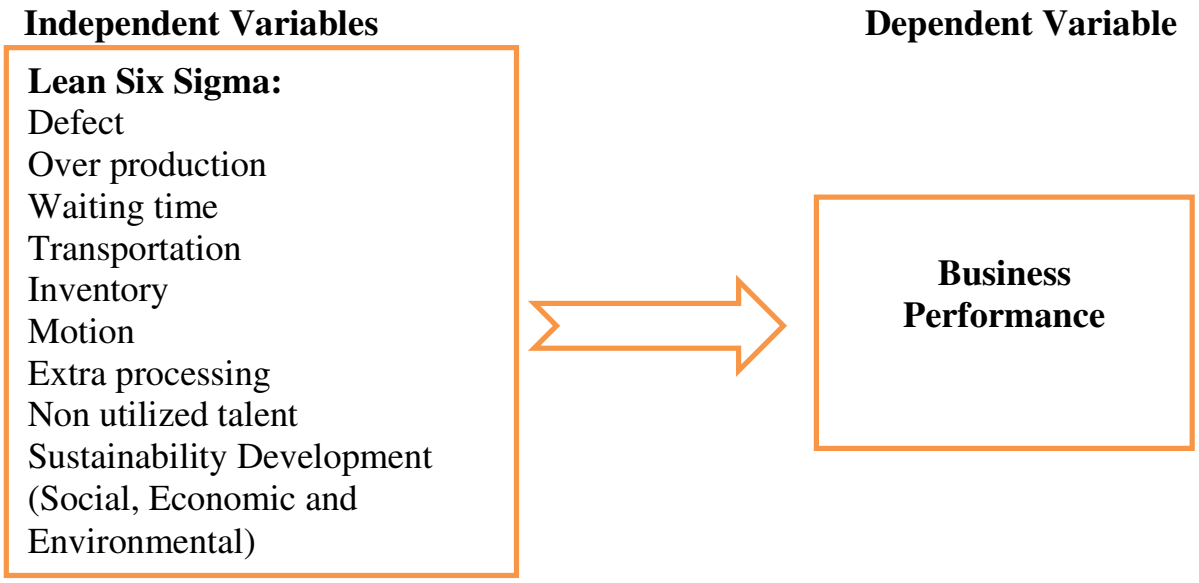
$H_{0.8}$: Non-utilized talent does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

$H_{0.9}$: Sustainability development does not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

1.6. Study Model:

The current research studies the effect of Lean Six Sigma elements on Jordanian Pharmaceutical Manufacturing Organizations' Business Performance, as shown in the study model(1):

Model (1): Study Model



Source: From the researcher based on many studies such as: (Olsen, 2004; Habidin, et. al., 2012; Zamri, et. al., 2013; Agus and Iteng, 2013; Dahman 2013)

1.7. Conceptual and Procedural Definitions of Variables:

Lean Manufacturing: Means creating more value for customers with fewer resources, therefore Lean's idea is to maximize customer value while minimizing waste.

Six Sigma: Set of techniques and tools for process improvement, which is a statistical tool that measures variation in process around its mean.

Lean Six Sigma: Process improvement program that combines two ideas Lean Production and Six Sigma, relies on a combined team effort to increase performance by systematically eliminating waste.

Defect: Villa (2010:340) defined it "work that contains errors, or lacks something necessary". A faultiness that harms worth or utility, out of specification that require resources to correct, it will be measured by asking about the effort in inspecting and fixing defects.

Over Production: Villa (2010:340) cleared it "making more or faster than is required by the next process". Producing too much than need or demand that leads to lower prices and/or unsold goods along with the possibility of not using, it will be measured by asking about the producing numbers of goods more than needed.

Waiting Time: Villa (2010:340) expressed it an "idle time created when material, information, people, or equipment is not ready". An idle time, where an employee is unable to work because of influences he has no control over, it will be measured by asking the long of waiting extra time for next process.

Non Utilized Talent: Villa (2010:340) stated that it is the "waste of not leveraging people's full talents and capabilities". Not using people's competencies, creative skill abilities

Transportation: Villa (2010:340) explained it as it is the "movement of patients and materials that adds no value". Transporting items or information that is not required to perform the process from one location to another, it will be measured by asking movement of products and people that are not required.

Inventory: Villa (2010:340) defined it by saying that it is "any supply in excess of what is required". Product or information that is sitting idle, it will be measured by asking about work in process that doesn't being processed.

Motion: Villa (2010:340) stated that it is the "movement of people that does not add value to the product or service". People, information or equipment making unnecessary movements that add no value to the products, will be measured by asking about the people that move more than needed.

Extra Processing: Villa (2010:340) detailed it an "additional effort that adds no value to the product or service from the customer's viewpoint". Effort that adds no value to the products, it will be measured by asking about bad product design quality.

Sustainability Development: The Brundtland commission (World Commission on Environment and Development 1987:8) clarified sustainability as: "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Leonard and Schneider (2014:120-121) gave a simple definition for sustainable development as it is the balancing the economic, social and environmental system.

Business Performance: Percentage of actual performance compared to goals, set of management and critical procedures that allows the management of an organization's performance to accomplish one or more preselected goals.

1.8. Study Limitations:

Human Limitation: This study will be carried on managers working at Jordanian Pharmaceutical Manufacturing Organizations.

Place Limitation: This study will be carried on Jordanian Pharmaceutical Manufacturing Organizations located in Jordan.

Time Limitation: This study will be carried out within the period between 1st semester and 2nd semester of academic year 2014/2015.

Study Delimitation: The use of one industry limits its generalizability to other industries. The study was carried out in Jordan; therefore, generalizing results of one industry and/or Jordanian setting to other industries and/or countries may be questionable. Extending the analyses to other industries and countries represent future research opportunities, which can be done by further testing with larger samples within same industry, and including other industries will help mitigate the issue of generalizing conclusions on other organizations and industries. Moreover, further empirical researches involving data collection over diverse countries especially Arab countries are needed.

Limitations to data access refer to the fact that data gathering through the questionnaires and annual reports is controlled to the period of these questionnaires, which may limit the quality and quantity of the data collected. And lack of similar studies in Jordan and other Arab countries.

Chapter Two:

Conceptual and Theoretical Framework and Previous Studies

2. Conceptual and Theoretical Framework:

This chapter deals with the conceptual and theoretical framework of Lean Six Sigma and Business Performance. It starts with reviewing different definitions of each element. Then, the constituents of each element, after that the chapter highlights the Business Performance indicators and measurements, followed by the relationship between Lean Six Sigma and organizations' Business Performance, previous models and finally previous studies.

2.1. Definitions of Variables:

It seems that there is no clear cut definition for Lean Production or Six Sigma, and there is no agreement upon the constituents neither for Lean Production nor Six Sigma. Lean Production concerns about eliminating waste, while Six Sigma is measuring tool to improve processes and performance. Merging both methods together may be more useful than using anyone lonely.

2.1.1. Lean Manufacturing:

Many authors defined Lean Production but the main common thing between all of them was that Lean tries to minimize waste, as Cavallini (2008:13) noted that lean production is an administration philosophy dedicated on the decreasing of the eight wastes. Villa (2010:340) said that Lean Manufacturing is a very powerful tool in defining and reducing waste. Ngo (2010:25) mentioned that Lean Manufacturing focusing on solving problems and making changes and it gains acceptance with businesses of all sizes and markets. Soare (2012:196) defined Lean

as a basic, essential philosophy which sets out how to make processes properly. Enoch (2013:575-576) stated that despite that Lean Manufacturing (LM) and Six Sigma Methodology (SSM) are separate systems but they have common goals and end results. The merging of Lean Manufacturing and Six Sigma Methodology into a batch gave birth to single methodology referred to as Lean Six Sigma which yields maximum result. Mousa (2013:1140) mentioned two points considered as weak in lean system the first is "the lean organization may become very susceptible to the impact of changes, and the second point that "JIT deliveries cause congestion in the supply chain, leading to delays, pollution, shortage of workers, etc." Antunes, et. al. (2013:2) said the goal of Lean Management is to improve the performance of industrial organizations by following two guidelines: the elimination of all waste present in all processes of an organization and placement of humans in the center of the process, taking advantage of their capacities at all levels. Kumar and Kumar (2013:560) pronounced that in this millennium the competition in the world market is no longer among companies but among global supply chains

Desale and Deodhar (2014:286) said: Taiici Ohno who developed the Lean Manufacturing system as a method of eliminating waste moved the attention of researchers focus away from the effect of workers' productivity on craft production towards a more encompassing production system as a whole.

In summary Lean Manufacturing can be defined as a continuous improvement tool used to eliminate wastes which can lead to have better performance results and creating more value for customers with fewer resources, therefore Lean's idea is to maximize customer value while minimizing waste.

2.1.2. Six Sigm:

Six Sigma has been tackled from different perspectives such as Divoky (2008:13) who stated that Six Sigma term was presented in the 1980"s by Motorola in a revolutionary effort to decrease defects to the level of only a few parts per million. Pulakanam and Voges (2010:149) said: Six Sigma system gained huge reputation after its adoption by General Electric in the mid-1990s. Varzandeh and Kamy (2010:511) who defined Six Sigma as a methodology that combine quality elements and enhances its own special approach to business and supply chain environment. Tahir (2010:101) said that the voice of customer is the main key to start a quality process. Radhakrishnan and Sivakumaran (2010:1) stated that "Six Sigma is a tool used to convert management problem into a statistical problem and to find a statistical solution then convert it to a management solution". Mandahawi, et. al. (2010:95) mentioned that Six Sigma system is essentially used to develop the performance of an existing process and reduce its variation to reach the final goal which is the customer satisfaction. Pokharkar, et. al. (2010:1161) stated that Six Sigma has three main elements: process improvement, Process design/re-design and process management. Dileep and Rau (2010:27) stated that Six Sigma is about results, increasing profitability through improved quality and efficiency, this desired results accomplished through the use of two Six Sigma methodologies: DMAIC (Define, Measure, Analyze, Improve, Control) and DMADV (Define, Measure, Analyze, Design, Verify). Weinstein (2010:572) stated that Six Sigma is a business development approach used to eliminate waste, increase profitability, to reduce costs linked with humble quality, and to improve the efficiency and effectiveness of operations.

Jaglan, et. al. (2011:461) pronounced Six Sigma system is a powerful tool that enables companies to use simple but powerful statistical methods to meet

changing in customers' expectations that help them to sustain in the market. Radhakrishnan and Balamurugan (2011:639) mentioned despite that it was introduced in 1980 by engineer M. Harry at Motorola AlSagheer (2011:13) stated that Six Sigma is a multidimensional method for developing process efficiency and attaining sustainability. Goh (2011:2) defined Six Sigma as a quality improvement structure that has been identified in industry for more than a quarter of a century. Yusr, et. al. (2011:1237-1238) defined Six Sigma as systematic system with extremely disciplined to increase market share, profitability, customer satisfaction by using statistical tools that can lead to a high performance. Kaushik (2012:53) and Micu (2012:505) clarified that letter Sigma (σ) is a Greek alphabet that has converted to a statistical symbol, which is used to define standard deviation. Vijay (2012:1) defined Six Sigma as an operational method that speeds up the progresses in the business system by several statistical features by getting the right projects led in the right way. Zhang, et. al. (2013:184) stated Six Sigma is a continuous improvement system depends on statistical tools to cut the process variability leading to nearly zero defect. Ahmad (2013:346) said that Six Sigma is a philosophy to continuously decrease variation in processes and aim at the removal of defects from every service, product and transactional process. Kosina (2013:17) defined it as a robust continuous improvement approach that depends on statistical ways. Reosekar and Pohekar (2013:147) mentioned that Six Sigma is an improvement strategy that yields dramatic reduction in defects or errors or mistakes in any process. Kabir, et. al. (2013:1045) said that Six-Sigma is a management philosophy dedicated on rejecting mistakes, rework and waste. Sharma, et. al. (2013:365) mentioned that since its development at Motorola in the 1980s, many firms including GE, Sony, Honeywell, Caterpillar, and Johnson Controls have applied Six Sigma and obtained substantial benefits, Six Sigma is a long-term program. It won't work well without full commitment from higher

management. Jayaraman, et. al (2013:228) ensured that Six Sigma is an active approach to improve the organization's performance. Baveja and Jain (2013:48) showed the Six Sigma's features that differentiate it from previous quality improvement from previous quality tools, the features include: a clear attention on reaching quantifiable and measurable financial earnings, an improved highlighting on strong and passionate management support and leadership, a special structure of "Champions," "Master Black Belts," etc. Dhawan (2013:546) described Six Sigma as a new quality management strategy which is seen as a scientific, systematic, statistical and smoother method to management innovation.

Khandekar and Sulakhe (2014:52) explained further that Six Sigma is a statistical measure that measures variation in process around its mean. Mutia, et.al (2014:125) defined Six Sigma as a statistical term that measures process in terms of defects, it shows defects in the outputs of a process and comforts one to know how far the processes differ from perfection. Maleki, et. al. (2013) defined Six Sigma as a regular strategy to eliminate the errors, wastes, to understand the needs of the clients and quality problems in order to improve processes. Aleem, et. al. (2014:95) ensured in their study that Six Sigma emphases on the following: "business success can be achieved through continuous effort to reduce variation in process outputs, business processes can be measured, analyzed, improved and controlled, and finally role of higher management is very precarious in order to achieve best Quality Improvement results".

In summary Six Sigma is a statistical system used to reduce of unwanted variations which led to better performance.

2.1.3. Lean Six Sigm:

A few years ago new trend was revealed in which companies tried to merge between Lean Manufacturing system and Six Sigma system in which called Lean

Six Sigma, where Hajikordestani (2007:18) defined Lean Six Sigma as the reduction of waste in a system that is producing three or four errors per million opportunities. Cavallini (2008:13) mentioned that Lean Six Sigma is a business upgrading structure that integrates Six Sigma methodology with the cost saving benefits of Lean production. While Laureani and Antony(2010:688) defined Lean Six Sigma as a business improvement system that purposes to maximize shareholders' value by improving quality, speed, customer satisfaction and costs: it achieves this through merging tools and principles of both systems: Lean and Six Sigma. Stoiljkovi, et. al. (2011:347) stated both tools are improvement tools, but one should focus more on those that are more relevant, if wastes need to be reduced or productivity needs to be increased, then focus on Lean, and if product variation needs to be measured, then Six Sigma must be applied. Lancaster (2011:7) mentioned that lean system and Six Sigma system has the same method which is trying to eliminate waste, but the main difference that Lean does not need the structure of trained people and leaders to implement.

Zamri, et. al. (2013:98) stated that Lean Six Sigma is a cost decrease mechanism. Arunagiri and Babu (2013:1) defined Lean Six Sigma as a "technique and also an effort that is used to minimize the cost of the process by eliminating the waste in various service sectors". Mezouari, et. al. (2013:862) stated that Lean Six Sigma is a set of statistical methods systematized around a rigorous project management. Muthukumaran, et. al .(2013:99) clarified the advantages of using Lean Six Sigma as follows: focusing on customer value stream, focusing on creating a visual workplace, creating standard work sheets, facing work-in-process inventory, focusing on good housekeeping, process control planning and monitoring, focusing on reducing variation and achieve uniform process outputs, focusing heavily on the application of statistical tools and techniques, employing a

structured, rigorous and well planned problem solving methodology, facing waste due to waiting, over processing, motion, over production, etc. Enoch (2013:575) defined Lean Six Sigma as is a well-structured model based methodology implemented to develop performances, improve effective leadership, and attain customer satisfaction and bottom line results. Muhareb and Graham-Jones (2014:1) considered Lean Six Sigma as a process that improve services or products continuously in order to obtain high product/service quality, competitive costs and eliminate delivery times, leading to customer satisfaction .

In conclusion, Lean Six Sigma is method formed by combining two systems Lean Production and Six Sigma aims to reduce wastes and to develop process efficiency.

2.1.5. Sustainability development:

The awareness of sustainability development or corporate social responsibility as some people call it is not a new term in our life. Concern for society and environment can be tracked to the beginning of time. According to one of the oldest known written documents, the account of Genesis by the biblical writer Moses “The LORD God took the man and put him in the Garden of Eden to work it and take care of it” (Genesis 2, 15), thus implying a balanced approach to using natural resources and exercising responsibility. The Brundtland commission (World Commission on Environment and Development 1987:8) clarified sustainability as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Fontaine (2013) defined corporate social responsibility (CSR) as a mechanism whereby business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms. Hai and Mai (2014:30) explained the term corporate social responsibility which was updated by European Commission

in 2011 as “a process whereby companies integrate social, environmental and ethical issues into their business operations and strategy in close interaction with their stakeholders, going beyond the requirements of applicable legislation and collective agreements”. Leonard and Schneider (2014:120-121) gave a simple definition for sustainable development as it is the balancing the economic, social and environmental system.

2.1.4. Business Performance:

Set of management and critical procedures that allows the management of an organization’s performance to accomplish one or more pre-selected goals. There are many indicators that measure it as Darabi (2007:24) defined number of business performance objectives and subjective measures such as financial or market based measures like capacity utilization, market share, profitability, service quality, customer satisfaction, retention and employees’ satisfaction.

2.2. Element of Variables

In this section the study tried to mention what elements and how other authors and researcher measured Lean Production, Six Sigma, Lean Six Sigma and Business Performance.

2.2.1. Elements of Lean Production:

Some authors and researchers divided the Lean Production into six elements, others to seven and most of them considered eight elements such as Cavallini (2008:13) who identified eight wastes over processing, defects, inventory, motion, waiting time, over production, transportation, and lack of creativity. Awaritoma (2010:44) noted seven wastes as follows; processing, inventory, overproduction, waiting, defects, motion, and transportation. Subramaniyam, et. al. (2011:166) mentioned seven elements of wastes (excess production and early production,

delays, movement and transport, poor process design, inventory, inefficient performance of a process and making defective items). Mezouari, et. al. (2013:862) stated three objectives of Lean Manufacturing: eliminate waste; speed and less resources, and intuitive approach simple problems resolving by using the following tools: added value analysis, value stream mapping, just in time, Kaizen and Work methods standardization. Dey (2013:4) defined seven elements of wastes (overproduction, inventory, defects, transport, motion, over processing and waiting). Desale and Deodhar (2014:286) mentioned six goals of Lean Manufacturing: increase output flexibility, reduce cycle times (productivity improvement), decrease inventories (reduce working capital requirements), benchmark, rise output value through a systematic consideration of customer requirements (develop response time to customer) and reduce the share of non-value-adding actions.

2.2.2. Elements of Six Sigma:

It seems that almost all authors and researchers agreed on six elements of Six Sigma such as: Antony (2009:274) found that companies are using Six Sigma to improve: quality level, customer satisfaction, market share, employees' moral, organizational culture, people development and return on investment. Weinstein (2010:572) stated that Six Sigma is a business development approach used to eliminate waste, increase profitability, to reduce costs linked with humble quality, and to improve the efficiency and effectiveness of operations. DeRuntz and Meier (2010:8) clarified six metrics used to measure Six Sigma results: risk management, revenue growth, retained revenue, increased capacity, cost reduction, and cost avoidance. AlSagheer (2011:11) stated that core purposes of Six Sigma were addressed through themes such as financial achievement, zero defect level and competition. Yusr, et. al. (2011:1237-1238) defined Six Sigma as systematic

system with extremely disciplined to increase market share, profitability, customer satisfaction by using statistical tools that can lead to a high performance. Yuksel (2012:77) clarified the measures for evaluating the Six Sigma programs as follow: avoiding cost drivers, reducing costs, increasing capacity, growing revenues and risk management.

Reosekar and Pohekar (2013:147) mentioned that Six Sigma lead to improve customer satisfaction, increased market share, business profitability. Huang (2013:17) presented six benefits Six Sigma: productivity improvements, cycle time declines, customer relations improvements, market share increases and defect and cost reduction. Mezouari, et. al. (2013:862) stated three objectives for Six Sigma reduce variation, analytical and rational approach, complex problems resolving and quality by using these tools: voice of customer, tools by steps of DMAIC, statistics and control cards. Anuradha, et. al. (2013:259) defined four key areas: driving rapid and sustainable improvement to the business processes, utilizing rigorous data analysis to understand and minimize variation in key processes, understanding and managing customer requirements and aligning key processes to achieve those requirements. Chetiya and Sharma (2014:1751) mentioned seven deliverables: yield Improvement, system improvement, cost improvement, cycle time reduction, quality improvement, customer satisfaction, and defect reduction.

2.2.3. Elements of Lean Six Sigma:

It appears that the authors and researchers did not agree on the elements of Lean Six Sigma yet, where Subramaniyam, et. al. (2011:167) defined five elements (faster time to market, reduction of poor design, reduction of over design, reduction in material cost and reduction in product development cost). While Berty (2011:12) introduced seven types of waste that anyone can face in production process, and he defined the seven types as follows: transport as moving products

not required, inventory as work in process not being processed, motion people moving more than needed, waiting as waiting extra time for next process, over production as producing products more than needed and over processing as bad product design quality and defects as an effort in inspecting and fixing defects. Also Stoiljkovi, et. al. (2011: 349) classified seven wastes in processes as follows: non-value added processing, inventory, overproduction, waiting, defects, movement, and transportation. Arunagiri and Babu (2013:1) mentioned the various types of waste that decrease the efficiency of the systems such as errors and defects, wasted motion, unutilized talent, excess inventory processing and complexity, transportation, delay and wait Time, overproduction. Enoch (2013:576) identified six factors in the success of manufacturing (small and medium-size enterprises) SMEs Lean Six Sigma implementation: strong leadership, management commitment, adequate skilled workforce, awareness and understanding of Lean Six Sigma, Customer satisfaction, and finally financial viability and infrastructure.

A few authors tried to study the effect of sustainable development on organizations' business performance through Lean Production, Six Sigma and Lean Six Sigma, such as Clegg (2007) who stated that there is a strong relationship between six sigma and both economic and social factors. Krambia-Kapardis and Ioannou (2011) concluded that the utilization of the tools available through Six Sigma can prove that Six Sigma can be used to save resources and improve quality and process. Boldt and Franchetti (2013) study aimed to investigate the application and benefits of conducting an assessment for waste reduction, energy reduction, and productivity improvements, where Lean Six Sigma has not been used in the solid waste reduction or environmental protection fields to the extent that it has been applied in manufacturing and in other sectors. Hai and Mai (2014) concluded

that there is relationship between Lean production and Corporate Social Responsibility (CSR), where the company might increase its efficiency and develop working condition and minimize environmental effects at the same time, whereas Lean Production initiatives bring about CSR Interests, mainly in environmental protection and working condition improvement.

The study used nine elements for Lean Six Sigma by adding the sustainable development as a new element as there is a strong relationship between the eight elements of the Lean Six Sigma and the new element depending on the studies above whereas the sustainable development is trying to balance between the economic, environmental and social responsibilities in another term balance people, planet and profit and try to define the relationships between them and their effect on Business Performance.

2.2.5. Elements of Sustainable Development:

It seems that there is a consensus among researchers, scholars and practitioners about the elements of sustainable development as economic, social and environmental responsibility such as Dakov and Novkov (2007:186), Ravet (2012:2), Leonard and Schneider (2014:120-121). However, Fontaine (2013) considered corporate social responsibility (CSR) as monitoring and ensuring its active compliance with the spirit of the law, ethical standards, and international norms. Moreover, Hai and Mai (2014:30) considered it as an integration of social, environmental and ethical issues into their business operations and strategy.

In summary, the current study will consider the most popular definition of sustainable development which consists of the following three dimensions (social, economic and environmental).

Proposed Elements of Lean Six Sigma in the current study:

It has been noticed in the last few years the importance of protecting the environment and the number of people and committees who are calling to preserve the environment/planet is increasing day after day. As the aim of Lean Six Sigma is to eliminate wastes it is important to know how to deal with these wastes in safe manners without harming the society, people, employees, and the environment surround us in another word sustainable development is an important variable that must be added to the elements of Lean Six Sigma as it is very essential and critical to balance between profit, people and planet to maintain the safety of resources and to reduce the pollution for the future generation.

2.2.6. Elements of Business Performance:

There was not any clear definition for Business Performance as well as for its elements where authors and researchers measured it through many perspectives such as: Jaakkola (2006:11) who noted many ways to determine the performance such as financial performance, market performance, customer performance or overall performance. Darabi (2007:24) stated number of business performance objectives and subjective measures like financial or market based measures like capacity utilization, market share, profitability, service quality, customer satisfaction, retention and employees' satisfaction. Sharabati (2008:45) used productivity, profitability and market valuation as elements to measure the business performance. Zu, et. al. (2008:648) in their study measured a firm performance outcome on two broad scales, business performance and quality performance. Quality performance contains seven items such as quality of product, delivery, process variability, cost of scrap and reworks, equipment downtime, customer satisfaction, cycle time. Business performance consists of sale, unit cost of manufacturing, market share, operating income, profit, and return on assets.

Vilas-Boas (2009:78) mentioned three elements for business performance; Return on Assets (ROA), Return on Sales (ROS), and Return on Equity (ROE). Mandahawia, et. al. (2012:103) used two indicators to measure the performance in their study production rate and Overall Equipment Effectiveness (OEE). Agus and Iteng (2013:324) tried to study the effect of Lean Production on the business performance by measuring the impact on return on sales and return on investment. August (2013:4077) tried to study the implementation of Six Sigma on the organization in terms of financial benefits, growth of the company, peoples' equity, customer satisfaction and productivity.

Based on the above mentioned studies, the current study will consider the following elements for each variable: defect, over production, waiting time, non-utilized talents, transportation, inventory, motions, and extra process as independent elements to measure the Lean Six Sigma and the effect of them on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance as the study measured it as one dimension.

The study will measure Business Performance by asking about the productivity, profitability and market share but Business Performance will be analyzed as a one dimension.

2.3. The Relationship between Lean Six Sigma and Business Performance:

Many researchers studied the relationships between Lean Production and Business Performance, as well as between Six Sigma and Business Performance, while very researchers studied the relationships between Lean Six Sigma and Business Performance, for example Olsen (2004) who tried to find the relationship between Lean Manufacturing management practices and the improving of the

financial performance, Parast (2011) in his study tried to investigate the effect of Six Sigma projects on firm innovation and the effect of Six Sigma on firm performance, Habidin, et. al. (2012) in their research analyzed the influence of the relationship between Lean Six Sigma and organizational performance for Malaysian automotive industries using Structural Equation Modeling (SEM), Zamri, et. al. (2013) aimed at analyzing of the relationship between Green Lean Six Sigma (GLSS) and Financial Performance (FP) for Malaysian automotive industries. Agus and Iteng (2013) paper meant to study the significance of incorporating Lean Production in the Malaysian manufacturing industry, while they used Just-In-Time and technology & innovation as elements of the Lean Production to see their effects on the business performance by measuring return on sales and return on investment, the moderating effect of the length of lean adoption.

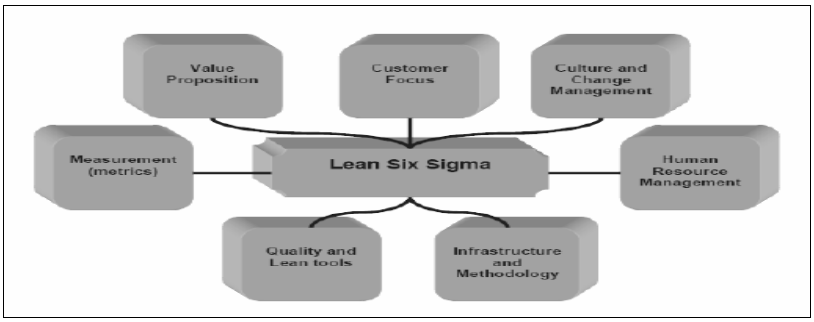
All the studies above found a positive effect of applying Six Sigma, Lean Production and Lean Six Sigma on the performance (financial and non-financial) therefore the study will investigate the effect of applying the Lean Six Sigma elements on the business performance for the Jordan Pharmaceutical Manufacturing Organizations.

2.4. Previous Models:

After reviewing related literature, it has been found that not only the definition and classification of each element was not clear and unified, but measurements, methods and models were not unified as well. Scholars and practitioners have used different methods and models to measure Lean Six Sigma and Business Performance. The following section will briefly discuss the most widely used methods and models to measure Lean Six Sigma and Business performance.

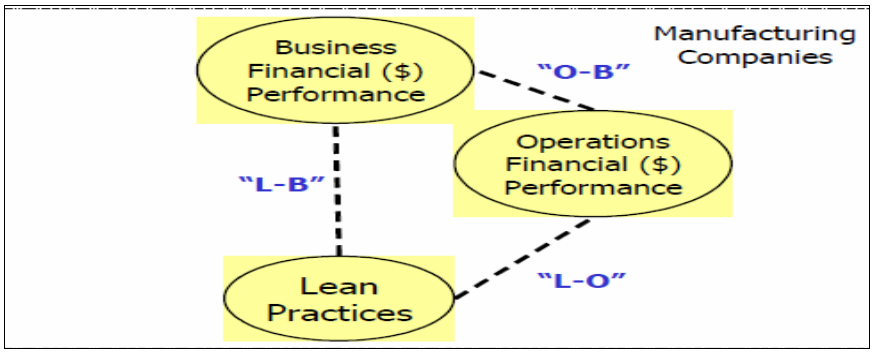
Furterer (2004) Model: A Lean Six Sigma structure settled by Furterer (2004) that was developed based on needs local government to implement those concepts. The majority of the authors framework's elements were mentioned to the Quality Award e.g. Business Excellence Model and Malcolm Baldrige National Quality Award (MBNQA). Thus, the case study of the author research was denoted the application of some of Lean Six Sigma tools to find solutions for the existing problem in the Government agency.

Model (2.1): Furterer (2004) Model



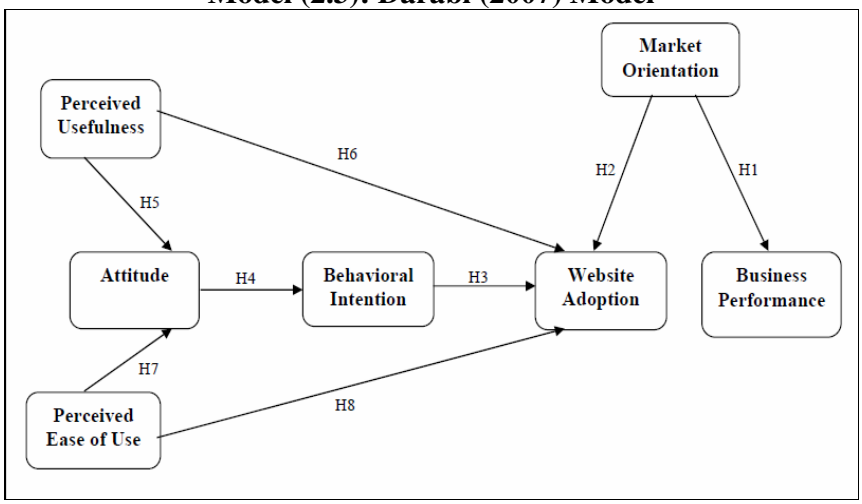
Olsen (2004) Model: Tried to find the relationship between Lean Manufacturing management practices and the improving of the financial performance. The study tests several research schemes; the first to be examined was the relationship between lean practice and either operations financial performance (L-O) or business financial performance (L-B). Next, the relationship between operations and business financial performance is tested (O-B).

Model (2.2): Olsen (2004) Model



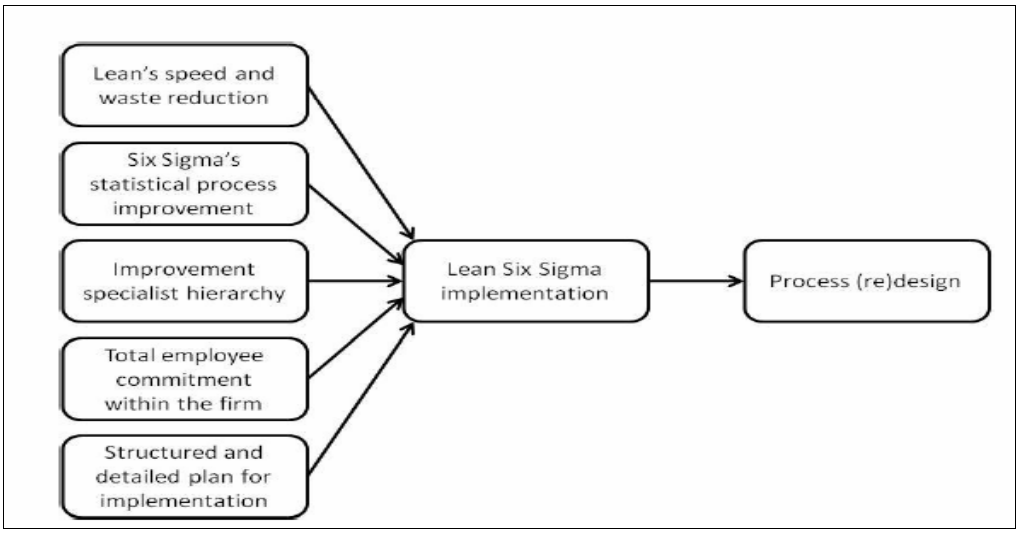
Darabi (2007) Model: Studied the impact of market orientation on Business Performance and website adoption, and built eight hypotheses on her study that can be seen in the figure below.

Model (2.3): Darabi (2007) Model



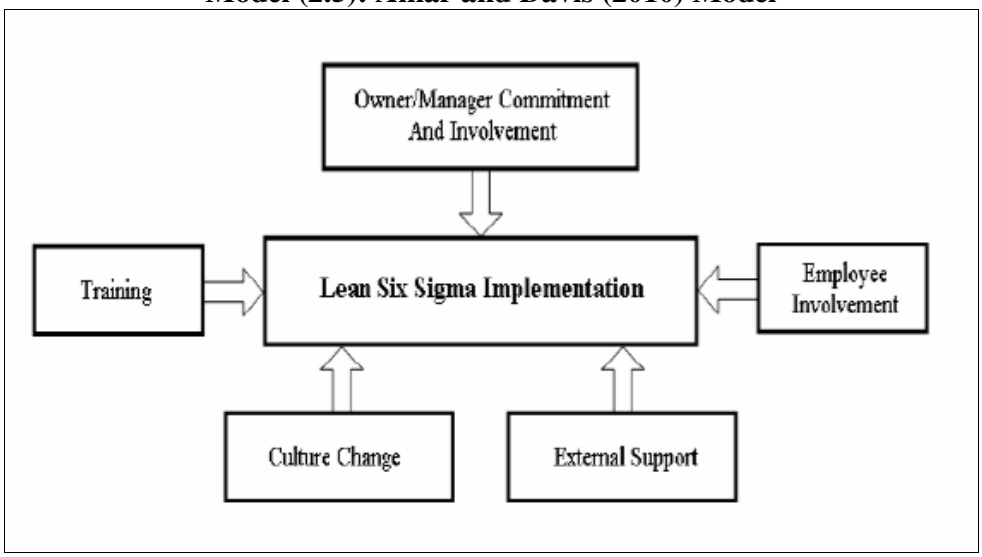
Reijns (2010) Model: Showed in his model that there are a number of independent variables, 'Factors' that were examined throughout the thesis, which influenced the dependent variable 'Process (re)design' through a mediating variable 'Lean Six Sigma implementation'.

Model (2.4): Reijns (2010) Model



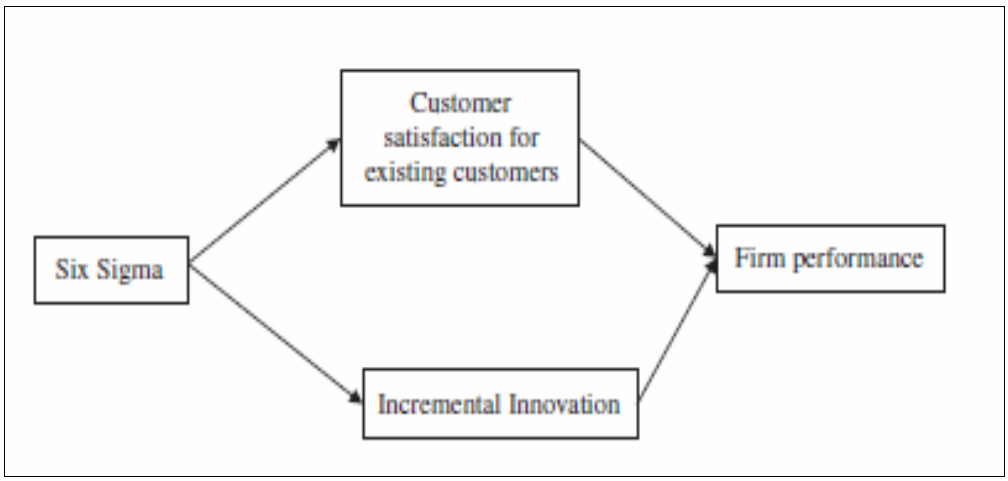
Amar and Davis (2010) Model: Amar and Davis (2010) have developed a Lean Six Sigma model specifically for Indonesian SMEs context that included training, culture change, external support, employee involvement and owner / manager commitment and involvement.

Model (2.5): Amar and Davis (2010) Model



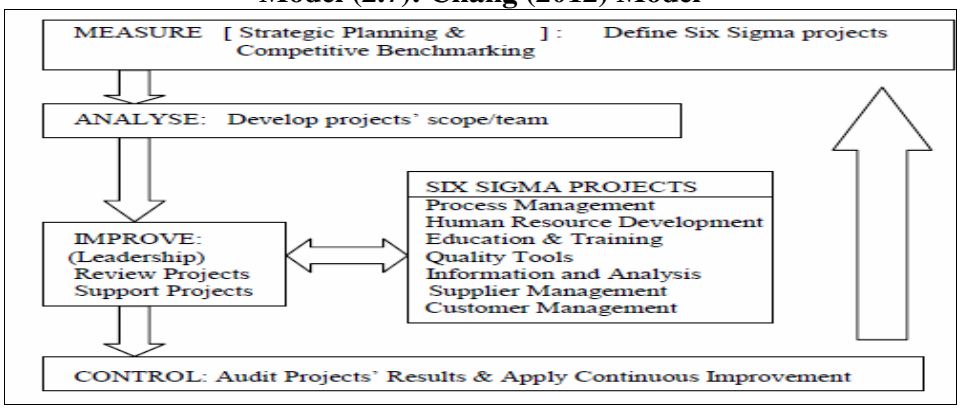
Parast (2011) Model: In his study tried to investigate the effect of Six Sigma projects on firm innovation and the effect of Six Sigma on firm performance.

Model (2.6): Parast (2011) Model



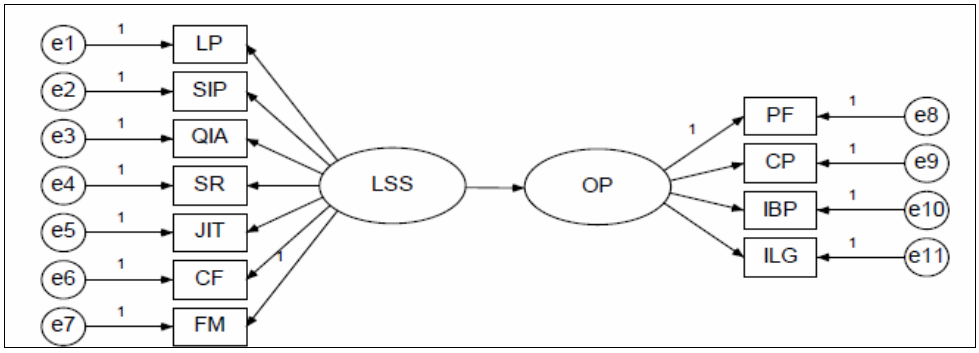
Chang (2012) Model: Developed his model essentially based on MBNQA (Malcolm Baldrige National Quality Award) model which contained Total Quality Management elements like leadership, strategic planning, human resource, process management, education and training, quality tools, customer management, supplier management and information and analysis. He claimed those elements as essential factors for SMEs to apply Six Sigma and assembled them into his framework follow the MAIC (measure - analyze - improve - control) steps.

Model (2.7): Chang (2012) Model



Habidin, et. al. (2012) Model: In their research model meant at analyzing the influence of the relationship between Lean Six Sigma and organizational performance for Malaysian automotive industries using Structural Equation Modeling (SEM).

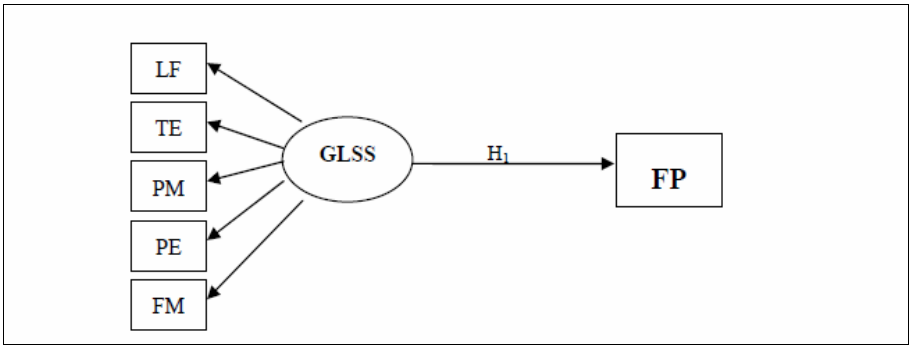
Model (2.8): Habidin, et. al. (2012) Model



LSS= Lean Six Sigma, OP = Organizational Performance OBSERVED VARIABLE: Leadership (LP), structured improvement procedures (SIP), quality information and analysis (QIA), supplier relationship (SR), just-in-time (JIT), customer focus (CF), focus in metric (FM), Financial (FP), customer (CP), internal business process (IBP), and innovation and learning growth (ILG)

Zamri, et. al. (2013) Model: Aimed at analyzing of the relationship between Green Lean Six Sigma (GLSS) and Financial Performance (FP) for Malaysian automotive industries as they considered leadership focus, training and education, project management and focus in metrics as elements of Green Lean Six Sigma.

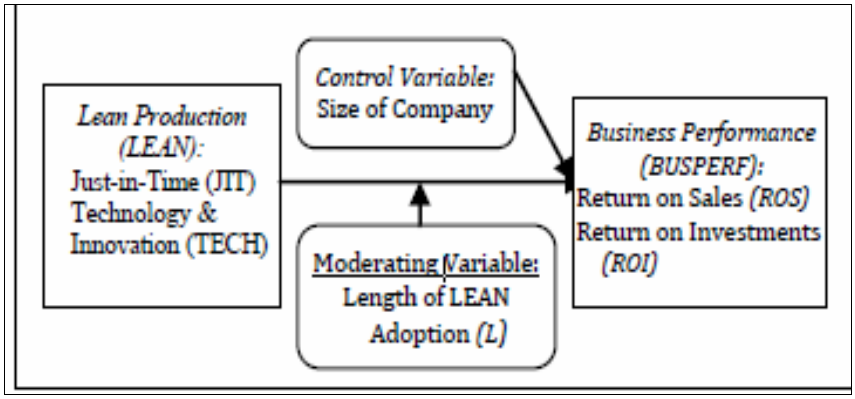
Model (2.9): Zamri, et. al. (2013) Model



GLSS=Green Lean Six Sigma, LF=Leadership Focus, TE=Training and Education, PM=Project Management, FP=Financial Performance, FM= Focus in Metrics.

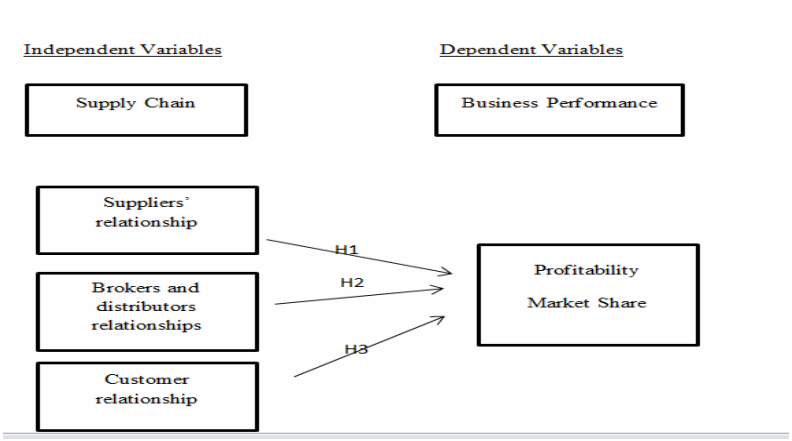
Agus and Iteng (2013) Model: Paper meant to study the significance of incorporating lean production (LEAN) in the Malaysian manufacturing industry, while they used Just-In-Time and technology & innovation as elements of the Lean Production to see their effects on the business performance by measuring return on sales and return on investment, the moderating effect of the length of lean adoption.

Model (2.10): Agus and Iteng (2013) Model



Dahman (2013) Model: In his study aimed to study suppliers' relationship, brokers and distributors relationships and customer relationship as an independent variables and study their effect on business performance by measuring profitability and market share.

Model (2.11): Dahman (2013) Model



2.5. Previous Studies:

Due to limited space the study will take only a snapshot from selected previous studies. The section will focus on interrelationships among Lean Six Sigma (LSS) components, and their effect on business performance.

2. Obaidullah (2005) noticed in his study titled: "**A Study of Six Sigma Implementation and Critical Success Factors**", he studied the implementation of Six Sigma in UK organizations and found that Six Sigma has been applied in both manufacturing and service organizations in UK and it need an average of four to nine month to complete full Six Sigma project, also the percentage of the employees who have been concerned in these projects was 1-20%.

3. Kateeb (2009) study titled: **"The Extent Unplanned Six sigma using impact in Housing bank for trade and finance",** aimed at applying the Six Sigma on Housing Bank for Trade and Finance and notice its effect, the study used the questionnaire as a methodology to collect the data The study sample consists of

(120) employee by random sample working in Housing bank for Trade and Finance and (310) customers. The results showed that there was significant statistical relationship between Six Sigma changes on mistake reduction, significant statistical relationship between Six Sigma on time circle reduction, and many other results.

4. Percin and Kahraman (2010) study titled: "**An Integrated Fuzzy Multi-Criteria Decision-Making Approach for Six Sigma Project Selection**", aimed at providing a good insight into the use of an integrated decision-making methodology in the evaluation of Six Sigma projects. They used three multi-criteria decision-making (MCDM) methods by applying a modified Delphi method, Analytical Hierarchy Process (AHP) and Fuzzy Technique for Order Preference by Similarity to Ideal Solution (FTOPSIS) methodologies. After the evaluation criteria of Six Sigma projects were determined by a Modified Delphi method, the weights of criteria are calculated by applying the AHP method. The FTOPSIS method was then employed to achieve the final ranking results. A real case application along with a sensitivity analysis was presented to show the effectiveness of the proposed methodology.

5. Reddy and Reddy (2010) study titled: "**Process improvement using Six Sigma – a case study in small scale industry**", aimed at process improving using Six Sigma at bearing manufacturing facility located at Hyderabad. They applied the Six Sigma project on improving in the rejection rate of bearing rings. One of the basic aims of Six Sigma is to reduce variation by statistical thinking. Various statistical tools and techniques were employed in this study to improve the operations. The results were that rejection rate of bearing rings has been reduced from 2.7% to 0.65% and sigma level of process increased from 4.04 to 4.44.

6. Moosaa and Sajid (2010) study titled: "**Critical analysis of Six Sigma implementation**", aimed at analyzing the critical success and failure factors of

implementing Six Sigma in organizations based on case studies, as well as available literature. The paper also showed useful conclusions and recommendations for strategists, CEO's and quality managers on how to implement Six Sigma effectively. It was the result of extensive literature study as well as many real life Six Sigma implementation processes and observations. Like usual research outputs, case studies were not part of the paper, rather an exhaustive review of Six Sigma application phenomenon was carried out in order to identify key factors involved in it. It mainly identified some important practical phenomena.

7. DelliFraine, et. al. (2010) study titled: "**Assessing the Evidence of Six Sigma and Lean in the Health Care Industry**", aimed at assessing the Evidence of Six Sigma and Lean in the Health Care Industry. The authors directed a comprehensive literature review to assess the empirical evidence relating Six Sigma and Lean Systems to improved clinical outcomes, processes of care, and financial performance of health care organizations, the authors identified 177 articles on Six Sigma and Lean Systems published in the last 10 years. However, only 34 of them reported any outcomes of the Six Sigma and Lean Systems projects studied, and less than one-third of these articles included statistical analyses to test for significant changes in outcomes. The review proved that there were significant gaps in the Six Sigma and Lean Systems health care quality improvement literature and very weak evidence that Six Sigma and Lean Systems improve health care quality.

8. Mandahawi, et. al. (2010) study titled: "**Reducing waiting time at an emergency department using design for Six Sigma and discrete event simulation**", aimed at reducing waiting time at an emergency department using design for Six Sigma and discrete event simulation. Design for Six Sigma (DFSS) was used to develop a triage process for an emergency department (ED) at an

Jordanian hospital, Different performance measures, such as length of stay (LOS) and waiting time (WT), are hired to evaluate the hospital's ED performance before and after the triage process. Discrete event simulation (DES) models were developed using ProModel software. The models have been proved and confirmed. The results showed that LOS will be reduced by 34% and WT by 61% after the triage system is implemented, without any additional staff. Moreover, as a result of the triage process, the WT sigma level is improved from 0.66 to 5.18, and the LOS sigma level is improved from 0.58 to 3.09.

9. Niemeijer, et. al. (2010) study titled: "**Quality in Trauma Care: Improving the Discharge Procedure of Patients by Means of Lean Six Sigma**", aimed at improving the discharge procedure of patients by means of Lean Six Sigma. The researchers used the process-focused method of Lean Six Sigma to decrease hospital stay by developing the discharge procedure of patients in the care processes and reducing waiting time and waste. The paper used the "Dutch Appropriateness Evaluation Protocol" to recognize the probable reasons of unfortunate hospital stay. The average length of stay of trauma patients at the Trauma Nursing Department at the beginning of the study was 10.4 days. The paper achieved that 30% of the length of stay was unnecessary. The central reasons of the unfortunate hospital stay were delays in several areas. The implementation of the improvement plan decreased almost 50% of the unfortunate hospital stay, enabling the trauma center to take almost all trauma patients to the Trauma Nursing Department. After the implementation of the improvements, the average length of stay was 8.5 days.

10. Singh, et. al. (2010) study titled: "**Lean implementation and its benefits to production industry**", aimed at discussing the implementation process of lean and its measured assistances for the production industry with the help of value stream mapping (VSM), VSM process symbols were used to discuss the

purpose. The results showed that reduction in lead time was 83.14 percent, reduction in processing time was 12.62 percent, reduction in work-in-process inventory was 89.47 percent, and reduction in manpower requirement was 30 percent. The rise in productivity per operator was 42.86 percent.

11. Kumaravadivel and Natarajan (2011) study titled: "**Empirical study on employee job satisfaction upon implementing Six Sigma DMAIC methodology in Indian foundry – A case study**" aimed at implementing the DMAIC (Define, Measure, Analyze, Improve, and Control) based Six Sigma Approach to reduce the frequency of faults and upgrade the sigma level of the sand casting process. The paper defined a step-by-step guide, using the DMAIC Methodology. The results showed an overall decline of defect rejection in the process and sigma level of the process being increased from 3.32 to 3.47.

12. Antony (2011) study titled: "**Reflective Practice Six Sigma vs Lean some perspectives from leading academics and practitioners**", aimed at giving the fundamental and critical differences between two of the most powerful methodologies (Six Sigma and Lean) in a process excellence creativity in any organization. The approach taken was to gather opinions from a number of leading academics and practitioners from five different countries. It was also important to guarantee that all participants have a good knowledge and expertise in the field of both Lean and Six Sigma methodologies. Although both methodologies were focused on process and quality development, Lean was formalization and systematization of experience and judgment which was not a feature of Six Sigma. Lean highlighted speed and waste; however Six Sigma emphasized variation, defects and process evaluation.

13. Yeh, et. al. (2011) study titled "**Applying Lean Six Sigma to improve healthcare: An empirical study**", aimed at applying Lean Six Sigma to improve the medical process of acute myocardial infarction. The 'define, measure, analyze,

improve, and control steps' of Six Sigma find critical-to quality factors and draw the value stream map to seek out non-value-added activities. The cause and effect diagram was also employed to analyze the root causes of waste and generate the improvement project by brainstorming. Reducing waste raised the process cycle efficiency. The results were that cycle time of the improved door-to-balloon process decreased by 58.4%. Process cycle efficiency increased from 32.27 to 51.81%, and the average days of hospital stay reduced by 3 days. Such effects helped save $ 4.422 million in medical resource. The study results indicated that lean six sigma not only enhanced medical quality but also strengthened market competitiveness.

14. Kuptasthien and Boonsompong (2011) study titled: "**Reduction of Tombstone Capacitor Problem by Six Sigma Technique: A Case Study of Printed Circuit Cable Assembly Line**", aimed at representing the implementation of Six Sigma technique and DMAIC improvement methodology into a mass manufacturing of printed circuit cables. The result showed that by following the theoretical Six Sigma technique and DMAIC steps, the defects from major tombstone capacitor problem could be decreased from 1,154 DPPM to 314 DPPM and increased 1st yield output from 98.4% to 99.66%.

15. Ali, et. al. (2011) study titled: "**Studying and Developing Model of Six Sigma Implementation in Companies of Yazd House of Industry and Mine**", aimed at studying and developing model of Six Sigma implementation in companies of Yazd House of Industry and Mine. Descriptive-survey method was used. The research sample included 276 top managers (CEOs) chosen randomly from among 1000 ones. To gather data a 63 material questionnaire (translated and altered) whose validity and reliability was achieved via existing ways. Descriptive statistics (charts, frequency, average, Frequency percent, etc) and deductive statistics (Anova, x2, etc) were used to analyze data. The outputs showed that more

than 77 % of the participants suggest that all 11 factors mentioned was significantly important for implementing Six Sigma in Companies of Yazd House of Industry and Mine. The factors included top management and leadership, Six Sigma teams, strategic planning, competitive benchmarking, process management, human resource development, education and training, quality tools, information and analysis, customer management and supplier management.

16. Yeh, et. al. (2011) study titled: **"Applying Six Sigma to promote self-management ability in health clubs",** aimed at to contribute to a better understanding of self-management ability in health clubs. The DMAIC (Define, Measure, Analyze, Improve, Control) model of Six Sigma was used to define matters faced by employees when they conduct self-management and to construct an evaluation system for important factors of self-management and to analyze the reasons for poor self-management. The result showed self-management ability of employees in health clubs was developed.

17. Jawadeh (2011) study titled: **"Feasibility of application of Six Sigma and its role in improving the quality of health services in the government hospitals in Gaza strip from the perspective of senior management",** aimed at determining Feasibility of application of Six Sigma and its role in improving the quality of health services in the government hospitals in Gaza strip from the perspective of senior management by defying the availability of Six Sigma's key factors and the role of Six Sigma in developing the quality of the health services. The researcher used the questionnaire to collect data and the retuning ratio of the questionnaire was 86.5%. The results showed the administrative, human and technical requirements as well as the confirmation of the senior management were important to achieve the Six Sigma role, and it showed that the senior management agreed that the application of Six Sigma had an influence on improving the quality health services.

18. Bharti, et. al. (2011) study titled: "**Six Sigma Approach for Quality Management in Plastic Injection Molding Process: A Case Study and Review"**, aimed at reviewing the effect of Six Sigma tools in a plastic injection molding industries along with a case study to improve the quality of nylon-6 bush (KAMANI BUSH) produced by plastic injection molding process. After using the DMAIC method, the results were as follows: process improved from 2.38σ standard to 5.18σ standard and the lower process capability index CPL for over shrinkage of nylon-6 bush had developed from 0.24 to 1.225, process mean reduced from 0.1015 to 0.0615.

19. Chakraborty and Tan (2012) study titled: "**Case study analysis of Six Sigma implementation in service organizations**", aimed at implementing Six Sigma in service organizations to identify critical success factors (CSFs), critical-to quality (CTQ) characteristics, tools and techniques and key performance indicators (KPIs), and also to understand the issues emerging from the implementation process. Exploratory empirical evidence was provided through four in-depth case studies of organizations mainly in Singapore. They include a hospital, a public service organization, a consultancy service and a hotel. The major results include an understanding about the suitability of Six Sigma implementation in service organizations. Management support and team member support appeared as primary success factors. The CTQs include time and cost, while use of soft tools instead of hard statistical tools are preferred by service organizations. At the project level, KPIs are understood more as CTQs.

20. Mandahawia, et. al. (2012) study titled: "**An Application of Customized Lean Six Sigma to Enhance Productivity at a Paper Manufacturing Company**", aimed at presenting a process development work applied at a local paper manufacturing company based on customized Lean Six Sigma methodologies. The DMAIC (Define, Measure, Analyze, Improve, and

Control) methodology and numerous lean tools were used to reorganize. Production rate and Overall Equipment Effectiveness (OEE) are employed to assess the performance of the cutting and the printing machines before and after the DMAIC cycle. The results showed that the production rate increased for printing machines by 5% and for the cutting machines by 10%. Moreover, the OEE for the printing and cutting machines has increased by 21.6% and 48.45%.

21. Goriwondo and Maunga (2012) study titled: "**Lean Six Sigma Application for Sustainable Production: A Case Study for Margarine Production in Zimbabwe**", is a case study used in identifying and effecting process improvements in margarine manufacturing, The Value Stream Mapping (VSM) tool was used to draw the Current State Map (CSM) of the margarine making line, the results showed that The value added ration on the CSM was 39% and was improved to 94% using the Lean Six Sigma approach. Waste reduction measures were employed mainly using the Total Productive Maintenance approach and affecting a pull system. The results obtained are shown in the Future State Map (FSM) and they specified improvements in cycle times of up to 86%.

22. Chung (2013) study titled: "**An Application of Six Sigma Methodology in Agarwood Tissue Culture**", aimed at optimize agarwood adventitious buds induced incidences and growth numbers. The study used design of experiment (DOE) and response surface methodology (RSM). The results showed that, the combination of 4.0 parts per million (ppm) Thidiazuron (TDZ) and 0.5 (ppm) Benzylaminopurine (BA), without activated carbon, had the best effect of adventitious bud induced incidence up to 21.75%, and adventitious bud growth number up to 24.8, improvements of 35.29% and 42.78%, respectively. The results confirmed that using the Six Sigma methodology improve the induction of agarwood tissue culture adventitious buds, promote the blooming of agarwood in large numbers, and further realize agarwood restoration.

23. Enoch (2013) study titled: "**Lean Six Sigma Methodologies and Organizational Profitability: A Review of Manufacturing SMEs in Nigeria**", aimed at investigating the influence of Lean and Six sigma methodologies (LSS) on the profitability of Manufacturing small and medium size enterprises (MSMEs) in Nigeria. The population of the study contained of 450 manufacturing SMEs with 2250 employees. The sample frame was made up of 225 MSMEs with 1026 staff selected randomly upon which copies of structured questionnaire were administered. 1002 valid responses received were analyzed. Pearson product moment correction (PPMC) confirmed the formulated propositions with negative association between awareness, LSS implementation and achievement critical success factors (CSFs) and the profitability level of MSMEs. The result showed that LSS implementation among MSMEs in Nigeria is almost none existing and has no influence on the profit level. The study recommended that CEOs of MSMEs should start training on LSS to allow them to provide a strong leadership.

24. Maleki, et. al. (2013) study titled: "**Reducing Waiting Time in Patients Undergone Spinal Surgeries at Operation's room of Shohada-ye-Tajrish Hospital using Six Sigma Model"** aimed at evaluate the influence of Six Sigma on reducing of waiting time for starting operation surgery for patient of spine surgery in operating room of Shohada-ye- Tajrish Hospital in Tehran. The study was conducted with the benefit of Six Sigma model in four stages, with qualitative and quantitative methods. The sample size was 198 persons. Data collection tools were: Chronometer clock, time measurement forms, and surgery operation registration notebooks. The results showed that Average waiting time for surgery reduction for patient with lumber laminectomy 51.4 minutes with standard deviation of 21.2, in Cage implant 62.6 with standard deviation of 18.3, and in Lumbar fusion surgery 51.6 with standard deviation of 20.7 has been reached after implementation of Six-Sigma.

25. Zaman, et. al. (2013) study titled: "**Study of feasibility of Six Sigma implementation in a manufacturing industry: a case study"**, aimed at discussing the implementation of Six sigma approach in decreasing refusal in a welding electrode manufacturing industry. The Six-sigma DMAIC approach was used. The result showed reducing in the Defect Per Million Output (DPMO) from 28356.96 to 1666.67 and increasing the sigma level from 3.41 to 4.43, without any huge capital investment.

26. Khaidir, et. al. (2013) study titled: "**Six Sigma Practices and Organizational Performance in Malaysian Healthcare Industry**", aimed at reviewing structural analysis the Six Sigma and organizational performance (OP) in Malaysian healthcare industry. A conceptual model using Structural Equation Modeling (SEM) was used to study the relationship. The study exposed Six Sigma (SS) practices enhance performance improvement in United States manufacturing industry, and there is positive and direct strong relationship between SS and financial performance in Malaysian automotive industry and using SS on operations of retail pharmacy is very applicable and helping to streamline and integrate the pharmacy process flow. Samples were selected from the list of hospital in Malaysian. In achieving the objectives of the study, the Malaysian private hospitals were selected as the population. The structured questionnaire as sampling method was used. Structural Equation Modeling (SEM) techniques were utilized to perform the required statistical analysis of the data from the survey. Exploratory factor analysis, reliability analysis and confirmatory factor analysis to test for construct validity, reliability, and measurements loading were performed. Having analyzed the measurement model, the structural model was then tested and confirmed. The statistical Package for the Social Sciences (SPSS) version 17 was used to analyze the preliminary data and provide descriptive analyses about thesis

sample such as means, standard deviations, and frequencies. SEM using AMOS 6.0 will use to test the measurement model.

27. Kumara and Khandujaa (2013) study titled: "**Application of Six-Sigma Methodology in small scale industries (SSI): A Case Study**", aimed at help to improve the six-sigma area of application in all types of organization, six-sigma application in Hydraulic jack manufacturing industry in small scale industries (SSI) environment, DMAIC methodology was used which is help to decrease the rejection rate of pump head of hydraulic jack set by removing error in process & method of operation. Statistical techniques Gauge R & R method, two sample test, Factorial method, control charts, Process capability analysis before & after application of six-sigma used. Applying of six-sigma in SSI helped to improve Z-bench Sigma level from 2.21 sigma to 5.64 sigma and cost saving of 0.01929 million/annum.

28. Venkatesh, et. al. (2013) study titled: "**Outcome of six sigma implementation a case study of manufacturing industry**", aimed at investigating whether Six Sigma has contributed to the improvement of the organization in terms of growth of the company, financial benefits, peoples' equity, productivity and customer satisfaction, and too study whether managers and workers differ in their opinions towards implementing Six Sigma. Sample Population consisted of all 26 employees who were involved in Six Sigma implementation. The respondents included both managers and workers who were trained in Six Sigma implementation. Those who were trained in Six Sigma included master black belt, black belts and green belts. Out of 26 employees 16 belonged to worker level and 10 belonged to managerial level. The data is collected using questionnaire method. Questionnaire was designed around various parameters that contributed for financial benefits and market growth. It was observed through the study that Six Sigma has contributed to the improved

financial status, productivity and customer satisfaction. However its contribution towards the welfare of the work force and growth of the company is not significant.

29. Bashir and Al-Tawarah (2013) study titled: "**Implementation of Six Sigma on Corrective Maintenance Case Study at the Directorate of Biomedical Engineering in the Jordanian Ministry of Health**", aimed at presenting a process improvement study applied on the Downtime of the medical equipment during the maintenance work in the Jordanian of Health Hospitals, based on customized Six Sigma methodology- DMAIC- (Define, Measure, Analyze, Improve and Control). Data was collected from different locations and different equipment to study the problem and make the necessary actions to resolve or reduce downtime. Obtained results indicated that the downtime reduced by 35% by introducing a new procedure to the clinical engineer to used when dealing with any medical equipment for maintenance work.

30. Bao, et. al. (2013) study titled: "**A multicenter study of the application of Six Sigma management in clinical rational drug use via pharmacist intervention**", aimed at determining the core reasons of outpatient irrational prescription drug use before and after pharmacist interventions in 6 large scale hospitals after investigating and to promote rational clinical drug use. The 5-step DMAIC method (defines measure, analyze, improve, control) in Six Sigma management was used. The statistical software package SAS9.1.3 was used to analyze the results. The study results were 8.56% and 4.46% ($P < 0.001$), the Z value increased from 2.82 to 3.01. The study showed that Six Sigma management will be able to mechanize and enhance hospital management, thereby eventually improving service quality.

31. Xu, et. al. (2013) study titled: "**Case Study on the Lean Six Sigma Management for Information Technology Service Management Project of G**

Commercial Bank", aimed at analyzing the current state of information system in G bank and also the its changes. The Lean Six Sigma management theory used to optimize the management of alteration and production in the G bank's ITSM. Authors tried to reach the four goals with DMAIC: optimizing the process and also improving the internal work efficiency. The second one is decreasing the variation and the error rate and also improving the system availability. The third one is to strengthen the business interaction and have the IT value been reflected preferably. The fourth one, the overtime time can be decreased and employee satisfaction can be enhanced at the same time. Specific measures were as follows: 1) Long-term process ability had been set up; 2) The operation control plan had been updated and implemented; 3) Process had returned to process owner for maintenance; 4) The team final report, including the future improvement opportunities confirmation, etc.

32. Edaily (2014) study titled: "**The Possibility of Applying Six Sigma and its Role in Cost Reduction and Increasing Competition – Applied Study of Advanced Technology Companies of Recycling Used Materials",** aimed at showing the important role of Six Sigma system and its use in managing Cost decrease of defect production, in order to increasing profits and improving the competitiveness. The researcher took "The Advanced Technologies for Consumed Materials Recycling", as a case study on one of the Jordanian Industrial Companies in Zarqa Governate in Jordan. The result was that the company didn't currently apply the Six Sigma system and its tools. Thus, this study showed that if the company decided to adopt Six Sigma and its tools, it would positively reflect on reducing waste production, improve efficiency and productivity, decreasing the operational costs, and developing the overall company's competitiveness in the market. Moreover, it is noted that, if the Six Sigma method and tools was applied, then the level of Sigma will further increase from 3.1 to 3.9. Furthermore, the

waste production would be reduced from 11.55 % to 3.5 %. Logically, that would lead to additional profits for the company by JD 61825.12.

33. Dwivedi, et. al. (2014) study titled: "**Six Sigma; As Applied in Quality Improvement for Injection Moulding Process**", aimed at defining the Black specks' problem, which decreases quality, due to defects in manufactured quantities, and to suggest measures for the improvement in the Injection Moulding operation using Six-Sigma DMAIC methodology. In order to study the problem a research has been carried out by studying the literature review on Total Quality Management (TQM), Six Sigma and other references for this analysis and research method.

34. Pranoto and Nurcahyo (2014) study titled: "**Implementation of Integrated System Six Sigma and Importance Performance Analysis for Quality Improvement of HSDPA Telecommunication Network and Customer Satisfaction"** aimed at improve quality of High Speed Downlink Packet Access (HSDPA) network and customer satisfaction, by using the Six Sigma DMAIC cycle and Importance Performance Analysis (IPA) as control, The result showed that the average change in Call Setup Success Rate (CSSR) increased from 98,44% to 99,43% and sigma level from $3.6<\sigma<3.7$ to $\sigma>4,0$. And the result of IPA measurement showed performance score is 3.62 greater than importance score 3.56.

35. Junankar, et. al. (2014) study titled: "**Six Sigma Technique for Quality Improvement In Valve Industry**", aimed at decreasing operational wastages using Six Sigma methodology (DMAIC) This study reported declining in defects in manufacturing industry through reduction in DPMO (Defects per Million Opportunities) from 1401 to 603.47, and the Sigma Level upgraded from 4.5 to 4.8.

From the literature reviews above, it can be concluded that all organizations can be benefited from using lean manufacturing or Six Sigma, as Ngo (2010) study provided a closer insight into the status of the applications of business improvement programs, Lean and the combined Lean Six Sigma in New Zealand market where thirty three manufacturing firms in New Zealand were involved, and this study will focus on the Jordanian Pharmaceutical Manufacturing Organizations. And Khaidir, et. al. (2013) in his study showed that effect of Six Sigma on organizational performance by taking these four indicators for the Six Sigma (leadership, costumer focus, structured improvement procedure and focus in metric), while this study will investigate the eight Lean Six Sigma elements as they were mentioned before the but it is expected that the benefit will be more if both are used together. Therefore, the current study will explore the effect of lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance.

2.6. Expected Contributions of the Current Study as Compared with Previous Studies:

1- Lean Six Sigma concept: The current study expects that it will increase awareness about the role of Lean Six Sigma in organizations' Performance.

2- Purpose: Most of the previous research works were conducted to measure and manage Lean Six Sigma from the financial perspective, and to increase the organizations' Lean Six Sigma indicators disclosure. Few studies were carried out to study the effect of the Lean Six Sigma elements on the organizations' Business Performance.

3- Environment: Most previous studies have been carried out in different countries outside the Arab region. The current study will be carried out in Jordan, as one of the Arab region countries.

4- Industry: Few researches about Lean Six Sigma carried out about pharmaceutical industry. The current research is dedicated to pharmaceutical industry only.

5- Methodology: Most previous studies were based on annual reports of different organizations and industries. The current study is based on perception.

6- Variables: Most of previous studies and researchers take eight elements of Lean Six Sigma, while in this study new element was added which is the sustainable development.

7- Population: Most all previous researches considered public shareholders organizations that were listed in the stock markets, while the current study covered both public and private shareholders organizations.

8- Comparison: The current study will compare the results with the results of previous studies mentioned earlier to highlight similarities and differences that might be there.

Chapter Three:

Study Methodology (Methods and Procedures):

3.1. Study Approach and Design:

The current study is considered as a descriptive and analytical study. It aims at studying the effect of Lean Six Sigma elements on Jordanian Pharmaceutical Manufacturing Organizations' business performance. It starts with literature review and experts' interviews to improve the currently used measurement model and explore the Lean Six Sigma profile of the Jordanian Pharmaceutical Manufacturing Organizations. Then, a panel of judges will be conducted to confirm the items to be included in the questionnaire will be carried out. Finally, the survey will be carried out and the data will be collected from the managers working at Jordanian Pharmaceutical Manufacturing organizations, then the data will be tested through the SPSS 20 focusing on the correlation among Lean Six Sigma variables and their relationships with Jordanian Pharmaceutical Manufacturing Organizations' business performance. Finally, the results were compared with previous researches work.

3.2. Study Population, Sample and Unit of Analysis:

The pharmaceutical manufacturing organizations that are registered in Jordanian Association of Pharmaceutical Manufacturers at 2015 in Jordan are 14 organizations. All pharmaceutical manufacturing organizations were chosen and surveyed by using questionnaire to collect the primary data and examine the topic of Lean Six Sigma and its effect on the organizations' business performance, thus negating any need for sampling.

Unit of Analysis: The survey unit of analysis is composing of all managers at three levels (top, middle and low level) who are working at pharmaceutical manufacturing organizations and they are approximately 300 managers, and who will be available at the time of distributing the questionnaires and who will fill it.

3.3. Data Collection Methods (Tools):

The data that will be used for fulfilling the purposes of the study can be divided into two groups: secondary and primary data as follows:

Secondary Data: Data was collected from different sources such as journals, working papers, researches, thesis, articles and worldwide Web and Jordanian Pharmaceutical Manufacturing organizations.

Primary Data: Data was collected by extensive survey by questionnaire

Tool of Collecting Primary Data:

The proper tool was chosen and tested to suit the current study and to match the study hypothesis and research model. Basically the original questionnaire items were developed relying on previous studies. Then, the questionnaire was revised and validated by an academic panel of judges and references. Then, the questionnaire was also reviewed and validated by professional and highly experienced experts in the field of pharmaceutical manufacturing organizations.

Questionnaire Variables:

The questionnaire variables are divided into two parts:

1- First part is composing of demographic characteristics related to gender, age, academic qualification, position, department, and experience.

2- Second part is composing of both independent and dependent variables as follows:

a- Independent Variables (Lean Six Sigma): Based on literature review such as Stoiljkovi, et. al. (2011) and Arunagiri and Babu (2013), the current study has identified nine variables that contribute to Jordanian pharmaceutical business performance (defect, over production, waiting time, transportation, inventory, extra motion, extra process, non-utilized talent and sustainability development (environmental, economic and social responsibility) each variable was measured by 5 - 6 items and the total were 57 items (from item 1 to item 57 in the questionnaire).

b- Dependent Variable (Business Performance): Based on literature review such as: Darabi (2007) and Sharabati (2008), the current study took it as one dimension the total items were 24 items (from item 58 to item 67 in the questionnaire).

All items were measured by five-point Likert-type scale to take the advantage of respondent's perceptions, varying from value 1 (strongly agree) to value 5 (strongly disagree) that was used through the study questionnaire.

Panel of judges and referees: panel of judges and referees were selected from both well-known academicians, and professional with highly experienced leaders in the pharmaceutical manufacturing organizations.

3.4. Data Collection and Analysis:

Research data have been collected during the time period of April to the first week of May at 2015. The targeted pharmaceutical manufacturing organizations were 14 organizations. This study tried to survey all these organization but only 7 organizations had been reached due to several reasons such as preoccupation with auditing from internal and external committees, the crowded manufacturing schedule for the next three months, and the lack of cooperation of some

organizations. Questionnaires were handed to 180 managers out of 300 managers working at JPMO i.e. 60%. 128 questionnaires were collected which form 71.1% response rate of total units of analysis. Eight questionnaires were abandoned due to incomplete statements from respondents. Consequently, the valid questionnaires were 120 out of 128 collected questionnaires which represent 66.6% of total units of analysis.

SPSS 20 was used to analyze the effect of Lean Six Sigma on business performance at pharmaceutical organizations.

1. Validity Test:

Two methods were used to confirm the content validity: First content validity, multiple sources of data (as journals, working papers, researches, thesis, articles and worldwide Web and Jordanian Pharmaceutical Manufacturing organizations, expert interviews) was used to set and refine the model and measures. Second face validity, panel of judges was carried out to modify the finale form of the questionnaire.

2. Reliability Test (Cronbach's Alpha):

The reliability is evident by strong Cronbach's alpha coefficients of internal consistency. Reliability analysis for variables is show in table (3.1) below.

If Alpha Coefficients is more than 60% will be accepted (Sekran 2003). As shown in table Cronbach's alpha coefficients for variables are ranging between 0.627 and 0.8127. Except transportation and Inventory were 0.573 and 0.557.

Table (3.1): Reliability Test:

No.	Variable	No. of Items	Cronbach's Alpha
1	Defects	5	0.765
2	Over Production	5	0.684
3	Waiting Time	5	0.701
4	Transportation	5	0.573
5	Inventory	5	0.557
6	Motion	5	0.812
7	Extra Processing	5	0.642
8	Non Utilized Talent	5	0.683
9	Environmental Responsibility	6	0.744
10	Economic Responsibility	5	0.665
11	Social Responsibility	6	0.683
12	Sustainable Development	3	0.627
13	Lean Six Sigma	9	0.808
14	Business Performance	10	0.748

The importance is calculated based on the following criteria: 5-1/3 = 1.33. So low, medium and high degree of presence will be considered based on the below:

The Importance of each item will be calculated as follows:

(5-1)/3 = 1.33.

Three levels of existence will be considered according to the following intervals:

1- Low degree of existence if the value lies between 1 and 2.33 (1 + 1.33 = 2.33).

2- Medium degree of existence if the value lies between 2.34 and 3.66 (2.33+ 1.33 = 2.34-3.67).

3- High degree of existence if the value lies between: 3.67 up to 5.

While the ranking will be based on t-value.

Chapter Four:

Analysis and Results

4.1. Introduction:

The initial goal of this research is to study the effect of Lean Six Sigma on business performance at Jordanian pharmaceutical manufacturing organizations. In this chapter the results and related analysis will be showed. In addition, it will focus on the significant results with its statistical indications. First, the study variables will be analyzed and described from statistical point of view by using means, standard deviations, t-values, importance and ranking. Second, the chapter will represent correlation among independent variables, then their correlation with dependent variables. Finally, study hypothesis will be tested by multiple-regressions.

4.2. Respondents' Demographic Description:

Table (4.1) below shows the general characteristics of the respondents in terms of gender, age, education, position, division, and years of experience:

1. Gender: Most of the respondents are males with 71 (59.2%) while female rated 49 (40.8%). This indicates that most of the directors and managers in Jordan are males; due the traditions and culture.

2. Age: The highest percentage of the respondents' ages were above 35-45 (52.5%), then above 25-35 (29.2%), then ages above 45-55 (15.8%) and ages above 55 (2.5%). This indicates that the average of the ages of directors and manager are above 35 – 45.

Table (4.1): Demographic Analysis

Dimension		Frequency	Percent
Gender	Male	71	59.2
	Female	49	40.8
	Total	120	100.0
Age	25-35	35	29.2
	Above 35-45	63	52.5
	Above 45-55	19	15.8
	Above 55	3	2.5
	Total	120	100.0
Education	Diploma or less	3	2.5
	Bachelor	86	71.7
	Master	29	24.2
	Doctorate	2	1.7
	Total	120	100.0
Position	High level	21	17.5
	Middle level	75	62.5
	Low level	24	20.0
	Total	120	100.0
Division	Production	28	23.3
	R&D	15	12.5
	Marketing	14	11.7
	Others	63	52.5
	Total	120	100.0
Years of Experience	Less or equal 5	12	10.0
	Above 5-10	70	58.3
	Above 10-15	26	21.7
	Above 15	12	10.0
	Total	120	100.0

3. Education: Most of the respondents were holding the BSc degree 86 (71.7%), the master degree 29 (24.2%), then diploma 3 (2.5%) and finally the PhD 2 (1.7%).

4. Position: This study divided the position into 3 levels high, middle and low management, most of the respondents were from the middle level 75 (62.5%), from the upper level were 21 respondents (17.5%) and from the low level 24 respondents (20%).

5. Division: This study divided the division into 4 groups; the majority of the respondents were from other department such as quality, finance and operation

as we can consider it administration 63 (52.5%), then production 28 (23.3%), research and development15 (12.5%) and finally marketing department 14 (11.7%).

6. Years of Experience: The majority of the respondents' experiences were having above 5 – 10 years of experience 70 (58.3%) then those with above 10 –15 years of experience 26 (21.7%), followed by less or equal than 5 years of experience 12 (10%) and more than 15 years of experience 12 (10%).

4.3. Study Variables Analysis (Descriptive Analysis):

This part analyzes and describes the independent and dependent variables from statistical point of view including means, standard deviations, t-values, ranking and importance.

Independent Variables (Lean Six Sigma):

Table (4.2) shows that the average means of the respondents' perception about the degree of implementing of the Lean Six Sigma variables are ranging from 4.01 to 4.64, with standard deviation that ranges from 0.31 to 0.54. Such results show that there is an agreement on high implementation of Lean Six Sigma variables. The mean of the total Lean Six Sigma variables is 4.34 with standard deviation 0.25 which indicates that there is an agreement on high presence of these variables. Finally, the overall result indicates that there is a significant implementation of the Lean Six Sigma among Jordanian Pharmaceutical Manufacturing Organizations, where (t=59.08>1.96). This indicates that the directors and managers working at Jordanian Pharmaceutical Manufacturing Organization realize the importance of the implantation of the Lean Six Sigma variables.

Table (4.2): Mean, Standard Deviation, Importance and Ranking of Lean Six Sigma Variables:

No	Item	Mean	Std. Deviation	t-Value	Importance	Rank
1	Defects	4.64	0.37	47.93	High	2
2	Over Production	4.49	0.37	43.98	High	4
3	Waiting Time	4.40	0.43	35.84	High	5
4	Transportation	4.43	0.35	44.13	High	3
5	Inventory	4.52	0.31	53.60	High	1
6	Motion	4.29	0.54	26.23	High	9
7	Extra Processing	4.04	0.41	27.89	High	7
8	Non Utilized Talent	4.18	0.49	26.42	High	8
9	Sustainable Development	4.08	0.35	33.25	High	6
	Environmental Responsibility	4.13	0.47	26.24	High	
	Economic Responsibility	4.10	0.49	24.64	High	
	Social Responsibility	4.01	0.46	24.37	High	
	Lean Six Sigma (Independent variables)	**4.34**	**0.25**	**59.08**	**High**	

t-Tabulated = 1.96

Defect:

Table (4.3) shows that the means of the respondents' perception about the degree of the implementation of defect items are ranging from 4.55 to 4.71with standard deviation that ranges from 0.47 to 0.50. Such results indicate that there is an agreement on high applying of defect variable items.

Table (4.3): Mean, Standard Deviation, Importance and Ranking of the Defect Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
1	The company is keen on the quality of raw materials	4.71	0.47	39.76	High	1
2	The company uses the appropriate means of transportation	4.61	0.50	35.02	High	4
3	The company is committed to follow the instructions and formulas for manufacturing such as mixing in approved precise proportions of materials	4.68	0.48	37.91	High	3
4	The company is keen to follow in time the production processes	4.55	0.57	29.44	High	5
5	The company is keen to pay attention to the cleanliness of the internal environment	4.67	0.47	38.87	High	2
	Defect	**4.64**	**0.37**	**47.93**	**High**	

t-Tabulated = 1.96

The average mean of the total defect variable items is 4.64 with standard deviation 0.37, which indicates that there is an agreement on high implanting of

this variable. Finally, the overall result indicates that there is a significant degree of implantation of the defect variable at Jordanian Pharmaceutical Manufacturing Organizations, where (t=47.93>1.96). This indicates that the directors and managers working at Jordanian Pharmaceutical Manufacturing Organization realize the importance of reducing the defect.

Over Production:

Table (4.4) shows that the average means of the respondents' perception about the degree of the implementation of over production items are ranging from 4.37 to 4.65, with standard deviation that ranges from 0.47 to 0.61. Such results indicate that there is an agreement on high applying of over production variable items. The mean of the total over production variable items is 4.49 with standard deviation 0.37 which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the over production variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=43.98>1.96).

Table (4.4): Mean, Standard Deviation, Importance and Ranking of the Over Production Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
6	The company is keen on the proper appreciation of the order quantity	4.37	0.59	25.42	High	5
7	The company emphasizes the orders before starting the production	4.46	0.51	31.12	High	2
8	The company is keen to ensure the effectiveness and safety of the product compared to competitors' products	4.65	0.47	38.03	High	1
9	The company is keen on estimating raw materials required for the production	4.53	0.57	29.07	High	3
10	The company is keen to manage machines efficiently and effectively	4.45	0.61	25.72	High	4
	Over Production	**4.49**	**0.37**	**43.98**	**High**	

t-Tabulated = 1.96

This indicates that the directors and managers know the importance of this variable and its effect on the business performance

Waiting Time:

Table (4.5) shows that the average means of the respondents' perception about the degree of the implementation of waiting time are ranging from 4.30 to 4.57, with standard deviation that ranges from 0.51 to 0.72. Such results indicate that there is an agreement on high applying of waiting time variable items. The mean of the total waiting time variable items is 4.40 with standard deviation 0.43 which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the waiting time variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=35.84>1.96). This indicates that the directors and managers know the importance of this variable and its effect on the business performance.

Table (4.5): Mean, Standard Deviation, Importance and Ranking of the Waiting Time Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
11	The company works on the availability of raw materials in a timely manner	4.30	0.72	19.65	High	5
12	The company is keen on the effectiveness of the production processes	4.30	0.61	23.23	High	3
13	The company emphasizes on the periodically maintenance of machinery	4.47	0.72	22.48	High	4
14	The company set priorities for manufacturing	4.57	0.51	33.63	High	1
15	The company takes into consideration the speeding up decision-making when the need arises	4.41	0.60	25.86	High	2
	Waiting Time	**4.40**	**0.43**	**35.84**	**High**	

t-Tabulated = 1.96

Transportation:

Table (4.6) shows that the average means of the respondents' perception about the degree of the implementation of transportation items are ranging from

4.22 to 4.58, with standard deviation that ranges from 0.51 to 0.68. Such results indicate that there is an agreement on high applying of best transportation variable items. The mean of the total transportation variable items is 4.43 with standard deviation 0. 35which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the transportation variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=44.13>1.96). This indicates that the directors and managers know the importance of using the appropriate transportation.

Table (4.6): Mean, Standard Deviation, Importance and Ranking of the Transportation Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
16	The company is keen to provide alternatives for transport operations in case of emergency	4.22	0.68	19.52	High	5
17	The company confirms the accuracy of the packaging operations	4.41	0.51	30.42	High	2
18	The company is committed to the customs procedures required to facilitate transfers	4.58	0.58	29.52	High	3
19	The company is keen on using appropriate means of transportation	4.51	0.53	31.14	High	1
20	The company owns the appropriate skills for workers to carry out handling during transport	4.44	0.59	26.80	High	4
	Transportation	**4.43**	**0.35**	**44.13**	**High**	

t-Tabulated = 1.96

Inventory:

Table (4.7) shows that the average means of the respondents' perception about the degree of the implementation of inventory items are ranging from 4.31 to 4.66, with standard deviation that ranges from 0.49 to 0.56. Such results indicate that there is an agreement on high applying of best inventory methods variable items. The mean of the total inventory variable items is 4.52 with standard deviation 0.31which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of

implantation of the inventory variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=53.60>1.96). This indicates that the directors and managers are paying attention to apply the best ways to store their inventory.

Table (4.7): Mean, Standard Deviation, Importance and Ranking of the Inventory Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
21	The company is keen to provide the appropriate storage conditions (temperature and humidity)	4.54	0.50	33.77	High	2
22	The appropriate skills for workers to perform the storage business become available in the company	4.31	0.53	27.12	High	5
23	The company is keen to provide the appropriate handling tools (forklift)	4.53	0.56	29.82	High	4
24	The company emphasizes the appropriate arrangement of the material inside the warehouse	4.66	0.49	37.10	High	1
25	The company is committed to conduct the various inventories	4.57	0.51	33.63	High	3
	Inventory	**4.52**	**0.31**	**53.60**	**High**	

t-Tabulated = 1.96

Motion:

Table (4.8) shows that the average means of the respondents' perception about the degree of the implementation of motion items are ranging from 4.19 to 4.53, with standard deviation that ranges from 0.63 to 0.78 such results indicate that there is an agreement on high applying of variable items. The mean of the total motion variable items is 4.29 with standard deviation 0.54, which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the motion variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=26.23>1.96). This indicates that the directors and managers try to reduce the unnecessary motion of information, people and goods.

Table (4.8): Mean, Standard Deviation, Importance and Ranking of the Motion Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
26	The company is keen on having a standard work (standardization)	4.53	0.63	26.55	High	1
27	The company is keen to reduce the movements of workers that are not connected with work	4.23	0.77	17.54	High	4
28	The company is keen on a good arrangement for the factory to reduce excess movements	4.32	0.74	19.55	High	2
29	The company is keen to use appropriate internal means of transportation between sections and departments	4.19	0.78	16.60	High	5
30	The company is keen to employ the appropriate number of workers	4.22	0.71	18.87	High	3
	Motion	**4.29**	**0.54**	**26.23**	**High**	

t-Tabulated = 1.96

Extra Processing:

Table (4.9) shows that the average means of the respondents' perception about the degree of the implementation of extra processing items are ranging from 2.92 to 4.48, with standard deviation that ranges from 0. 51 to 1.41 such results indicate that there is an agreement on high applying of extra processing variable items, except item no. 31 which stated "The company is working to adjust the time of the production process" and shows that there is no agreement on its medium implementation and no significant implementation, where t=-.64<1.96.

Table (4.9): Mean, Standard Deviation, Importance and Ranking of the Extra Processing Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
31	The company is working to adjust the time of the production process	2.92	1.41	-.64	Medium	5
32	The company emphasizes the flow of required procedures	4.20	0.61	21.46	High	3
33	The company is committed to the production scheduling.	4.43	0.58	26.69	High	2
34	The company describes the working procedures for workers	4.48	0.51	31.41	High	1
35	The company is keen on the appropriate use of statistical aspects	4.20	0.79	16.64	High	4
	Extra Processing	**4.04**	**0.41**	**27.89**	**High**	

t-Tabulated = 1.96

The mean of the total extra processing variable items is 4.04 with standard deviation 0.41, which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the motion variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=27.89>1.96). This indicates that the directors and managers try to standardize the work.

Non Utilized Talent:

Table (4.10) shows that the average means of the respondents' perception about the degree of the implementation of non-utilized talent items are ranging from 4.05 to 4.31, with standard deviation that ranges from 0.62 to 0.95 such results indicate that there is an agreement on high applying of variable items. The mean of the total non-utilized talent variable items is 4.18 with standard deviation 0.49 which indicates that there is an agreement on high implanting of this variable.

Table (4.10): Mean, Standard Deviation, Importance and Ranking of the Non Utilized Talent Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
36	The company works to discover talent	4.05	0.70	16.36	High	3
37	The company works to develop and train employees on the skills needed	4.21	0.62	21.48	High	1
38	The company encourages new ideas	4.31	0.69	20.71	High	2
39	The company encourages creativity and innovation through incentives system.	4.05	0.95	12.07	High	4
40	The Company has an available research center that supports research and development	4.31	0.69	20.71	High	2
	Non Utilized Talent	**4.18**	**0.49**	**26.42**	**High**	

t-Tabulated = 1.96

Finally, the overall result indicates that there is a significant degree of implantation of the non-utilized talent variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=26.42>1.96). This indicates that the directors and managers work in Jordanian Pharmaceutical Manufacturing

Organizations; they know the importance of this variable and its effect on the Business Performance.

Sustainable Development:

Table (4.11) shows that the average means of the respondents' perception about the degree of the implementation of sustainable development items are ranging from 4.01 to 4.13, with standard deviation that ranges from 0.45 to 0.49, such results indicate that there is an agreement on high applying of variable items. The mean of the total sustainable development variable items is 4.08 with standard deviation 0.35, which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the sustainability development variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=33.25>1.96). This indicates that the directors and managers are aware of the good effect of this variable on the business performance.

Table (4.11): Mean, Standard Deviation, Importance and Ranking of the Sustainable Development Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
1	Environmental Responsibility	4.13	0.47	26.24	High	1
2	Economic Responsibility	4.10	0.49	24.64	High	2
3	Social Responsibility	4.01	0.45	24.37	High	3
	Sustainable Development	**4.08**	**0.35**	**33.25**	**High**	

t-Tabulated = 1.96

Environmental Responsibility:

Table (4.12) shows that the average means of the respondents' perception about the degree of the implementation of environmental responsibility items are ranging from 3.79 to 4.33, with standard deviation that ranges from 0.50 to 0.82. Such results indicate that there is an agreement on high applying of variable items. The mean of the total environmental responsibility variable items is 4.13 with standard deviation 0.47 which indicates that there is an agreement on high

implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the environmental responsibility variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=26.24>1.96). This indicates that the directors and managers pay attention to maintain a safe environment for future generation.

Table (4.12): Mean, Standard Deviation, Importance and Ranking of the Environmental Responsibility Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
41	The company is interested in reducing the environmental pollution	4.33	0.50	28.90	High	1
42	The company achieved an optimum exploitation of resources, especially non-renewable resources.	4.10	0.75	15.96	High	5
43	The company owns a variety of means to deal with the surrounding environment-friendly products	4.19	0.73	17.83	High	4
44	The company provides guidance on the use of products and ways to get rid of them and their residues	4.21	0.68	19.45	High	2
45	The Company uses non-harmful products (eco-friendly) and set forth in the Good Manufacturing.	4.19	0.72	18.12	High	3
46	The company recycle some wasted materials	3.79	0.82	10.41	High	6
	Environmental Responsibility	**4.13**	**0.47**	**26.24**	**High**	

t-Tabulated = 1.96

Economic Responsibility:

Table (4.13) shows that the average means of the respondents' perception about the degree of the implementation of economic responsibility items are ranging from 3.63 to 4.31, with standard deviation that ranges from 0.59 to 1.04. Such results indicate that there is an agreement on high applying of variable items. The mean of the total environmental responsibility variable items is 4.10 with standard deviation 0.49, which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the economic responsibility variable on the

Jordanian Pharmaceutical Manufacturing Organizations, where (t=24.64>1.96). This indicates that the directors and managers know the importance of this variable and its effect on the business performance.

Table (4.13): Mean, Standard Deviation, Importance and Ranking of the Economic Responsibility Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
47	The company is committed to government laws related to economic aspect	4.21	0.59	22.47	High	1
48	The company is seeking to pay tax dues on time specified	4.15	0.61	20.56	High	2
49	The company contributes to the local economy by bringing hard currency	4.21	0.72	18.53	High	4
50	The company helps in building infrastructure such as bridges…etc	3.63	1.04	6.63	Medium	5
51	The company contributes to the employment of local labor	4.31	0.70	20.36	High	3
	Economic Responsibility	**4.10**	**0.49**	**24.64**	**High**	

t-Tabulated = 1.96

Social Responsibility:

Table (4.14) shows that the average means of the respondents' perception about the degree of the implementation of social responsibly items are ranging from 3.88 to 4.23, with standard deviation that ranges from 0.61 to 0.84. Such results indicate that there is an agreement on high applying of variable items. The mean of the total social responsibility variable items is 4.01 with standard deviation 0.45, which indicates that there is an agreement on high implanting of this variable. Finally, the overall result indicates that there is a significant degree of implantation of the social responsibility variable on the Jordanian Pharmaceutical Manufacturing Organizations, where (t=24.37>1.96). This indicates that the directors and managers know the importance of this variable and its effect on the business performance.

Table (4.14): Mean, Standard Deviation, Importance and Ranking of the Social Responsibility Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
52	The company is hiring people with special needs	3.88	0.73	13.07	High	4
53	The company owns programs help support education in the community	3.91	0.78	12.73	High	5
54	The company owns a budget for social work as a financial support such as community donating to charity	4.03	0.73	15.57	High	3
55	The company has binding laws for moral behavior	4.18	0.70	18.38	High	2
56	The company has plans for a health awareness to the community courses	3.87	0.84	11.28	High	6
57	The Company follows the binding laws to ensure the safety of workers from the product	4.23	0.61	21.99	High	1
	Social Responsibility	**4.01**	**0.45**	**24.37**	**High**	

t-Tabulated = 1.96

Dependent Variable (Business Performance):

Table (4.15) shows that the average means of the respondents' perception about the degree of implementing of the business performance dimension are ranging from 3.92 to 4.32, with standard deviation that ranges from 0.52 to 0.70. Such results show that there is an agreement on high implementing of business performance dimension.

The mean of the total business performance dimension is 4.12with standard deviation 0.34 which indicates that there is an agreement on high presence of this dimension. Finally, the overall result indicates that there is a significant degree of implementing of the business performance among Jordanian Pharmaceutical Manufacturing Organizations, where (t=35.88>1.96). This indicates that the directors and managers work in Jordanian Pharmaceutical Manufacturing Organizations; they know the importance of the implantation of the business performance dimension.

Table (4.15): Mean, Standard Deviation, Importance and Ranking of Business Performance Items:

No.	Item	Mean	Std. Deviation	t-Value	Importance	Rank
58	The company gets the best productivity of the individual	4.01	0.57	19.45	High	5
59	The company has the least cost to produce per unit compared with competitors	3.92	0.57	17.66	High	8
60	The company has the least work rotation (staff)	4.09	0.65	18.22	High	7
61	The quality of products match with competitors	4.25	0.58	23.61	High	2
62	The company has continually increase in sales	4.30	0.61	23.23	High	3
63	The company achieves better profit compared with competitors	4.16	0.61	20.55	High	4
64	The market value of the company's shares increase on an annual basis	4.13	0.68	18.25	High	6
65	Return on investment commensurate with return on the industry	4.05	0.70	16.36	High	10
66	The Company manages cost effectively	4.03	0.67	16.96	High	9
67	The company has an exceptional position among competitors	4.32	0.52	27.98	High	1
	Business Performance	**4.12**	**0.34**	**35.88**	**High**	

t-Tabulated = 1.96

4.4. Relationships between the Study Variables:

Table (4.16) shows that the relationships among Lean Six Sigma variables are medium to strong relationships, where r ranging between 0.215 and 0.536, except the relationship between non utilized talent and transportation, which was weak and not significant where (r=0.119, sig.=0.195).

The table (4.16) also shows that the relationships between each variable of Lean Six Sigma and sustainable development are strong, since r ranging between 0.320 and 0.441. The relationships among sustainable development variables are medium, since r ranging from 0.215 to 0.270. Also, the correlation between each Lean Six Sigma variable with business performance is strong to very strong, since r ranging from 0.425 to 0.656. Finally, the relationship between total Lean Six Sigma and Business Performance is very strong where r=0.880.

This indicates that it is important to improve all variables lean Six Sigma variables together to maximize the organizations' business performance

Table (4.16): Bivariate Pearson's Correlation (r) Among Independent Variables, Dependent variables, and between Independent and Dependent Variables.

No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Defects	Correlation														
		Sig.														
2	Over Production	Correlation	.536**													
		Sig.	.000													
3	Waiting Time	Correlation	.348**	.472**												
		Sig.	.000	.000												
4	Transportation	Correlation	.449**	.436**	.422**											
		Sig.	.000	.000	.000											
5	Inventory	Correlation	.385**	.363**	.358**	.385**										
		Sig.	.000	.000	.000	.000										
6	Motion	Correlation	.292**	.459**	.458**	.356**	.405**									
		Sig.	.001	.000	.000	.000	.000									
7	Extra Processing	Correlation	.259**	.237**	.277**	.266**	.278**	.360**								
		Sig.	.004	.009	.002	.003	.002	.000								
8	Non Utilized Talent	Correlation	.351**	.215*	.278**	.119	.284**	.246**	.450**							
		Sig.	.000	.018	.002	.195	.002	.007	.000							
9	Environmental Responsibility	Correlation	.307**	.350**	.285**	.286**	.254**	.365**	.310**	.299**						
		Sig.	.001	.000	.002	.002	.005	.000	.001	.001						
10	Economic Responsibility	Correlation	.193*	.183*	.151	.371**	.362**	.259**	.287**	.247**	.238**					
		Sig.	.034	.045	.099	.000	.000	.004	.001	.007	.009					
11	Social Responsibility	Correlation	.322**	.228*	.250**	.266**	.290**	.250**	.205*	.203*	.215*	.270**				
		Sig.	.000	.012	.006	.003	.001	.006	.025	.026	**.018**	**.003**				
12	Sustainable Development	Correlation	.384**	.356**	.320**	.441**	.431**	.411**	.383**	.355**	.673**	.749**	.684**			
		Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000			
13	Lean Six Sigma	Correlation	.683**	.710**	.699**	.664**	.655**	.683**	.586**	.556**	.464**	.393**	.387**	.588**		
		Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000		
14	Business Performance	Correlation	.656**	.633**	.573**	.617**	.621**	.635**	.425**	.446**	.459**	.384**	.461**	**.612****	**.880****	
		Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	**.000**	**.000**	

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

4.5. Testing Study Hypothesis:

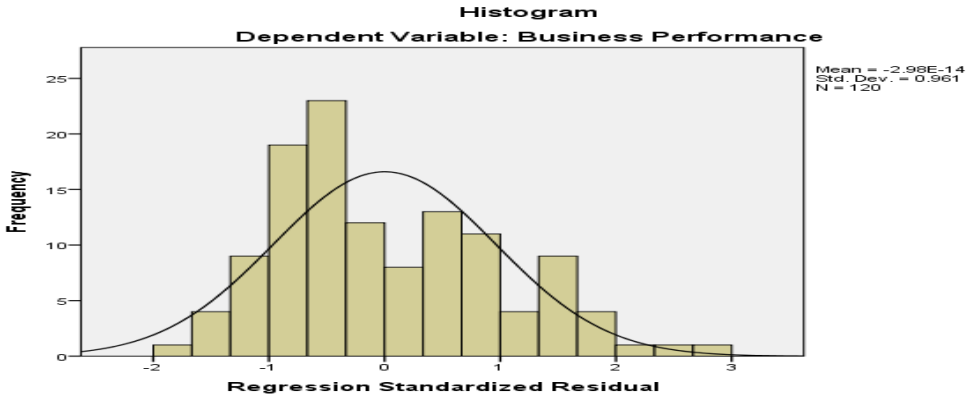
To test the hypotheses, the multiple regressions analysis is used to analyze the effect of the Lean Six Sigma variables on Business Performance.

To be able to use multiple regressions the following assumptions should be fulfilled: Normality, validity, reliability, multi-colleanearity, independence of errors and correlation. R^2 also indicates the fitness of the model (Sekaran 2003).

Normal Distribution (Histogram):

The histogram in the figure (4.1) shows that the data were normality distributed, since the residuals so not affect the normal distribution.

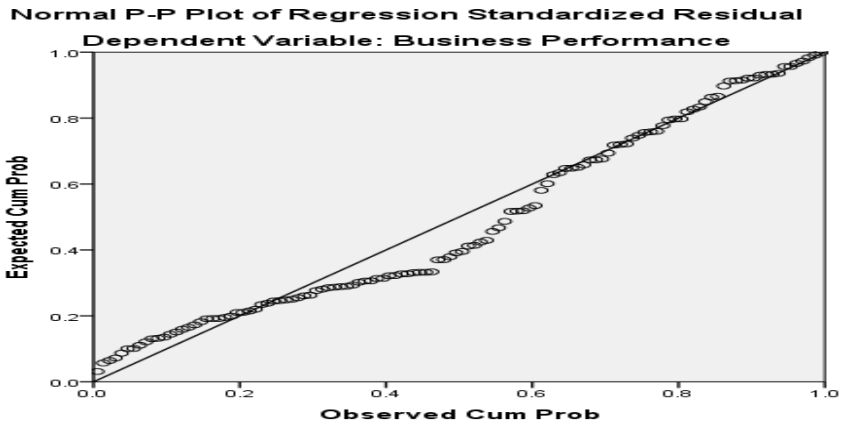
Figure (4.1): Normal Distribution



Linearity Test:

Figure (4.2) shows that the relationship between independent and dependent variables is linear.

Figure (4.2): Linearity Test



As far as normality, validity and reliability were assumed, so regressions analysis can be used in the case at hand; especially after achieving the following underlying assumptions: Durbin-Watson test to ensure independence of errors, If

Durbin-Watson test value is about 2 the model does not violate this assumption. While, VIF (Variance Inflation Factor) and tolerance are used to test multi collinearity. If VIF is less than 10 and tolerance is more than 0.2, the multi-collinearity model does not violate this assumption.

Table (4.17) shows that Durbin Watson value is (d=1.455), which is around two the residuals are not correlated with each other; therefore, the independence of errors is not violated. Table (4.17) result also shows that the VIF values are less than 10 and the tolerance values are more than 0.05. This indicates that there is no multi-collinearity within the independent variables of the study.

Table (4.17): Multi-Collinearity Test for Main Hypothesis

No.		Tolerance	VIF	Durbin-Watson
1	Defects	0.58	1.70	1.45
2	Over Production	0.56	1.77	
3	Waiting Time	0.64	1.55	
4	Transportation	0.61	1.63	
5	Inventory	0.68	1.45	
6	Motion	0.62	1.60	
7	Extra Processing	0.69	1.43	
8	Non Utilized Talent	0.68	1.47	
9	Sustainable Development	0.62	1.59	

The Main Hypothesis:

H_{01}: Lean Six Sigma elements do not have a direct significant effect on JPMOs' BP, at $\alpha \leq 0.05$.

Multiple Regressions:

Table (4.18) shows that when regressing the nine independent variables of Lean Six Sigma together against dependent variable business performance. R^2 shows the fitness of the model for multiple regressions and explains the variance of independent variable on dependent variable. Since R^2 is 81% then the independent

variable can explain 81% of variance on dependent variable, since (R^2=0.81, F=52.46, Sig.=0.000).

Table (4.18): Results of Multiple Regressions Analysis (ANOVAa): Regressing Lean Six Sigma Variables against Business Performance.

Model	r	R^2	Adjusted R^2	F	Sig.
1	0.90[a]	0.81	0.79	52.46	0.00[b]

Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted, which states that the Lean Six Sigma elements have a direct significant effect at Jordanian Pharmaceutical Manufacturing Organizations' business performance, at (α=0.05) except extra processing and waiting time.

Table (4.19) shows the significance effect of each independent variable on dependent variable.

Table (4.19): Results of Multiple Regressions Analysis (Coefficientsa): Regressing Lean Six Sigma Variables against Business Performance:

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.21	0.22		-0.94	0.34
	Defects	0.17	0.04	0.23	4.27	0.00
	Over Production	0.10	0.04	0.13	2.34	0.02
	Waiting Time	0.07	0.03	0.10	1.94	0.054
	Transportation	0.12	0.03	0.18	3.40	0.00
	Inventory	0.14	0.03	0.18	3.72	0.00
	Motion	0.16	0.03	0.22	4.34	0.00
	Extra Processing	0.01	0.03	0.01	0.32	0.74
	Non Utilized Talent	0.08	0.03	0.12	2.39	0.01
	Sustainable Development	0.16	0.05	0.14	2.72	0.00

Dependent Variable: Business Performance

Sub-Hypothesis:

$H_{0.1}$: Defect does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of defect on business performance, since (Beta=0. 23, t=4.27, sig. 0.00, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the defect has an effect on business performance at (α≤0.05).

$H_{0.2}$: Over production does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of over production on business performance, since (Beta=0.13, t=2.34, sig. 0.02, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the over production has an effect on business performance at (α≤0.05).

$H_{0.3}$: Waiting time does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a non-significant effect of waiting time on business performance, since (Beta=0.10, t=1.94, sig.0.054, p>0.05). Therefore, the null hypothesis is accepted.

$H_{0.4}$: Transportation does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of transportation on business performance, since (Beta=0.18, t=3.40, sig. 0.00, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the transportation has an effect on business performance at (α≤0.05).

$H_{0.5}$: Inventory does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of inventory on business performance, since (Beta=0.18, t=3.72, sig. 0. 00, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the inventory has an effect on business performance at (α≤0.05).

$H_{0.6}$: Motion does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of motion on business performance, since (Beta=0. 22, t=4.34, sig. 0. 00, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the motion has an effect on business performance at (α≤0.05).

$H_{0.7}$: Extra processing does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a non-significant effect of extra processing on business performance, since (Beta=0.01, t=0.32, sig=0.74, p>0.05). Therefore, the null hypothesis is accepted.

$H_{0.8}$: Non-utilized talent does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of non-utilized talent on business performance, since (Beta=0.12, t=2.39, sig.01, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the non-utilized talent has an effect on business performance at (α≤0.05).

$H_{0.9}$: Sustainability development does not have a direct significant effect on JPMOs' BP, at α≤0.05.

Table (4.19) shows that there is a positive direct effect of non-utilized talent on business performance, since (Beta=0.14, t=2.72, sig. 00, p<0.05). Therefore, the null hypothesis is rejected and the alternative hypothesis is accepted, which indicates that the sustainability development has an effect on business performance at (α≤0.05).

From the above table (4.19), this study closes that all Lean Six Sigma variables have an effect on business performance at Jordanian Pharmaceutical Manufacturing organizations except extra processing and waiting time. The defect was holding the highest effect (Beta=0. 23, t=4.273, sig. 0.00), followed by motion variable (Beta=0. 22, t=4.34, sig. 0. 00), then inventory (Beta=0.18, t=3.72, sig. 0. 00), transportation (Beta=0.18, t=3.40, sig. 0.00), sustainability development (Beta=0.14, t=2.72, sig. 00), over production (Beta=0.13, t=2.34, sig. 0.02) then non utilized talent (Beta=0.12, t=2.39, sig.01).

Chapter Five:

Results' Discussion, Conclusion and Recommendations

5.1. Results' Discussion:

Result of this study shows that there is a significant implementation of the Lean Six Sigma element among the Jordanian pharmaceutical manufacturing organizations at Jordan. All variables of Lean Six Sigma elements have a direct significant effect at Jordanian Pharmaceutical Manufacturing Organizations' business performance except extra processing and waiting time, where the degree of implementing of the Lean Six Sigma variables are ranging from 4.01 to 4.64, with standard deviation that ranges from 0.31 to 0.54. Such results show that there is an agreement on high implementation of Lean Six Sigma variables. The mean of the total Lean Six Sigma variables is 4.34 with standard deviation 0.25 which indicates that there is an agreement on high presence of these variables. This result is supported by the previous studies, such as: Obaidullah (2005), Moosaa and Sajid (2010), Singh, et. al. (2010), finally Kumaravadivel and Natarajan (2011).

Results show that the relationships among Lean Six Sigma variables are medium to strong relationships, where r ranging between 0.215 and 0.536, except the relationship between non utilized talent and transportation, which was weak and not significant where (r=0.119, sig.=0.195). **The relationships between each variable of Lean Six Sigma and sustainable development are strong, since r ranging between 0.320 and 0.441.** The relationships among sustainable development variables are medium, since r ranging from 0.215 to 0.270. Moreover, the correlation between each Lean Six Sigma variable with business performance is strong to very strong, since r ranging from 0.425 to 0.656. Finally, the relationship between total Lean Six Sigma and business performance is very strong

where r = 0.880. This result is supported the previous studies, such as: Berty (2011), Stoiljkovi, et. al. (2011) finally Arunagiri and Babu (2013).

Results show that all Lean Six Sigma variables have an effect on business performance at Jordanian Pharmaceutical Manufacturing organizations except extra processing and waiting time. The defect was holding the highest effect (Beta=0. 23, t=4.27, sig. 0.00), followed by motion variable (Beta=0. 22, t=4.34, sig. 0. 00), then inventory (Beta=0.18, t=3.72, sig. 0. 00), transportation (Beta=0.180, t=3.402, sig. 0.001), sustainability development (Beta=0.14, t=2.72, sig. 00), over production (Beta=0.13, t=2.34, sig. 0.02) then non utilized talent (Beta=0.12, t=2.391, sig.01). This result is supported previous studies, such as: Yeh, et. al. (2011), Kuptasthien and Boonsompong (2011), Mandahawia, et. al. Goriwondo and Maunga (2012), Enoch (2013), Maleki, et. al. (2013) and Dwivedi, et. al. (2014).

5.2. Conclusion:

The result shows that there is an agreement among participants on high implementation of each Lean Six Sigma variable (defect, over production, waiting time, transportation, inventory, motion, extra processing, non-utilized talent and sustainability development), which indicates that there is an agreement on high presence of these variables in Jordanian Pharmaceutical Manufacturing Organization. Moreover, the overall result indicates that there is a significant implementation of the Lean Six Sigma among Jordanian Pharmaceutical Manufacturing Organizations. This indicates that the managers working at Jordanian Pharmaceutical Manufacturing Organization realize the importance of the implantation of the Lean Six Sigma variables.

The results also show that the relationships between Lean Six Sigma variables is medium to strong relationships, except the relationship between non

utilized talent and transportation, which is weak and not significant. **The relationships between each variable of Lean Six Sigma and sustainable development are strong too.** Moreover, the relationships among sustainable development variables are medium. Furthermore, the correlation between each Lean Six Sigma variable and business performance is strong to very strong. In addition, the relationship between total Lean Six Sigma and business performance is very strong.

Finally, the current study indicates that all Lean Six Sigma variables have an effect on Jordanian Pharmaceutical Manufacturing organizations' business performance, except extra processing and waiting time. The defect was having the highest effect, followed by motion, then inventory, transportation, sustainability development, over production and non utilized talent, respectively.

5.3. Recommendations:

In the light of the current study results the following recommendations can be drawn:

Recommendations for Jordanian Pharmaceutical Manufacturing Organizations:

1. The current study recommends using Lean Six Sigma as a tool and technique to eliminate wastes and reduce pollutions in organizations.
2. The current study advice to conduct special training courses on how to implement Lean Six Sigma for managers and other employees.
3. The current study recommends to visit and analyze separately all wastes creating manufacturing processes to be able to reduce the waste and production cost.
4. Manufacturing organizations should assign a Lean Six Sigma champion as specialists to follow Lean Six Sigma profile.

5. The current study recommends including sustainable development elements within Lean Six Sigma criteria at Jordanian Pharmaceutical Manufacturing Organization as it may affect the organizations' Business Performance.

Recommendations for Academics and Future Research:

6. The current study recommends adding sustainable development elements to lean six elements in further studies.

7. This study is directed towards Pharmaceutical industry. Further empirical research work is needed to test the degree to which the study findings can be generalized to other industries.

8. This study was conducted on Jordanian organizations. Generalizing Jordanian results to other countries is questionable. Therefore, the study recommends carrying out similar study in different countries especially Arab countries

9. Finally, there is a need to analyze data of other organizations over a longer time in order to clearly test the assumptions of the Lean Six Sigma system. The significant differences between organizations and/or industries could be explored by further studies. So, it is recommended to work out researches that compare results with other countries specially developing countries under similar assessment and assumptions.

English References:

Abu-Hameeda, A. (2013). **"The impact of Implementing Total Quality Management Standards in Building Differentiation Strategy of Jordanians Pharmaceutical Manufacturing Companies"**. Unpublished Master thesis. Middle East University.

Agus, A.; and Iteng, R. (2013). "Lean Production and Business Performance: The Moderating Effect of the Length of Lean Adoption". **Journal of Economics, Business and Management**, 1(4), 324-328.

Ahmad, S. (2013). "Service Sector Performance Management through Six Sigma". **International journal of innovative research & development**, 2(13), 346-350.

Aleem, H.; Anwar, S.; Shariff, I.; and Abdul Aziz, S. (2014). "Six Sigma Application: An Order Management System". **IOSR Journal of Humanities And Social Science**, 19(1), 95-100.

Ali, M.; Mohamadali, F.; and Milad, S. (2011). "Studying and Developing Model of Six Sigma Implementation in Companies of Yazd House of Industry and Mine". **International Business and Management**, 3(2), 22-29. www.cscanada.net.

AlSagheer, A. (2011). "Six Sigma for Sustainability In Multinational Organizations". **Journal of Business Case Studies**, 7(3), 7-16.

Amar, K.; and Davis, D. (2010). "Key elements of a Lean six sigma framework for Indonesian SMEs". **Proceedings of the 1st International Conference on Industrial Engineering and Business Management**, Yogyakarta.

Antony, J. (2009). "Reflective practice, Six Sigma vs TQM: some perspectives of leading practitioners and academics". **International Journal of Productivity and Performance Management**. 58(3), 274-279.

Antony, J. (2011). "Reflective Practice Six Sigma vs Lean some perspectives from leading academics and practitioners**". International Journal of Productivity and Performance Management**, 60(2), 185-190.

Antunes, D.; Sousa, S.; and Nunes, E. (3 – 5 July 2013). "Using Project Six Sigma and Lean Concepts in Internal Logistics." **Proceedings of the World Congress on Engineering** 2013, London, U.K, 1, 1-6.

Anuradha, Rao, D.; Khandekar, A, Arora, T.; and Kour, G. (2013). "Six Sigma implementation in software companies using DTS". **International Journal of Mathematical Archive**, 4(9), 258-263.

Arunagiri, P.; and Babu, A. (2013). "Review on Reduction of Delay in manufacturing process using Lean six sigma (LSS) systems". **International Journal of Scientific and Research Publications**, 3(2), 1-4.

Awaritoma, O. (2010). **"Performance Management in Lean Production"**. Unpublished Master thesis, Linnaeus University.

Bao, L.; Chen, N.; Shang, T.; Fang, O.; Xu, Z.; Guo, W.; and Wang, Y. (2013) "A multicenter study of the application of Six Sigma management in clinical rational drug use via pharmacist intervention". **Turkish Journal of Medical Sciences**, 43(3), 362-367.

Bashir, A.; and Al-Tawarah. A. (July 2012). "Implementation of six sigma on Corrective Maintenance Case Study at the Directorate of Biomedical Engineering in the Jordanian Ministry of Health". **Proceedings of the 2012**

International Conference on Industrial Engineering and Operations Management, Istanbul, Turkey, July 3-6, 2012, 2508-2516

Baveja, N.; and Jain, A. (2013). "Role of Human Resources in Six Sigma". **Atharva A Journal of Management Research**, 5(1), 46-53.

Berty, E. (October 2011). **"Cigarette Reject Rate Reduction using a Lean Six Sigma Approach**", Unpublished Master thesis. Royal Institute of Technology.

Bharti, P.; Khan, M.; and Singh, H. (2011). "Six Sigma Approach for Quality Management in Plastic Injection Molding Process: A Case Study and Review". **International Journal of Applied Engineering Research**, 6(3), 303-314.

Boldt, E.; and Franchetti, M. (2013). "Total Sustainability Assessments for Manufacturing Operations Using the Lean Six Sigma Approach". **Science Journal of Environmental Engineering Research,** 2013.

Brundtland, G.H. (1987) .World commission on environment and development: our common future. Oxford University Press, Oxford.

Cavallini, A.G. (2008). **"Lean Six Sigma as a Source of Competitive Advantage".** Unpublished Master thesis, Brigham Young University.

Chakraborty, A.; and Tan, K. (2012). "Case study analysis of Six Sigma implementation in service organizations". **Business Process Management Journal**, 18(6), 992-1019. www.emeraldinsight.com/1463-7154.htm.

Chang, T. (2002). "**Six Sigma: a framework for small and medium sized enterprises to achieve total quality"**. Unpublished doctoral dissertation, Cleveland State University, Ohio, USA.

Chetiya, A.R.; and Sharma, S. (2014). "An Analysis of Predictor Variables for Operational Excellence through Six Sigma". **Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management** Bali, Indonesia, January 7-9 2014, 1750-1757.

Chinvigai, C.; Dafaoui, E.; and El Mhamedi, A. (May 2010). "Iso 9001: 2000/2008 And Lean-Six Sigma Integration Toward To Cmmi-Dev For Performance Process Improvement". **8th International Conference Of Modeling And Simulation** - Mosim'10 - May 10-12, 2010 - Hammamet – Tunisia, 3-9.

Chung, C. (September 2013). "An Application of Six Sigma Methodology in Agarwood Tissue Culture". **Open Journal of Optimization**, 2(3), 80-88.

Clegg, B. (2007). "Maximising the Economic and Social Impact of Six Sigma". Production and Operations Management (POMS), May 4th-7th. Texas, USA.

Dahman, T. (2013). "**The Impact of Supply Chain Management to Organization Performance**". Unpublished Master Thesis, Middle East University.

Dakov, I.; and Novkov, S. (2007). "Assessment of the lean production effect on the sustainable industrial enterprise development". **Business: theory and practice**, 8(4), 183-188.

Darabi, Y. (2007). **"The impact of Market orientation on business performance and website adoption: a study among Iranian SMEs".** Unpublished Master thesis, Lulea University of Technology.

DelliFraine, J.L.; Langabeer, J.R.; and Nembhard, I.M. (2010). "Assessing the Evidence of Six Sigma and Lean in the Health Care Industry". **Q Manage Health Care**, 19(3), 211-225.

DeRuntz, B.; and Meier, R. (2010). "An Evaluative Approach to Successfully Implementing Six Sigma". **The Technology Interface Journal**, 10(3), 1-9.

Desale, S.V.; and Deodhar, S.V (March 2014). "Identification And Eliminating Waste In Construction By Using Lean And Six Sigma Principles". **International Journal of Innovative Research In Science, Engineering And Technology**, 3(4), 285-296.

Dey, S. (2013). "Transforming Washington DC's Parking Meter Program Using Lean Six Sigma Based Asset Management", **TRB 2014 Annual Meeting**, 1 21.

Dhawan, S. (November - December 2013). "Professionalism among the Pupil Teachers: A six-sigma Approach in Teacher Education". **Scholarly research journal for interdisciplinary studies**, 2(4), 544-557.

Dileep, G.; and Rau, S. (October 2010). "Patient Satisfaction As An Indicator Of Quality Care.-A Study With Reference To Six Sigma Implementation In Medium Scale Hospitals." **National Journal on Advances In Computing And Management,** 1(2), 27-33.

Divoky, J. (2008). "Factors Affecting Six Sigma Project Selection In The Information Systems/Information Technology Arena". **Review of Business Information Systems**, 12(4), 13-20.

Dwivedi, V.; Anas, M., and Siraj. M. (2014). "Six Sigma; As Applied in Quality Improvement for Injection Moulding Process." **International Review of Applied Engineering Research,** 4(4), 317-324.

Edaily, F. (2014). "**The Possibility of Applying Six Sigma and its Role in Cost Reduction and Increasing Competition – Applied Study of Advanced**

Technology Companies of Recycling Used Materials An Empirical Study". Unpublished Master Thesis, Zarqa University.

Enoch, O. K. (October, 2013). "Lean Six Sigma Methodologies and Organizational Profitability: A Review of Manufacturing SMEs in Nigeria". **American Journal of Industrial and Business Management**, 3, 573-582. http://dx.doi.org/10.4236/ajibm.2013.36066 Published Online (http://www.scirp.org/journal/ajibm).

Fontaine, M. (2013). Corporate Social Responsibility and Sustainability: The New Bottom Line? ***International Journal of Business and Social Science,*** 4(4):110-119.

Furterer, S.L. (2004). **"A framework roadmap for implementation lean six sigma in local government entities".** Unpublished doctoral dissertation. University of Central Florida, Orlando, USA.

Goh, T.N. (2011). "Six Sigma as a Change Agent in Quality Management". **The 55th EOQ Congress and World Quality Congress**, Budapest, June 20-23, 2011, 1-10.

Goriwondo, W.M.; and Maunga, N. (2012). "Lean Six Sigma Application for Sustainable Production: A Case Study for Margarine Production in Zimbabwe". **International Journal of Innovative Technology and Exploring Engineering (IJITEE)**, 1(5), 87-96.

Gupta, N. (March-April 2013). "An Overview on Six Sigma: Quality Improvement Program". **International Journal Of Technical Research And Applications,** 1(1), 29-39.

Habidin, N.F.; Yusof, S.M.,;Che Omar, C.Z., Mohamad, S.I.S.; Janudin, S. E.; and Omar, B. (2012). "Lean Six Sigma Initiative: Business Engineering

Practices and Performance in Malaysian Automotive Industry". **IOSR Journal of Engineering**, 2(7), 13-18.

Hai, H.; and Mai, N. (2014). "An Exploratory Study of the Relationship between Lean Production and Corporate Social Responsibility in Vietnamese SMEs". **VNU Journal of Science: Economics and Business** 30(2), 28-38.

Hajikordestani, R.N. (2007). "**Taxonomy of Lean Six Sigma Success Factors for Service Organizations"**, Unpublished Master thesis. University of Central Florida.

Huang, Y. (2013). **Applying Linear Programming Method in Six Sigma Approach to Develop a Truck Planning Tool**. Unpublished Master thesis. University of Wisconsin-Stout.

Jaakkola, M. (2006). **"Strategic marketing and its effect on business performance: moderating effect of country-specific factors".** Unpublished Master thesis, Helsinki **University of Technology.**

Jaglan, P.; Kaushik, P.; and Khanduja, D. (October-December, 2011). "Six Sigma: A Road Map For Smes". **International Journal of Advanced Engineering Technology,** 2(4), 461-464.

Jawadeh, S. (2011). **"Feasibility of Application of Six Sigma and its role in improving the quality of health services in the Government Hospitals In Gaza Strip From The perspective Of Senior management".** Unpublished Master Thesis, The Islamic University.

Jayaraman, P.; Kannabiran, K.; and Kumar S.A.V. (2013). "A Six Sigma Approach for Software Process Improvements and its Implementation". **International Journal of Mining, Metallurgy & Mechanical Engineering (IJMMME)**, 1(3), 228-232.

Jovanovic, R.; Delic, M.; Kamberovic, B.; Vulanovic. S.; and Radlovacki. V. (2013). "Planning the use of Lean Six Sigma as a framework for blood bank management improvements". **International Journal of Industrial Engineering and Management (IJIEM),** 4(4), 237-244.

Junankar, A.A.; Gupta, P.M.; Sayed, A.R.; and Bhende, N.V. (2014). "Six Sigma Technique for Quality Improvement in Valve Industry". **IJREAT International Journal of Research in Engineering & Advanced Technology**, 2(1), 1-5.

Kabir, M.; Boby, S.; and Lutfi, M. (2013). "Productivity Improvement by using Six-Sigma". **International Journal of Engineering and Technology**, 3(12), 1045-1073.

Kateeb, Muhanad. (2009). **"The Extent unplanned Six Sigma using impact in Housing bank for trade and finance"**. Unpublished Master Thesis, Middle East University.

Kaushik, P. (2012). "Six Sigma look at in education: a managing perception". **International Journal of Research in IT & Management**, 2 (6), 49-59.

Kazemi, M.; and Nikkar, A. (2014). "Classification criteria for selecting Six-sigma projects". **Applied mathematics in Engineering, Management and Technology,** 2(3), 397-403.

Khaidir, N.A.; Habidin, N.F.; Ali, N.; Shazali, N. A., and Noor Jamaludin, N. H. (January – February 2013). "Six Sigma Practices and Organizational Performance in Malaysian Healthcare Industry." **IOSR Journal of Business and Management (IOSR-JBM),** 6(5), 29-37. www.iosrjournals.org.

Khaidir, N.A.; Habidin, N.F.; Jamaludin, N.H.; Shazali, N.A.; and Ali, N. (2014). "Investigation of Six Sigma Practices and Process Innovation for Malaysian

Healthcare Industry". **International Journal of Innovation and Applied Studies**, 5(2), 131-138.

Khandekar, A.S.; and Sulakhe, V.N. (January 2014). "Six Sigma – The Revival of Tqm". **International Journal of Medical Engineering and Robotics Researches.** 3(1), 50-58.

Koripadu, M.; and Subbaiah, K.V. (February 2014). "Problem Solving Management Using Six Sigma Tools & Techniques". **International Journal of Scientific & Technology Research,** 3(2), 91-93.

Kosina, J. (2013). "The process to estimate economical benefits of six sigma projects. "**Quality Innovation Prosperity**, 17(1), 16-27.

Krambia-Kapardis, M.; and Ioannou, A. (2011). "Six sigma: The panacea to sustainability". Journal of Modern Accounting and Auditing, 7(2), 158-172.

Kumar, V.M.; and Kumar, M.V. (April 2013). "Six Sigma Approach to Quality Assurance in Global Supply Chains". **International Journal of Science and Research,** 2(4), 560-562.

Kumara, V.; and Khandujaa, R. (August 2013). "Application of Six-Sigma Methodology in SSI: A Case Study". **International Journal of Current Engineering and Technology**, 3(3), 971-976.

Kumaravadivel, A.; and Natarajan, U. (2011). "Empirical study on employee job satisfaction upon implementing six sigma DMAIC methodology in Indian foundry – A case study". **International Journal of Engineering, Science and Technology**, 3(4), 164-184.

Kuptasthien,N.; and Boonsompong, T. (2011). "Reduction of Tombstone Capacitor Problem by Six Sigma Technique: A Case Study of Printed Circuit Cable Assembly Line". **Proceedings of the 2011 IEEE ICQR**, 546-550.

Kuptasthien,N.; and Boonsompong, T. (2011). "Reduction of Tombstone Capacitor Problem by Six Sigma Technique: A Case Study of Printed Circuit Cable Assembly Line". **Proceedings of the 2011 IEEE ICQR**, 546-550.

Lancaster, J. (2011). "**Lean and Six Sigma in Hospitality Organizations: Benefits, Challenges, and Implementation**". Unpublished Master thesis. University of Nevada, Las Vegas.

Leonard, T.; Schneider J. (2004). "Integrated sustainability in the pharmaceutical industry". **International Journal for sustainable business,** 11(5), 119-128.

Maleki, M.; Riahi, L.; Dashti, T.; and Karbasian, S. (2013). "Reducing Waiting Time in Patients Undergone Spinal Surgeries at Operation's room of Shohada-ye-Tajrish Hospital using Six Sigma Model". **New York Science Journal**, 6(12), 136-141.

Mandahawi, N.; Al-Shihabi, S.; Abdallah, A.A.; and Alfarah, Y.M. (2010). "Reducing waiting time at an emergency department using design for Six Sigma and discrete event simulation". **Int. J. Six Sigma and Competitive Advantage**, 6(1-2), 91-104.

Mandahawia, N.; Fouad, R.H.; Obeidat, S. (2012). "An Application of Customized Lean Six Sigma to Enhance Productivity at a Paper Manufacturing Company". **Jordan Journal of Mechanical and Industrial Engineering**, 6(1), 103-109.

Mezouari, S.; Bouaouda, Z.; and Drissi, H. (2013). "Lean Six Sigma in Africa: Fad or real solution of competitiveness.?". **International Journal of Management & Information Technology**, 6(3), 861-866.

Micu, D. (15-16 November 2012). "Six Sigma: Tools and Methodology For The Clothing Industry". **Proceedings Of The 6th International Management**

Conference Approaches In Organizational Management, Bucharest, Romania, 505-510.

Moosaa, K.; and Sajid, A. (July 2010). "Critical analysis of Six Sigma implementation". **Total Quality Management & Business Excellence**, 21(7), 745-759.

Mousa, A. (2013). "Lean, six sigma and lean six sigma: Overview". **International Journal of Scientific & Engineering Research**, 4(5), 1137-1153.

Muhareb, T.M.; and Graham-Jones J. (2014). "Using Lean Six-Sigma in the Improvement of Service Quality at Aviation Industry: Case Study at the Departure Area in KKIA"**. International Journal of Social, Human Science and Engineering,** 8(1), 1-7.

Muthukumaran, G.; Venkatachalapathy, V.S.K.; and Pajaniradja, K. (March - April 2013). "Impact on integration of Lean Manufacturing and Six Sigma in various applications - a review". **Journal of Mechanical and Civil Engineering (IOSR-JMCE)**, 6(1), 98-101.

Mutia, P.M.; and Nyambegera, S.M. (2014). "Six Sigma Approach for Quality Improvement and its Future in Kenyan Organizations: a Research Agenda". **International journal of Science Commerce and Humanities**, 2(1), 125-136.

Ngo, S.T.Q.N. (2010). "**The Relationship between Lean Six Sigma and Organizational Performance: An Empirical Investigation**". Unpublished Master thesis. Lincoln University.

Niemeijer, G.C.; Trip, A.; Ahaus, K. T. B., Does, R. J. M. M., and Wendt, K. W. (September 2010). "Quality in Trauma Care: Improving the Discharge

Procedure of Patients by Means of Lean Six Sigma". **The Journal of Trauma Injury, Infection, and Critical Care**, 69(3), 614-619.

Obaidullah, H. K.K. (2005). "A Study of Six Sigma Implementation and Critical Success Factors". **Pakistan's 9th International Convention on Quality Improvement**, 1-12.

Olsen, E.O. (2004). **"Lean Manufacturing Management: the relationship between practice and firm level financial performance".** Unpublished doctoral dissertation, The Ohio State University.

Parast, M.M. (2011). "The effect of Six Sigma projects on innovation and firm performance". **International Journal of Project Management**, 29 (1), 45-55.

Percin, S.; and Kahraman, C. (October 2010). "An Integrated Fuzzy Multi-Criteria Decision-Making Approach for Six Sigma Project Selection". **International Journal of Computational Intelligence Systems**, 3(5), 610-621.

Pokharkar, D.; Jadhav, V.; Gholve, S.; and Vilasrao Kadam. (2010). "Six Sigma: Golden Opportunity for Pharmaceutical Industry". **International Journal of PharmTech Research**, 2(2), 1160-1164.

Pranoto, S.; and Nurcahyo, R. (2014). "Implementation of Integrated System Six Sigma and Importance Performance Analysis for Quality Improvement of HSDPA Telecommunication Network and Customer Satisfaction". **Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management** Bali, Indonesia, January 7 – 9 2014, 1544-1553.

Pulakanam, V.; and Voges, K.E. (November 2010). "Adoption of Six Sigma by organizations: What Has Empirical Research Discovered?" **International Review of Business Research Papers,** 6(5), 149-163.

Radhakrishnan, R. and Balamurugan, P. (November 2011). "Construction of Control Charts Based On Six Sigma Initiatives for the Number of Defects and Average Number of Defects per Unit". **Journal of Modern Applied Statistical Methods,** 10(2), Article 22, 639-645.

Radhakrishnan, R.; and Sivakumaran, P. K. (2010). "Construction and Selection of Tightened-Normal-Tightened Schemes of Type TNT-(n1, n2; c) indexed through Six Sigma Quality Levels". **Proceedings of the 2010 International Conference on Industrial Engineering and Operations Management** Dhaka, Bangladesh, January 9-10 2010, 1-6.

Ravet, D. (2012). Lean production: the link between supply chain and sustainable development in an international environment. **Colloque Franco-Tch□eque Trends in international business**, June 2011, Lyon, France. 1-20.

Reddy, G.P.P.; and Reddy, V.V. (2010). "Process improvement using Six Sigma – a case study in small scale industry". **Int. J. Six Sigma and Competitive Advantage**, 6(1-2), 1-11.

Reijns, T.J.F. (2010). "**The advantages and limitations of Lean Six Sigma in process (re)design: Combining continuous improvement methods to align the product characteristics with the customer's requirements**". Unpublished Bachelor Thesis, Tilburg University.

Reosekar, R.S.; and Pohekar, S.D. (August 2013). "Design and Development Of Six Sigma Implementation Framework For Indian Industries". **International**

Journal of Engineering, Business and Enterprise Applications (Ijebea), 5(2), 147-152.

Rusko, M.; and Kralikova, R. (2011). "Application of Six Sigma Method To EMS Design", **research papers, faculty of materials science and technology in Trnava Slovak University of technology in Bratislava**, 30, 39-44

Rusko, M.; and Kralikova, R. (2011). "Application of Six Sigma Method To EMS Design", **research papers, faculty of materials science and technology in Trnava Slovak University of technology in Bratislava**, 30, 39 – 44.

Salminen, J. **(2005). "Measuring performance and determining success factors of construction sites"**. Unpublished Doctoral Dissertation, Helsinki University of Technology.

Sekaran, U. (2003). **Research Methods for Business: A Skill Building Approach.** 4th Edition. John Wiley and Sons (ASIA) Pte Ltd. Singapore.

Sharabati, A.A. (2008). **The Effect of Intellectual Capital on the Performance of Pharmaceutical Manufacturing Organizations in Jordan**. Unpublished Doctorate thesis. Amman Arab University.

Sharma, S.; Bhardwaj, D.; and Kumar. V. (July 2013). "Six Sigma Approach: Application, Benefits and Scope." **International Journal of Medical Engineering and Robotics Researches**, 2(3), 365-370.

Singh, B.; Garg, S.K.; Sharma, S.K.; and Grewal, C. (2010). "Lean implementation and its benefits to production industry". **International Journal of Lean Six Sigma**, 1(2), 157-168.

Soare, P. (15-16 November 2012). "Opportunities For Driving Continuous Improvement Through TQM, Lean And Six Sigma Within Business Process Management". **Proceedings of the 6th International Management**

Conference "Approaches In Organisational Management", Bucharest, Romania. 193-202.

Stoiljkovi, V.; Trajkovi, J.; and Stoiljkovi, B. (2011). "Lean six sigma sample analysis process in a microbiology laboratory". **J Med Biochem**, 30(4), 346–353.

Subramaniyam, P.; Srinivasan, K.; and Prabaharan, M. (2011). "An Innovative Lean Six Sigma Approach for Engineering Design". **International Journal of Innovation, Management and Technology**, 2(2), 166-170.

Sunal, G.; and Evangeliou, E. (2012). **"Six Sigma in Project Management Implementation of Six Sigma at Klesman Electric"**. Unpublished Master thesis.

Tahir, T. (2010). "The voice of customer (voc table): understanding customer needs for six sigma process." **Technical Journal of LBSIMDS**, 1(1), 101-106.

Varzandeh, J.; and Kamy, F. (February 2010). "Comparative and Strategic Role of ERP in "Six Sigma" Quality". **Proceedings of ASBBS,** 17(1), 511-517.

Venkatesh, N.; Sumangala, C.; and DSouza, L. (August 2013). "Outcome of six sigma implementation a case study of manufacturing industry". **International Journal of Innovative Research in Science, Engineering and Technology**, 2(8), 4076-4082. www.ijirset.com

Vijay, S.M. (2012). "Integration of six sigma with project management". **International Journal of Advanced Engineering Technology**, 3(1), 29-32.

Vilas-Boas, R.D. S. (2009). "**International diversification: entry mode, location decision and performance**". Unpublished Doctoral Dissertation, University of Salamanca.

Villa, D. (2010). "Automation Lean, Six Sigma: Synergies For Improving Laboratory Efficiency". Med Biochem, 29(4), 339-348.

Waghmare, A.C.; Parikh, R.H.; Gajbhiye, P.R.; Athavale, S.A.; and Pal, S.D. (2013). "Application Of Six Sigma Technique For Quality And Safety Improvement In A Hot Rolling Industry". **Global Journal of Engineering, Design and Technology**, 2(3), 8-11.

Weinstein, L. (2010). "A discussion of the suitability of Six Sigma techniques in non-profit arts and culture-oriented organizations", **Asia Pacific Journal of Arts and Cultural Management**, 7(1), 569-583.

Xu, Y.; Zhang, F.; and Ye.; X. (2013). "Case Study on the Lean Six Sigma Management for Information Technology Service Management Project of G Commercial Bank**". Technology and Investment**, 4(2), 76-84. http://dx.doi.org/10.4236/ti.2013.42009.

Yeh, C.W.; Shyu, C.S.; Hsu, C.H.; and Cheng, K. M. (2011). "Applying six sigma to promote self-management ability in health clubs". **African Journal of Business Management**, 5(4), 1365-1373.

Yeh, H.L.; Lin, C.S.; Su, C.T.; and Wang, P.C. (December 2011). "Applying lean six sigma to improve healthcare: An empirical study". **African Journal of Business Management**, 5(31), 12356-12370. http://www.academicjournals.org/AJBM

Yuksel, H. (2012). "Evaluation of the Success of Six Sigma Projects by Data Envelopment Analysis". **International Journal of Business and Management**, 7(13), 75-84.

Yusr, M. M.; Othman, A.; and Mokhtar, S. S. (2011). "Innovation and six sigma foundation from the perspective of the absorptive capacity theory".

International Conference on management (ICM) proceeding, 1233-1274.

Zaman, M.; Pattanayak, S.K.; and Paul, A. (2013). "Study of feasibility of six sigma implementation in a manufacturing industry: a case study". **International Journal of Mechanical and Industrial Engineering (IJMIE)**, 3(1), 96-100.

Zamri, F.; Hibadullah, S. N.; Fuzi, N. M.; and Desa, A. F. (2013). "Green Lean Six Sigma and Financial Performance in Malaysian Automotive Industry". **Business Management and Strategy**, 4(1), 97-106.

Zhang, Q.; Irfan, M.; Zhu, X.; and Khattak, M. (2013). "Six Sigma in Synergy with Risk Management". **European Journal of Business and Management**, 5(12), 184-188.

Zu, X.; Fredendall, L.; and Douglas, T. (2008). "The evolving theory of quality management: The role of Six Sigma". **Journal of Operations Management,** 26(5), 630-650.

Appendices:

Appendix (1): Panel of Referees Committee.

No.	Name	Qualification	Organization
1	Prof. Mohammad Al No'imi	Ph. D. Management	Middle East University
2	Prof. Kamil Moghrabi	Ph. D. Management	Middle East University
3	Dr. Mohammad Khir Abu Zeid	Ph. D. Management	Middle East University
4	Dr. Amjad Tweqat	Ph. D. Management	Middle East University
5	Dr. Ali Abbas	Ph. D. Management	Middle East University
6	Dr. Abdul Bari Dorah	Ph. D. Management	Middle East University
7	Dr. Ahmad Ali Saleh	Ph. D. Management	Middle East University
8	Dr. Nidal Al Salihi	Ph. D. Management	Middle East University
9	Dr. Haitham Hijazi	Ph. D. Management	Middle East University
10	Dr. Hanadi Salameh	Ph. D. Marketing	Middle East University
11	Dr. Ahmad Al Zamel	Ph. D. Marketing	Middle East University
12	Dr. Ghazi Samawi	Ph. D. Management	GJU
13	Dr. Wa'd Nsoor	Ph. D. Management	Hashemite University
14	Dr. Mahmoud Al Omari		GM of research and innovation center at JPM
15	Eng. Mohammad A. Tarabia		Executive Manufacturing Manager
16	Mais Dabain		Consultant

Appendix (2): List of Members of the Jordanian Association of Pharmaceutical Manufacturers 2015.

No.	Company	Year Established	Type
1	The Arab Pharmaceutical Manufacturing Co. LTD (APM)	1962	Public
2	Dar Al Dawa Development and Investment Co. (DAD)	1975	Public
3	Hikma Pharmaceuticals (HIKMA)	1977	Pubic
4	Jordanian Pharmaceutical Manufacturing Co. PLC (JPM)	1978	Public
5	Arab Center for Pharmaceutical and Chemical (ACPC)	1983	Public
6	United Pharmaceutical (UPM)	1989	Private
7	Amman Pharmaceutical Industries Co. (API)	1989	Private
8	Ram Pharmaceutical Industries Co. Ltd (RAM)	1992	Private
9	Hayat Pharmaceutical Industry (HPI)	1993	Public
10	Middle East Pharmaceutical Manufacturing Co. (MIDPHARMA)	1993	Public
11	Pharma International (INTER)	1994	Private
12	Jordan Sweden Medical and Sterilization Co.	1996	Private
13	TQ PHARMA	2007	Private
14	Jordan River Pharmaceutical Industries Co. (JoRiver)	1999	Private

Appendix (3): Panel of Referees Committee Letter (English Version)

The Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance.

Dear Professor:

The lean six sigma is considered as a tool for modern measurement and management of business performance to achieve efficiency and effectiveness. It's also one of the best tools that are used to measure the quality of products, in which managers of manufacturing companies and other institutions are trying to find the best ways to measure and assess the quality of their products and linking it to the financial and non-financial performance, in order to improve and develop the overall business performance.

The purpose of this master thesis is to know the effect of Lean Six Sigma on the Jordanian pharmaceutical Manufacturing Organizations' business performance.

You have been chosen and invited to participate as one of the panel judge for this master thesis questionnaire. Your guidance and participation in this research is highly appreciated.

Please put down your suggestions and recommendations onto the questionnaire, adding any comments you wish about any particular issues that you consider of importance. It is important to state that the design and analysis of this study concentrates on the firm.

Again, thank you for your participation and guidance, and if you have any questions or concerns please do not hesitate to contact (079) 5684078.

Thank you in advance for your help.

Researcher: William Al Kunsol

Supervisor: Dr. Abdulaziz AlSharbati

Appendix (4): Participants Letter (English Version)

The Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance.

Dear Participant:

The lean six sigma is considered as a tool for modern measurement and management of business performance to achieve efficiency and effectiveness. It's also one of the best tools that are used to measure the quality of products, in which managers of manufacturing companies and other institutions are trying to find the best ways to measure and assess the quality of their products and linking it to the financial and non-financial performance, in order to improve and develop the overall business performance.

The purpose of this master thesis is to know the effect of Lean Six Sigma on the Jordanian pharmaceutical Manufacturing Organizations' business performance.

I hope that you will assess the paragraphs of this questionnaire, which his words are measured by Fifth Likert scale (1 to 5) and give your suggestions about it, and add any comments about the topics that you feel is important for this topic and / or for the pharmaceutical industry, and I'm ready to take your recommendations into consideration when rewriting and revising the questionnaire.

We appreciate your participation and guidance for the benefit of this study.

I reiterate my thanks for your participation and your guidance, and if you have any question or comment, please call (00962795684078).

Thank you for your attention.

Researcher: William Hanna Al-Kunsol

Supervisor: Dr. Abdulaziz AlSharbati

Appendix (5): Thesis Questionnaire (English Version)

Questionnaire of the Effect of Lean Six Sigma on the Jordanian Pharmaceutical Manufacturing Organizations' Business Performance.

Part one: Demographic information

Gender: □Male □Female

Age (years): □25 – 35 □ above 35 – 45 □above 45 - 55 □above 55

Education: □Diploma or less □Bachelor □Master □Doctorate

Position: □ High level □Middle level □ Low level

Division: □ Production □R&D □ Marketing □Others

Years of experience: □ Less or equal 5 □Above 5 – 10 □ Above 10 – 15 □Above 15

The following 67 items tap into Lean Six Sigma and its effect on company's business performance. Please, answer these questions based on actual and current situation and not on beliefs.

[1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree] based on how you feel about the statement.

Defects:

1.	The company is keen on the quality of raw materials	1	2	3	4	5
2.	The company uses the appropriate means of transportation	1	2	3	4	5
3.	The company is committed to follow the instructions and formulas for manufacturing such as mixing in approved precise proportions of materials	1	2	3	4	5
4.	The company is keen to follow in time the production processes	1	2	3	4	5
5.	The company is keen to pay attention to the cleanliness of the internal environment	1	2	3	4	5

Over Production:

6.	The company is keen on the proper appreciation of the order quantity	1	2	3	4	5
7.	The company emphasizes the orders before starting the production	1	2	3	4	5
8.	The company is keen to ensure the effectiveness and safety of the product compared to competitors' products	1	2	3	4	5
9.	The company is keen on estimating raw materials required for the production	1	2	3	4	5
10	The company is keen to manage machines efficiently and effectively	1	2	3	4	5

Waiting Time:

11	The company works on the availability of raw materials in a timely manner	1	2	3	4	5
12	The company is keen on the effectiveness of the production processes	1	2	3	4	5
13	The company emphasizes on the periodically maintenance of machinery	1	2	3	4	5
14	The company set priorities for manufacturing	1	2	3	4	5
15	The company takes into consideration the speeding up decision-making when the need arises	1	2	3	4	5

Transportation:

16	The company is keen to provide alternatives for transport operations in case of emergency	1	2	3	4	5
17	The company confirms the accuracy of the packaging operations	1	2	3	4	5
18	The company is committed to the customs procedures required to facilitate transfers	1	2	3	4	5
19	The company is keen on using appropriate means of transportation	1	2	3	4	5
20	The company owns the appropriate skills for workers to carry out handling during transport	1	2	3	4	5

Inventory:

21	The company is keen to provide the appropriate storage conditions (temperature and humidity)	1	2	3	4	5
22	The appropriate skills for workers to perform the storage business become available in the company	1	2	3	4	5
23	The company is keen to provide the appropriate handling tools (forklift)	1	2	3	4	5
24	The company emphasizes the appropriate arrangement of the material inside the warehouse	1	2	3	4	5
25	The company is committed to conduct the various inventories	1	2	3	4	5

Motion:

	The company is keen on having a standard work (standardization)	1	2	3	4	5
26	The company is keen to reduce the movements of workers that are not connected with work	1	2	3	4	5
27	The company is keen on a good arrangement for the factory to reduce excess movements	1	2	3	4	5
28	The company is keen to use appropriate internal means of transportation between sections and departments	1	2	3	4	5
29	The company is keen to employ the appropriate number of workers	1	2	3	4	5

Extra processing

30.	The company is working to adjust the time of the production process	1	2	3	4	5
31.	The company emphasizes the flow of required procedures	1	2	3	4	5
32.	The company is committed to the production scheduling.	1	2	3	4	5
33.	The company describes the working procedures for workers	1	2	3	4	5
34.	The company is keen on the appropriate use of statistical aspects	1	2	3	4	5

Non Utilized Talent:

35.	The company works to discover talent	1	2	3	4	5
36.	The company works to develop and train employees on the skills needed	1	2	3	4	5
37.	The company encourages new ideas	1	2	3	4	5
38.	The company encourages creativity and innovation through incentives system.	1	2	3	4	5
39.	The Company has an available research center that supports research and development	1	2	3	4	5

Sustainable Development:

Environmental Responsibility

40.	The company is interested in reducing the environmental pollution	1	2	3	4	5
41.	The company achieved an optimum exploitation of resources, especially non-renewable resources.	1	2	3	4	5
42.	The company owns a variety of means to deal with the surrounding environment-friendly products	1	2	3	4	5
43.	The company provides guidance on the use of products and ways to get rid of them and their residues	1	2	3	4	5
44.	The Company uses non-harmful products (eco-friendly) and set forth in the Good Manufacturing.	1	2	3	4	5
45.	The company recycles some materials	1	2	3	4	5

Economic Responsibility

46.	The company is committed to government laws related to economic aspect	1	2	3	4	5
47.	The company is seeking to pay tax dues on time specified	1	2	3	4	5
48.	The company contributes to the local economy by bringing hard currency	1	2	3	4	5
49.	The company helps in building infrastructure such as bridges…etc	1	2	3	4	5
50.	The company contributes to the employment of local labor	1	2	3	4	5

Social Responsibility

51.	The company is hiring people with special needs	1	2	3	4	5
52.	The company owns programs help support education in the community	1	2	3	4	5
53.	The company owns a budget for social work as a financial support such as community donating to charity	1	2	3	4	5
54.	The company has binding laws for moral behavior	1	2	3	4	5
55.	The company has plans for a health awareness to the community courses	1	2	3	4	5
56.	The Company follows the binding laws to ensure the safety of workers from the product	1	2	3	4	5

Business Performance:

57.	The company gets the best productivity of the individual	1	2	3	4	5
58.	The company has the least cost to produce per unit compared with competitors	1	2	3	4	5
59.	The company has the least work rotation (staff)	1	2	3	4	5
60.	The quality of products match with competitors	1	2	3	4	5
61.	The company has continually increase in sales	1	2	3	4	5
62.	The company achieves better profit compared with competitors	1	2	3	4	5
63.	The market value of the company's shares increase on an annual basis	1	2	3	4	5
64.	Return on investment commensurate with return on the industry	1	2	3	4	5
65.	The Company manages cost effectively	1	2	3	4	5
66.	The company has an exceptional position among competitors	1	2	3	4	5

Appendix (6): Panel of Referees Committee Letter (Arabic Version)

استبيانة حول أثر الحيود السداسي الرشيق على أداء أعمال شركات صناعة الأدوية الأردنية

حضرة الأستاذ الفاضل:

يعتبر الحيود السداسي الرشيق اداة من الادوات الحديثة في عالم الاعمال لتحقيق الكفاءة والفاعلية. وهي تعتبر من أفضل الأدوات التي تستخدم لقياس جودة المنتجات للشركات. حيث يحاول المديرين بالشركات الصناعية والمؤسسات الأخرى إيجاد أفضل الطرق لقياس وتقييم جودة منتجاتهم وربطها بالأداء المالي وغير المالي، من أجل تحسين وتطوير أداء الشركات.

إن غرض رسالة ماجستيرهذه هو معرفة أثر الحيود السداسي الرشيق في أداء أعمال شركات صناعة الأدوية الأردنية.

أرجوا من حضرتكم التكرم بتقييم فقرات هذا الاستبيان الذي ستقاس عباراته بواسطة مقياس لكرت الخماسي (من 1 إلى 5) وبتزويدي باقتراحاتكم بشأنه، وإضافة أي تعليقات حول المواضيع التي ترونها هامة لهذه الرسالة و/أو لصناعة الأدوية، وأنا على أتم الاستعداد للأخذ بتوصياتكم عند إعادة كتابة وتعديل الاستبيان. وإننا نقدر اشتراككم وتوجيهاتكم لصالح هذه الدراسة.

أكرر شكري لاشتراككم وتوجيهاتكم، وإذا كان لديكم أي استفسار أو ملاحظة، الرجاء الاتصال على الرقم (00962795684078).

وشكرا لكم على اهتمامكم.

الباحث: وليم حنا القنصل
المشرف: عبد العزيز الشرباتي

Appendix (7): Participants Letter (Arabic Arabic)

استبيانة حول أثر الحيود السداسي الرشيق على أداء أعمال شركات صناعة الأدوية الأردنية

حضرة المشارك العزيز:

يعتبر الحيود السداسي الرشيق أداة من الأدوات الحديثة في عالم الاعمال لتحقيق الكفاءة والفاعلية. وهي تعتبر من أفضل الأدوات التي تستخدم لقياس جودة المنتجات للشركات. حيث يحاول المديرين بالشركات الصناعية والمؤسسات الأخرى إيجاد أفضل الطرق لقياس وتقييم جودة منتجاتهم وربطها بالأداء المالي وغير المالي، من أجل تحسين وتطوير أداء الشركات.

إن غرض رسالة ماجستيرهذه هو معرفة أثر الحيود السداسي الرشيق في أداء أعمال شركات صناعة الأدوية الأردنية.

أرجو من حضرتكم التكرم َبإكمال استِبْانة الحيود السداسي الرشيق لشركَتِكَم والتي تَحتوي على 67 فقرة، ونَتَوَقَّعُ أنْ تَسْتَغْرِقَ تَعبئتُها حَوَالي 15 دقيقة. وَإذْ وَنُقَدِّرُ اشْتِرَاكَكَ مَعَنَا فِي هذِهِ ألدِّرَاسَةُ عِلْمًا أنَّ الإجاباتِ سرّيةٌ وسوف تُسْتَخْدَمُ لأغْرَاضِ البَحْث فقط.

الرَّجَاءُ التأكّد من إكمال الإجابات على جميع الفقرات في هذة ألاستِبْانة. وَإذا رَغِبْتُم في مُتَابَعَة هذا البحثِ فَسَتَكُونُ نتائج الدِّرَاسَةِ متوفرةَ لَكُمْ إنْ طَلَبْتُم.

أُكَرِّرُ شُكْري لاشتراككم ولتوجيهاتكَم، وإذا كان لديكم أي استفسار أو ملاحظة، الرجاء الاتصال على الرقم (0795684078).

الباحث: وليم حنا القنصل
المشرف: عبد العزيز الشرباتي

Appendix (8): Thesis Questionnaire (Arabic Version)

استبيانة حَولَ أثر الحيود السداسي الرشيق في أداء أعمال شركات صناعة الأدوية الأردنية.

الجنس: □ ذكر □ أنثى

العمر: □ 25 – 35 □أكبر من 35 - 45 □أكبرمن45 - 55 □ أكبر من 55

المؤهل العلمي: □ دبلوم وما دون □ بكالوريوس □ ماجستير □ دكتوراه

المستوى الوظيفي: □ الادارة العليا □ الوسطى □ السفلى

القسم: □ الانتاج □ البحث والتطوير □ التسويق □ اخرى

سنوات الخبرة: □ أصغرأو يساوي 5 □أكبر من 5-10 □أكبرمن 10-15 □ أكبر من 15

(الرجاء التأكّدْ من إجابة كُلّ سؤال ووضع دائرة حول الجواب الصحيحَ استِنادًا إلى مشاعرك وأحاسيسك حول الواقع الموجود وليس بناء على الاعتقاد أو الوضع المثالي لكل فقرة كالتالي: (1 = غير مطبق بقوة.....، 5 = مطبق بقوة)

رقم	السؤال	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
		1	2	3	4	5
	1. الانتاج المعيب:					
.1	تحرص الشركة على جودة المواد الخام	1	2	3	4	5
.2	تستخدم الشركة اساليب النقل المناسبة	1	2	3	4	5
.3	تلتزم الشركة باتباع التعليمات وصيغ التصنيع مثل المزج بالنسب المعتمدة الدقيقة للمواد	1	2	3	4	5
.4	تحرص الشركة على تتابع عمليات الانتاج زمنيا	1	2	3	4	5
.5	تحرص الشركة على الاهتمام بنظافة البيئة الداخلية	1	2	3	4	5
	2. الانتاج الزائد:					
.6	تحرص الشركة على التقدير المناسب لحجم الطلب	1	2	3	4	5
.7	تؤكد الشركة على الطلبيات قبل البدء بالانتاج	1	2	3	4	5
.8	تحرص الشركة على ضمان فعالية وسلامة المنتج مقارنة بمنتج المنافسين	1	2	3	4	5
.9	تحرص الشركة على تقدير المواد الخام اللازمة للانتاج	1	2	3	4	5
.10	تحرص الشركة على إدارة الالات بكفاءة وفاعلية	1	2	3	4	5
	3. وقت الانتظار:					
.11	تعمل الشركة على توفر المواد الخام في الوقت المناسب	1	2	3	4	5
.12	تحرص الشركة على فاعلية العمليات الانتاجية	1	2	3	4	5
.13	تؤكد الشركة على صيانة الالات الدورية	1	2	3	4	5
.14	تحدد الشركة اولويات التصنيع	1	2	3	4	5
.15	تراعي الشركة تسريع اتخاذ القرار متى دعت الحاجة لذلك	1	2	3	4	5
	4. عمليات النقل:					
.16	تحرص الشركة على توفر بدائل لعمليات النقل في الحالات الطارئة	1	2	3	4	5
.17	تؤكد الشركة على دقة عمليات التغليف	1	2	3	4	5
.18	تلتزم الشركة بالاجراءات الجمركية المطلوبة لتسهيل عمليات النقل	1	2	3	4	5

رقم	السؤال	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
		1	2	3	4	5
19.	تحرص الشركة على استخدام وسائل النقل المناسبة	1	2	3	4	5
20.	تمتلك الشركة المهارات المناسبة للعاملين للقيام بعمليات المناولة أثناء النقل	1	2	3	4	5
	5. التخزين:					
21.	تحرص الشركة على توفر ظروف التخزين المناسبة (الحرارة والرطوبة)	1	2	3	4	5
22.	تتوافر في الشركة المهارات المناسبة للعاملين لاداء اعمال التخزين	1	2	3	4	5
23.	تحرص الشركة على توفر ادوات المناولة المناسبة (الرافعة الشوكية)	1	2	3	4	5
24.	تؤكد الشركة على الترتيب المناسب للمواد داخل المخزن	1	2	3	4	5
25.	تلتزم الشركة باجراء عمليات الجرد المختلفة	1	2	3	4	5
	6. الحركات الزائدة:					
26.	تحرص الشركة على وجود عمل معياري (standardization)	1	2	3	4	5
27.	تحرص الشركة على تقليل تحركات العاملين غير مربوطة بالعمل	1	2	3	4	5
28.	تحرص الشركة على الترتيب الجيد للمصنع لتقليل الحركات الزائدة	1	2	3	4	5
29.	تحرص الشركة على استخدام وسائل النقل الداخلية المناسبة بين الاقسام والادارات	1	2	3	4	5
30.	تحرص الشركة على توظيف عدد العاملين المناسب	1	2	3	4	5
	7. العمليات الزائدة:					
31.	تعمل الشركة على ضبط وقت الدورة الانتاجية	1	2	3	4	5
32.	تؤكد الشركة على انسياب الاجراءات المطلوبة	1	2	3	4	5
33.	تلتزم الشركة بجدولة الانتاج	1	2	3	4	5
34.	توضح الشركة اجراءات العمل للعاملين	1	2	3	4	5
35.	تحرص الشركة على الاستخدام المناسب للجوانب الاحصائية	1	2	3	4	5
	8. المواهب غير مستغلة:					
36.	تعمل الشركة لاكتشاف المواهب الفردية للعاملين	1	2	3	4	5
37.	تعمل الشركة على تطوير وتدريب العاملين على المهارات اللازمة	1	2	3	4	5
38.	تشجع الشركة الافكار الجديدة	1	2	3	4	5
39.	تشجع الشركة الابداع والابتكار من خلال نظام الحوافز	1	2	3	4	5
40.	يتوافر لدى الشركة مركز ابحاث يدعم البحث والتطوير	1	2	3	4	5
	9. **التنمية المستدامة**					
	المسؤولية البيئية:					
41.	تهتم الشركة بالحد من التلوث البيئي	1	2	3	4	5
42.	تحقق الشركة استغلال امثل للموارد خصوصا الموارد غير متجددة	1	2	3	4	5
43.	تمتلك الشركة وسائل متعددة لمعالجة المنتجات الضارة بالبيئة المحيطة	1	2	3	4	5
44.	توفر الشركة الارشادات حول استخدام المنتجات وسبل التخلص منها وبقاياها	1	2	3	4	5
45.	تستخدم الشركة منتجات غير ضارة (الصديقة للبيئة) والمنصوص عليها ضمن التصنيع الجيد	1	2	3	4	5
46.	تقوم الشركة باعادة تدوير بعض المواد	1	2	3	4	5
	المسؤولية الاقتصادية:					
47.	تلتزم الشركة بالقوانين الحكومية المتعلقة بالجانب الاقتصادي	1	2	3	4	5
48.	تسعى الشركة الى تسديد المستحقات الضريبية وفي مواعيدها المحددة	1	2	3	4	5
49.	تساهم الشركة في الاقتصاد المحلي من خلال جلب العملة الصعبة	1	2	3	4	5
50.	تساعد الشركة في بناء البنية التحتية مثل بناء الجسور	1	2	3	4	5
51.	تساهم الشركة في توظيف العمالة المحلية	1	2	3	4	5

رقم	السؤال	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
		1	2	3	4	5
	المسؤولية الاجتماعية:					
52.	تقوم الشركة بتوظيف ذوي الاحتياجات الخاصة	1	2	3	4	5
53.	تمتلك الشركة برامج يساعد في دعم التعليم في المجتمع	1	2	3	4	5
54.	تمتلك الشركة ميزانية للعمل الاجتماعي كدعم المجتمع المحلي ماديا مثل التبرع للجمعيات الخيرية	1	2	3	4	5
55.	لدى الشركة قوانين ملزمة للسلوكيات الاخلاقية	1	2	3	4	5
56.	لدى الشركة خطط لعقد دورات توعية صحية للمجتمع المحلي	1	2	3	4	5
57.	تتبع الشركة القوانين الملزمة لضمان سلامة العاملين من المستحضر	1	2	3	4	5

رقم	السؤال	غير موافق بشدة	غير موافق	محايد	موافق	موافق بشدة
		1	2	3	4	5
	10. مؤشرات الأداء:					
58.	تحصل الشركة على أفضل انتاجية الفرد	1	2	3	4	5
59.	لدى الشركة أقل تكلفة لإنتاج الوحدة الواحدة مقارنة مع المنافسين	1	2	3	4	5
60.	لدى الشركة أقل دوران العمل (الموظفين)	1	2	3	4	5
61.	تتناسب جودة المنتجات المقدمة مع المنافسين	1	2	3	4	5
62.	لدى الشركة زيادة في المبيعات بإستمرار	1	2	3	4	5
63.	تحقق الشركة أفضل ارباح مقارنة مع المنافسين	1	2	3	4	5
64.	القيمة السوقية لأسهم الشركة تزداد بشكل سنوي	1	2	3	4	5
65.	العائد على الاستثمار يتناسب مع العائد للصناعة	1	2	3	4	5
66.	تقوم الشركة بادارة التكاليف بفاعلية	1	2	3	4	5
67.	تحظى الشركة بمكانة متميزة بين الشركات المنافسة	1	2	3	4	5