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MIDDLE EAST UNIVERSITY FOR GRADUATE STUDIES

Analyzing the Bottlenecks in Operations Management Using Cause and Effect Diagram

Applied Study on the Jordanian Human Drug manufacturing Companies (JPM & AlHikma)

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DELEGATION

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DISCUSSION COMMITTEE DECISION

This dissertation was discussed under title:

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DEDICATION

To my mother's soul, for without her encouragement, patience, compassion and guidance I wouldn't have been what I am now.

To my father, Dr. Husam AlKhatib: for his help, moral and emotional support, advice and effective presence that paved my way at time of need.

To such lovely and dedicated parents that made my dreams come true, I dedicate this thesis with acknowledgement and pride.

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Analyzing the Bottlenecks in Operations Management Using Cause and Effect Diagram

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Abstract

The main objective of this study is to analyze the Bottleneck in Operations Management Using Cause and Effect Diagram in the Jordanian Human Pharmaceutical manufacturing Companies.

Study sample consist of whole workers of the JPM and ALHikma from the lowest Level (Head of Section; Supervisor) amount (75).

In order to achieve the objectives of the study, the researcher designed a questionnaire consisting of (40) paragraphs to gather the primary information from study sample. The statistical package for social sciences (SPSS) program was used to analyze and examine the hypotheses.

The study used many statistical methods. After executing the analysis to study hypotheses; the study concluded that:

- The important level of optimization of using the Work Methods in Jordanian Human Pharmaceutical manufacturing Companies was Median.
- The important level of Performance Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.
- The important level of Productivity Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.
- There is significant impact in Optimizing the Usage of Raw Materials; Optimizing the Usage of Technical Infrastructure; Optimizing the Usage of Work Methods; Optimizing the Usage of Measurements Methods; Optimizing the Usage of Skillful Workers in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level **($\alpha \leq 0.05$).**
- There is significant impact in Optimizing the Usage of Technical Infrastructure; Optimizing the Usage of Work Methods; Optimizing the Usage of Measurements Methods; Optimizing the Usage of Skillful Workers Optimizing the Usage of Skillful Workers in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level **($\alpha \leq 0.05$).**
- There is no significant impact in Optimizing the Usage of Raw Materials in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level **($\alpha \leq 0.05$).**

Chapter One
Study General Framework

(1-1): Introduction

(1-2): Study Problem and Its Questions

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(1-1): *Introduction*

The concept of "bottleneck focused approach" in operations management can be traced back to the days of Henry Ford. In his effort to deliver an affordable car, Ford introduced the moving assembly line which exploited the economies of scale involved in producing a standard product in high volume. It was understood that the workstation with the maximum processing requirement, denoted as the bottleneck, would constrain the output of the system. This understanding was inherent in the attempt to 'balance capacity' by ensuring that the total work was allocated equally among the workstations. The focus on bottlenecks was implicitly captured by the importance given to the capacity utilisation metric as the prime tool for managerial planning and control in such high volume low variety environment (**Mukherjee & Chatterjee, 2006**).

The complexity of operations has increased tremendously from the days of Henry Ford. Single model assembly lines have given place to mixed model assembly lines. Inflexible transfer lines have yielded ground to various forms of flexible manufacturing systems. The need for constant product innovation and the resultant product proliferation has resulted in an increase in the variety of the product mix. The identification of bottleneck becomes much more difficult as we move from the high volume low variety repetitive manufacturing scenario towards the low volume with high variety job shops, and finally, to the project environment.

Job shops and projects primarily compete on the dimension of time as opposed to a mass production system where throughput at the lowest cost is the primary concern. Thus the definition of bottleneck has to be agreed upon that given 'capacity' is no longer approachable in job shops and projects in the same way as in assembly lines.

For a practicing manager running a production set up, focusing on the bottleneck is an intuitive way of managing this complexity, management science literature does not provide a bottleneck definition which is universally valid for all production scenarios. The absence of a universally applicable definition implies the absence of any universally applicable bottleneck focused approach.

From the above, the purpose of this study is to *Analyzing the Bottlenecks in Operations Management Using Casue and Effect Diagram in the Jordanian Human Pharmaceuticals manufacturing Companies.*

(1-2): Study Problem and Its Questions

Process improvement involves identifying and with regard taking action the causes of variation. With most practical applications, the number of possible causes for any given problem can be huge. Dr. Kaoru Ishikawa, however has developed a simple method by graphically displaying the causes of any given quality problem. His method is refered to by several names, the Ishikawa diagram, the fishbone diagram, and the cause and effect diagram.

The production process class in the cause and effect diagram uses production processes as the main categories, or branches.

There is a lot of problems and is often called bottlenecks, and where these bottlenecks that impact on the performance of organizations in both its Goods and service which will reflect on their productivity in terms of quantity and quality, through investigation the reasearcher encountered a number of managers in the Jordanian Human Pharmaceuticals manufacturing Companies and asked them about the reasons for Bottlenecks in Operations Management. The reasearcher confine the main elements in Bottlenecks happening like Raw Materials; Machineries; Work Methods.. etc.

Based on above, the Study Problem will be demonstrated through the following questions:

***Question One*: How important are the Study of Variables in the Jordanian Human Pharmaceutical Manufacturing Companies?**

***Question Two:* Does the optimization of using the Raw Materials improve the performance in the Jordanian Human Pharmaceutical manufacturing Companies?**

***Question Three:* Does the optimization in using the Technical infrastructure improve the performance in the Jordanian Human Pharmaceutical manufacturing Companies?**

***Question Four:* Is Using the Optimization Work Methods improve the performance of the Jordanian Human Pharmaceutical manufacturing Companies?**

***Question Five:* Is Using the Optimization Measurements Methods improve the performance of the Jordanian Human Pharmaceutical manufacturing Companies?**

Question Six: **Is Using the Skillful Workers improve the Jordanian Human Pharmaceutical manufacturing Companies Performance?**

Question Seven: **Is Using the Casue and Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers) improve the Jordanian Human Pharmaceutical manufacturing Companies Productivity through improving the performance?**

(1-3): Study Hypotheses

Based on the study problem and the literature review, the following research hypotheses are:

HO1: **There is no significant statistical impact of using Casue and Effect Factors (*Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers*) on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO1-1*: There is no significant statistical impact in Optimizing the Usage of Raw Materials on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO1-2*: There is no significant statistical impact in Optimizing the Usage of Technical Infrastructure on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO1-3*: There is no significant statistical impact in Optimizing the Work Methods on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO1-4*: There is no significant statistical impact in Optimizing the Measurements Methods on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO1-5*: There is no significant statistical impact in Optimizing the Skillful Workers on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2:* There is no significant statistical impact of using Casue and Effect Factors (*Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers*) on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2-1*: There is no significant statistical impact in Optimizing the Usage of Raw Materials on improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2-2*: There is no significant statistical impact in Optimizing the Usage of Technical Infrastructure on improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2-3*: There is no significant statistical impact in Optimizing the Usage of Work Methods on improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2-4*: There is no significant statistical impact in Optimizing the Usage of Measurements Methods on improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

***HO2-5*: There is no significant statistical impact in Optimizing the Usage of Skillful Workers on improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

(1-4): The significance of the Study

The importance of the Current Study is to identify the following:

1. The importance of Casue and Effect Diagram as a tool to improve performance.
2. Clarify the extent of impact of the Casue and Effect Factors on improving the performance and productivity in Jordanian Human Pharmaceutical manufacturing Companies.
3. The results of this study can provide, a better context for the Jordanian Human Pharmaceutical manufacturing Companies, more information for the decision makers about the Bottlenecks in Operations Management and the solutions for these Bottlenecks.

(1-5): Objectives of the Study

The attempt of this study is to analyze the Bottleneck in Operations Management Using Casue and Effect Diagram in the Jordanian Human Pharmaceutical manufacturing Companies, through the following objectives:

1. Prepare a theoretical framework; through learning about Bottleneck in Operations Management and the Casue and Effect Diagram.
2. Identify the level of impotance of the study variables in the Jordanian Human Pharmaceutical manufacturing Companies.
3. Explore the impact of Operations Management Casue and Effect Factors on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies.
4. Explore the impact of Operations Management Casue and Effect Factors on Improving the Productivity through the improved performance of the Jordanian Human Pharmaceutical manufacturing Companies.

(1-6): Study Limitations

The study scope on the following:

Human Limitations: All employess working in the Jordanian Human Pharmaceutical manufacturing Companies.

Place Limitations: Jordanian Human Pharmaceutical manufacturing Companies (JPM & AlHikma).

Time Limitations: The time consumed to carry out and complete the study.

Scientific Limitations: The researcher will depend on the Casue and Effect Factors suggested by Al – Nuiami, et...al, (2009) (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers).

(1-7): Study Difficulties

1. Implementing the study on the Jordanian Human Pharmaceutical manufacturing Companies (JPM & AlHikma)
2. The limited number of practical studies in Casue and Effect Diagram in Arab world.

(1-8): Study Model

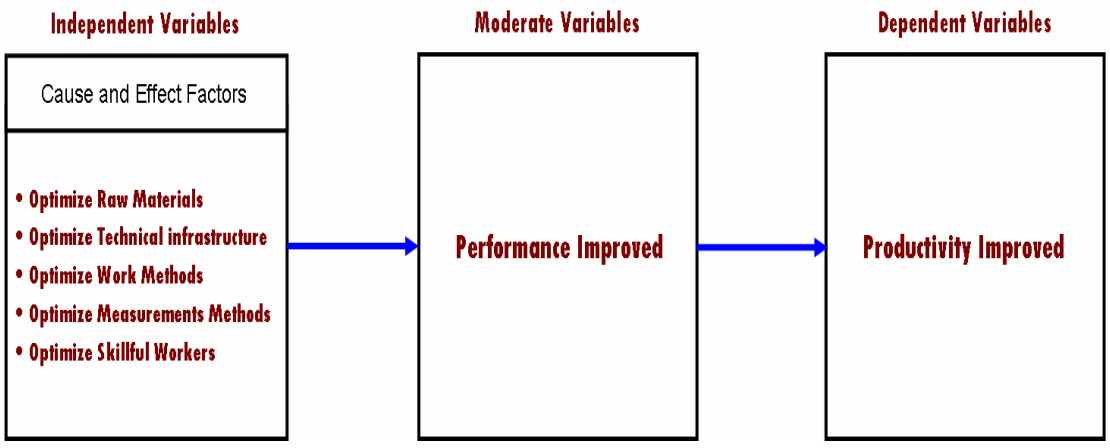

Figure (1–1)
Study Model

(1-9): Terminologies of the Study

Casue and Effect Diagram: fishbone or Ishikawa diagram was developed by Kaoru Ishikawa. The premise is that generally when a problem occurs the effect is very obvious, and the temptation is to treat the effect. With the Ishikawa approach the causes of the effect are sought. Once these are known and eliminated, the effect will not be seen again (**Truscott, 2003**).

Bottlenecks: Contrains at anyone workstation that cause a loss of time and productivity for the whole system. Another definition: is a workstation, department or processing unit with maximum requirement that is capable of contraining output for the whole system.

Performance: Is a continuous and flexible process that involves managers and those whom they manage acting as partners within a framework that sets out how they can best work together to achieve the required results (**Armstrong, 2006: 4**). Or we can say: it's the organizations' ability to obtain its goods by using resources in an effective and efficient manner.

Productivity: Is the organization's output of products and services devided by its inputs. The ability of a business to utilize its

human, capital and material resources to the best advantage and the best balance. “Knool & O’donell”

CHAPTER TWO

THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

(2-1): Introduction

(2-2): Bottlenecks in Operations Management

(2-3): Cause and Effect Diagram

(2-4): Previous Studies

(2-5): Differents between Current Study & Previous Studies

(2-1): Introduction

The importance of understanding and managing operation bottlenecks has been the focus of the optimizing production technology philosophy, more recently called the theory of constraints or synchronous manufacturing. This literature argues that bottlenecks are inevitable (and even desirable) in many manufacturing setting, and typically uses simple analogies and appeals to common sense to support its analysis. While provocative, this qualitative approach is difficult to evaluate objectively. Further, much of the original optimizing production technology is cloaked in commercial secrecy, further confounding a balanced appraisal of its efficacy. This chapter divided into the following five sections

(2-2): Bottlenecks in Operations Management

The term bottleneck has been extensively used in operations management literature. Yet there are few instances where it has been explicitly defined. However, practitioners have a clear understanding of the implications of a resource being a bottleneck. According to **Goldratt & Cox (1984**), "An hour lost at a bottleneck is an hour lost for the entire system. An hour saved at a non-bottleneck is a mirage"

A survey of the research and pedagogical literature finds that there exists no clear consensus as to the definition of a "bottleneck" resource. Several of these definitions are:

- ***Congestion points***, or bottlenecks, primarily occur when manufacturing resources required in a given time period are unavailable (**Laure, 1999: 42**).
- ***A bottleneck*** is defined as any resource whose capacity is less than the demand placed upon it. ***A bottleneck***, in other words, is a process that limits throughput (**Anderson, 1994: 46**).
- ***Production bottlenecks*** are generally considered to be temporary blockades to increased output … (where) inventories build up at different places and different times (**Schmidt, 1996: 110**).
- ***A facility***, function, department, etc.., that impedes production (**Sapoutzis, 1995: 234**).
- ***A bottlenecks operation …*** is any operation that limits output (**Voss, 1995: 312**).

In my opinion, these statements capture the essence of the concept of bottleneck. It communicates in very simple terms the crucial role played by bottlenecks. Moreover, the statement is 'actionable' in that it provides a clear focus for managerial planning and control activities.

Bottlenecks are a common problem in process layout. Bottlenecks are difficult to eliminate for several reasons. They are often caused by pieces of equipment that are expensive or come in increments that far exceed a firm's requirement. There may be difficulty in obtaining equipment or people be varies from one job to the next, as dose the jobs processing time, bottlnecks may move (**Hansen, 2002: 256**)

(**Carringer, 1994: 16-19**) in a production context. The complimentary slackness conditions for linear and non-linear mathematical programmes state that dual variables exist if and only if the corresponding constraints are binding.

In the context of a production system, this translates to the fact that an improvementfor the whole (entire system) is possible if and only if there is an improvement for a crucial part (bottleneck) of the whole (**Gary, 1997: 20-23**).

When a process consists of asset series of operation, its capacity is determined by the slowest operation in the sequence. The capacity-limiting operation is called the bottlenecks operation (**Noori & Radford, 1995: 196**).

With the bottlenecks resource setting the production pace. Balancing the flow of work rather than fully utilizing the capacity of each work center is the first rule of synchronous operations (**Ingemansson & Bolmsjo, 2004: 268**).

Bottleneck resources are scheduled by the optimizing production technology software using market demands and a simple job priority system. This ensures that the maximum amount of work flows through bottlneck resources. Since the bottlencks determine the real capacity of the process, they must be as produtive asa possible. An hour lost at a bottleneck is an hour lost for the total process (**Upton & Kim, 1998: 5**).

The schedules for the bottleneck work center are then used to derive schedules for the succeeding work centers. The schedules for preceding Work centers are de-veloped by working backward from the bottleneck schedules.Work

center that do not feed a bottlneck or are not fed by a bottlneck are schedules backward from the final assembly schedule (**Sivasubramanian, 2003: 239**).

A simple way to increase the capacity of a bottlneck work centers is to ensure that it is always staffed, even during breaks and shift changes. A Cross-training worker reduces the chance of idle time caused by employee absenteeism. Reducing setup time, improving the bottleneck process, and increasing preventive maintenance can increase the bottleneck availble processing time. Careful inspection of parts immediately before the bottleneck can prevent wasting valuable time processing defective parts (**Mabin & Steve, 2000: 345**).

Because bottleneck resources govern the output of the process, prtecting their preventive is important. **Goldartt and Cox** (**1984**) suggest that buffer inventories be strategically placed ta various points in the process. First, every bottleneck operations must have a buffer in front of it; this protects the bottleneck from any disruption to the systems that lead to bottleneck idle time. Second, an inventory buffer must also be placed in front of every assembly operations that reqquires a part form a non bottleneck operation. This protects the final assembly schedule by ensuring that there is not a shortage of parts that do not flow through bottleneck resources.

Brown, et...al, (**2001: 232**) defining two types of bottleneck has been identified. If the bottleneck is at the final assembly (or final service) stage of the operation, then the system's capacity will be no greater than the capacity of the final assembly. On the other hand, if the bottleneck is upstream (ahead) of final

assembly, then the capacity of the process (including process outputs) will be limited to the capacity of the bottleneck, but it may be difficult to identify.

In the theortical Studies on the related problems of control of inventories, production scheduling, or optimal purchasing times and quantities, almost invariably tacitly assume that the quantities of the various goods (**Rinehart, 1987: 543**).

(2-3): Cause and Effect Diagram

Kaoru Ishikawa, suggested the cause-and-effect diagram is used where it is required to brainstorm and show pictorially cause-and-effect relationships and the root causes of a problem like Bottlenecks in Operations Management (**Truscott, 2003**).

It is frequently called a fishbone diagram (because of its shape) or an Iskikawa diagram (after its creator). There are several types of cause-and-effect diagram, based on the formation of the main branches (categories), including general 4 M (manpower, machines, materials, methods) or 4 P (people, procedures, plant, process) and those constructed in terms of process steps and sequence (**Paik & Bagchi, 2007: 309**).

Cause and effect diagrams are tools that are used to organize and graphically display all of the knowledge a group has relating to a particular problem. Usually, the steps are (**Pyzdek, 2003: 261-262**):

1. Develop a flow chart of the area to be improved.
2. Define the problem to be solved.
3. Brainstorm to find all possible causes of the problem.
4. Organize the brainstorming results in rational categories.
5. Construct a cause and effect diagram that accurately displays the relationships of all the data in each category.

To construct a cause and effect diagram (**Shina, 2002: 94**):

- Use brainstorming to identify all possible causes for the effect. Ask outside experts to add to the list produced by brainstorming.
- Review the list and look for any interrelationships between the possible causes. Define three to six major categories that can be grouped together and categorize them. Common categories are sometimes referred to as the four M's: Materials, Machines, Methods and Manpower.
- Within each category, further subdivision might be required based on relationship or cause. They can ultimately be divided into subgroups.
- Draw the diagram, using arrows and names of each group, subgroup, and individual cause.
- Evaluate and select the most probable cause(s), based on the problem solving group decision tools.

Once these steps are complete, constructing the cause and effect diagram is very simple. The steps are (**Taghizadegan, 2002: 155**):

1. Draw a box on the far right-hand side of a large sheet of paper and draw a horizontal arrow that points to the box. Inside of the box, write the description of the problem you are trying to solve.
2. Write the names of the categories above and below the horizontal line. Think of these as branches from the main trunk of the tree.
3. Draw in the detailed cause data for each category. Think of these as limbs and twigs on the branches.

Shina (**2002: 94**) clarify the Cause and Effects Establishment through:

Ask why five times. Identify root causes by analyzing potential causes as long as one can ask why and get an answer: that potential cause was not the root cause. For example, ask the "five whys" questions—in this case, plastics injection molding of a large tube-shaped part had uneven wall thickness.

1. Why was the wall thickness uneven? *It was due to sink marks on the last filling profile of the part.*
2. Why did sink marks appear in the parts? *It was due to lack of polymer melt in the wall thickness.*
3. Why was there a lack of polymer material in the wall thickness? *It was due to runners freezing too fast.*
4. Why were runners freezing too fast? *It was due to material temperatures being too low.*
5. Why were material temperatures too low? *It was due to bad thermocouples.*

All interactions associated with the delivery of product or services have an effect on the customers. Compaines looking at where those effects are less than desirable. These effects are the result of upstream causes. All operations, whether in service or product delivery, either delivered to an internal or external customer, have causes that end in results. These are all cause-and-effect relationships. The causes are those things that are done while the work is being performed. The objective of improvement programs is to identify the causes that are not being done in a manner that produces defect-free results and improve how the work is being done. The approach is to build the quality in. The first step in identifying causes is to start with the observable effects (**Larson, 2003: 50**).

Basu & Wright (**2003: 29**) cite the following eight causes cover most situations:

1. Money (funding)
2. Method
3. Machines (equipment)
4. Material
5. Marketing
6. Measurements
7. Management and mystery (lack of communication, secret agendas etc.)
8. Maxims (rules and regulations).

In essence, cause and effect relates to three critical points (**Goldsby & Martichenko, 2005: 78**):

1. An action today will create one or more effects in the future.
2. The future effect caused by an action today will generally be felt and managed by someone other than the creator of the action.
3. The future effect caused by an action today could be felt tomorrow or years later, depending on the significance of the action.

(2-4): Previous Studies

- **(Krishna & Rajan, 2009) Under title "*Cause Marketing: Spillover Effects of Cause-Related Products in a Product Portfolio*".** Tested the behavioral underpinnings of our model in two laboratory experiments to demonstrate the existence of both a direct utility benefit to consumers from cause marketing (CM) and a spillover benefit onto other products in the portfolio. Linking one product in a product portfolio to a cause can therefore increase sales both of that product and, via a spillover effect, of other products in the firm's portfolio. We construct a CM game in which each firm chooses which products, if any, to place on CM. In the absence of a spillover benefit, a firm places a product on CM if and only if it can increase its price by enough to compensate for the cost of CM. Thus, in equilibrium, firms either have either products or neither product on CM. However, with the introduction of a spillover benefit to the second product, this result changes. They show that if a single firm in the market links only one product to a cause, it can raise prices on both products and earn a higher profit. They assume each firm has an advantage

in one product and show that there is an equilibrium in which each firm links only its disadvantaged product to a cause. If the spillover effect is strong, there is a second equilibrium in which each firm links only its advantaged product to a cause. In each case, firms raise their prices on both products and earn higher profits than when neither firm engages in CM. they also show that a firm will never place its entire portfolio on CM. Overall; the work implies that, by carrying cause-related products, companies can not only improve their image in the public eye but also increase profits.

- (**Wymer & Samu, 2009**) "***The influence of cause marketing associations on product and cause brand value***". Purpose presented in this paper is to add to our understanding of the added value, both monetary and non-monetary, to a hrand when supporting a cause in a cause marketing ad. The findings show that consumers do not perceive the brand to be worth more if it was shown to be supporting a cause. The study also failed to show a significant improvement in consumer brand attitudes for brands featured in a cause marketing ads. However, there was an attitude improvement for the cause. Product type and consumer dispositional variables were also examined. In summary, this study calls into question the value brands derive from being paired with a cause.

- (**Gill & Singh, 2009**) **Under title** "***Bottleneck Analysis and Alleviation in Pipelined Systems: A Fast Hierarchical Approach***". Purpose is to build a method for

performance analysis to develop a method for bottleneck identification and alleviation for pipelined asynchronous systems. More specifically, this paper makes two contributions. First, we introduce a method that, given a throughput goal, identifies which parts of the pipelined system constrain its throughput. Each such bottleneck is categorized based on the type of structural transformation that could potentially alleviate it: increase degree of pipelining (stage splitting, stage duplication, and loop unrolling); decrease forward latency (stage merging and parallelization); and perform slack matching. The second contribution is a method that guides the user to systematically apply these modifications to alleviate the bottlenecks and reach a target throughput goal. We have validated the bottleneck analysis method on several examples and were able to attain the desired throughput goal in each case through iterative application of our bottleneck alleviation method. Runtimes were negligible in all cases (less than 50 ms).

- (**Matuszek & Mleczko, 2009**) **Under title "*Production Control in Moving Bottlenecks in Conditions of Unit and Small-batch Production*". The** purpose to draw on the basis of research on overloads of moving bottlenecks in conditions of unit and small batch production in real conditions having a big number of resources and tasks. The methods used so far are not capable of finding the global optimum of such big data ranges. At present few working enterprises in conditions of unit and small batch production, especially in small and medium-sized enterprises (SME), are exploiting techniques of the production process optimization. For this reason

computer tools for applying to the industrial scale are needed. The above method basis on the data so far collected in computer systems. Results of preliminary research were introduced from applying the possibility of TOC (Theory of Constraints) to the industrial scale for reducing bottlenecks in unit and small batch production. The authors built a heuristic algorithm which could find solution good enough and based on TOC assumptions and verification of assumptions using tests in real production systems. The above method found application to the industrial scale, as extension of the ERP class system.

- (**Varzakas1 & Arvanitoyannis, 2009**) **Under title "*Application of Failure Mode and Effect Analysis and Cause and Effect Analysis on Processing of ready to eat vegetables*".**

Purpose to attempt in conjunction with cause and effect diagrams. Critical control points have been identified and implemented in the cause and effect diagram (also known as Ishikawa, tree diagram and fishbone diagram). The main emphasis was put on the quantification of risk assessment by determining the risk priority number (RPN) per identified processing hazard. Receiving, storage and distribution, packaging and cooling were the processes identified as the ones with the highest RPN (225, 225, 180 and 144 respectively) and corrective actions were undertaken. Following the application of corrective actions, a second calculation of RPN values was carried out leading to considerably lower values (below the upper acceptable limit of 130). It is noteworthy that the application of Ishikawa (cause and effect or tree diagram) led to converging results thus corroborating the

validity of conclusions derived from risk assessment and FMEA. Therefore, the incorporation of FMEA and cause and effect analysis within the ISO22000 system of a ready to eat vegetables processing industry is considered imperative.

- **(Paik & Bagchi, 2007) Under title "*Understanding the Causes of the Bullwhip Effect in a Supply Chain*".** Attempts to determine the relative contribution of each of the causes of the bullwhip effect and to identify which causes of the bullwhip effect have relatively significant impacts on the variability of orders in supply chains. The methodology of the study based on Computer simulation models is developed. A fractional factorial design is used in collecting data from the simulation models. Statistical analyses are conducted to address the research objectives. The research findings – When all of the nine possible causes of the bullwhip effect are present in the simulation models, the following six factors are statistically significant: demand forecast updating, order batching, material delays, information delays, purchasing delays and level of echelons. Among these six factors, demand forecast updating, level of echelons, and price variations are the three most significant ones.

- **(Kaarna, 2007) Under title "*Bottlenecks of Value Creation Process: Theory of Constraints Approach*".** The purpose of the article is to compare Theory of Constraints based value creation approaches. Approaches can be divided into two: approaches with focus on creating better value proposal and approaches with

focus on delivering better value proposal to customers. In the latter case it is assumed that company already has competitive value proposal. Differences and similarities found suggest for a possibility of creating a better model. Yet several questions have to be answered before developing a new model becomes reasonable.

- **(Lu, et..al, 2006) Under title "*Study of the Shifting Production Bottleneck: Possible Causes and Solutions".*** Purpose to studies some factors that often cause bottleneck shift from one machine to another, including product-mix, production lot-size and load-balanced level, and puts forward corresponding solutions to overcome these problems based on basic principles of TOC, for providing enterprises some useful advices to prevent the appearance of those unexpected bottlenecks, or to reduce the unexpected production fluctuate when the shifting is unavoidable.

- **(Ingemansson, et..al, 2005) Under title "*Reducing Bottlenecks in a Manufacturing System with Automatic Data Collection and Discrete-Event Simulation".*** Purpose to Seeks to present a methodology for working with bottle-neck reduction by using a combination of automatic data collection and discrete-event simulation (DES) for a manufacturing system. A case study showed an improvement of the availability in one machine from 58.5 to 60.2 percent. This single alteration with a minimum of investment resulted in a 3 percent increase of the overall output in the manufacturing system consisting of 11 numerically controlled machines and six

other stations. A new simulation run was performed one year after the first study in order to see how the improvement work has progressed with the suggested method. The method resulted in an increase of 6 percent in overall output.

- **(Hafizi & Zawiyah 2004) Under title "*Knowledge Management in Malaysian Banks: a study of causes and effects*".** Purpose to a study aiming to identify the causes and effects of adopting KM practices among 10 local commercial banks in Malaysia. Analysis of the results confirmed that there is a relation between the causes and effects of implementing KM practices. KM equips organizations to be more competitive and provides better integration and sharing of information. Increases in knowledge sharing, both horizontally and vertically, along with increases in workers' efficiency, appear to be common effects resulting from adopting KM practices. It is hoped that this study will encourage local banks to maximize the benefits that KM can offer.

- **(Hajjat, 2003) Under title "*Effect of Cause-Related Marketing on Attitudes and Purchase Intentions: the Moderating Role of Cause Involvement and Donation Size*".** Purpose to present research was to examine the role of involvement and donation in moderating the effect of cause related marketing (CRM) and ordinary marketing (OM) on consumer attitudes and purchase intentions. It is proposed that the level of involvement (i.e., high or low involvement) may make either veridical information (i.e., high involvement) or peripheral cues (i.e., low involvement) in

the message more salient, and hence, more relevant and more important in the formation of attitudes and purchase intentions. Therefore, the level of donation size (i.e., high or low level) may be perceived either as an important element in the message (i.e., high involvement) or as a peripheral cue (i.e., low involvement). The results shown the painful images (i.e., high cause involvement) and the other half were shown pleasant images concerning the cause (i.e., low cause involvement). In one half of the ads, 5% of sales were claimed to be donated (i.e., high donation) and 0.1% in the other (i.e., low donation). In one half of the ads, a fictitious nonprofit organization (NPO) was affiliated with the experimental brand and claimed to work on the sponsored cause (i.e.,CRM) and in the other half there was no mention of a specific cause (i.e.,OM).

- **(Jacobs, et..al, 2003) Under title "*Effects of virtual development on product quality: exploring defect causes*".** Explores the effects of virtual development on product quality, from the viewpoint of "conformance to specifications". Specifically, causes of defect injection and non- or late-detection are explored. Because of the practical difficulties of obtaining hard project-specific defect data, an approach was taken that relied upon accumulated expert knowledge. The accumulated expert knowledge based approach was found to be a practical alternative to an in-depth defect causal analysis on a per-project basis. Defect injection causes seem to be concentrated in the requirements specification phases. Defect dispersion is likely to increase, as requirements specifications are input for derived requirements

specifications in multiple, related sub-projects. Similarly, a concentration of causes for the non- or late detection of defects was found in the Integration Test phases. Virtual development increases the likelihood of defects in the end product because of the increased likelihood of defect dispersion, because of new virtual development related defect causes, and because causes already existing in co-located development are more likely to occur.

- (**Brown, et..al, 1998**) **Under title "*Cycle Time Reductions for Test Area Bottleneck Equipment*".** Purpose to find potential areas for productivity improvement that would collectively yield a 60% reduction in manufacturing cycle time for the back-end factory. This paper will present findings and measurable results pertaining to the Burn-In and Tester operations, which are the current factory constraints. The model shows that the cumulative impact of these recommendations is a 32% reduction in average cycle time, a significant contribution to the overall goal. Additional opportunities are being investigated with models of the Assembly area.

- (**James, et..al, 1998**) **Under title "*A cause and effect approach to analyzing performance measures: part 2 – Internal Plant Operations*".** Purpose to find potential areas for productivity improvement that would collectively yield a 60% reduction in manufacturing cycle time for the back-end factory. This paper will present findings and measurable results pertaining to the Burn-In and Tester operations, which are the current factory constraints. The model shows that the cumulative

impact of these recommendations is a 32% reduction in average cycle time, a significant contribution to the overall goal. Additional opportunities are being investigated with models of the Assembly area.

(2-5): Different between Current Study & Previous Studies

The most important of the current study distinguishing from previous studies is: the current study reaches out the the five dimensions of cause and effect factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers), that improved productivity through improved performance. And the current study depends on the questionnaire. Besides the current study differents from previous studies in implementation sector in Jordanian Human Pharmaceutical manufacturing Companies.

CHAPTER THREE

METHOD AND PROCEDURES

(3-1): Introduction

(3-2): Study Methodology

(3-3): Study Population and Sample

(3-4): Study Tools and Data Collection

(3-5): Statistical Treatment

(3-6): Reliability and Validity

(3-1): Introduction

This chapter is divided into the following Six sections: Study Methodology; Study Population and Sample; Study Tools and Data Collection; Statistical Treatment; Reliability and Validity; and (Z) Test to Ensure Data Normal Distribution.

(3-2): Study Methodology

Descriptive Studies involves collecting data in order to test hypotheses and answer questions concerning the current status of the subject(s) of a study. Typical descriptive studies are concerned with the assessment of attitudes, opinions, demographic information, conditions, and procedures. In this Study the researcher chose the Analytical descriptive Method using an applied manner.

(3-3): Study Population and Sample

To increase credibility in this study, it is important for the sample to be chosen to better represent the population that the researcher will investigate.

The population of the study is the whole workers of the Jordanian Human Pharmaceuticals manufacturing Companies, specifically in, JPM & AlHikma Compaines. The sample of the study will be all workers of the JPM and ALHikma from the lowest hierarchical Level (Head of

Section; Supervisor). Table (3-1) show employee number in JPM and ALHikma from the lowest Level.

Table (3-1): Employee number in JPM and ALHikma from the lowest Level

No	Company	No. of Employee
1	Jordanian Pharmaceutical Manufacturing (JPM)	30
2	Hikma pharmaceutical company (Hikma)	45
Total		75

Table (3-2) shows the demographic variables to study sample gender; age; educate Level; specialization and experience.

Table (3-2) Descriptive the demographic variables to study sample

No.	Variables	Categorization	Frequency	Percent
1	Gender	Male	54	0.72
		Female	21	0.28
2	Age	Less than 30 years	10	0.13
		Between 30 – 40 Years	28	0.37
		Between 41 – 50 years	30	0.40
		Above 51 Years	7	0.09
3	Education Level	BSc	22	0.29
		High Diploma	6	0.08
		Master	47	0.63
		PhD	-	-
4	Specialization	Chemical Sciences	33	0.44
		Engineering	21	0.28
		Pharmaceutical	14	0.19
		Administrative Sciences	7	0.09
5	Experience	Less than 5 years	14	0.19
		Between 5 – 10 Years	14	0.19
		Between 11 – 15 years	21	0.28
		Above 16 Years	26	0.35

(3-4): Study Tools and Data Collection

The current study consists of two dimensions, theortical and practical. In the theortical dimension the researcher depened on the scientific studies/thoughts that are related to the current study. Whereas, in the practical side the researcher depend on descriptive and analytical mothods using the practical manner to collect, analyze data and test hypothesis.

The data collection, manners analysis and programs used in the current study are based on two sources:

1. Secondary sources: books, journals, articles thesis to write the theortical framework of the study.
2. Primary source: the questionnaire that was designed to reflect the study objectives and questions.

In this study, both primary and secondary data were used. Data for the model collected via questionnair.After conducting a thorough review of the literature pertaining to Bottlenecks in Operations Management, the researcher formulated the questionnaire instrument for this study.

The questionnair instrument sections are as follows:

Section One: Demographic variables. The demographic information was collected with closed-ended questions, through (5) factors.

Section Two: ***Cause & Effect Factors***. This section measured the Casue and Effect Factors suggested by **Al – Nuiami, et...al,** (**2009**) (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers), through (5) dimensions to measure and (30) item on a Likert-type scale.

Section Three: ***Performance Improved***. This section measured the Performance improvment through (5) item on a Likert-type scale.

Section Four: ***Productivity Improved***. This section measured the Productivity Improvment through (5) item on a Likert-type scale.

(3-5): Statistical Treatment

Data from the returned responses collected for the analysis and conclusions of the study questions. The researchers used the Statistical Package for the Social Sciences SPSS computer program to analyze the data. Finally, the researchers used the suitable Statistical methods that consist of:

- **Cronbach Alpha (α) to test Reliability.**
- **Kolmogorov – Smirnov (Z) to ensure that the data is normal distribution.**
- **Percentage and Frequency.**
- **Arithmetic Mean and Standard Deviation to answer the study questions.**

- **Simple Liner and Multiple Regression analysis with (F) test using ANOVA table to Measure the impact of Casue and Effect Factors on Improved Performance.**
- **Path Analysis to identify direct and indirect effect between study variables.**
- **Relative importance, that assigning due to:**

$$\text{Class Interval} = \frac{\text{Maximum Class} - \text{Minimum Class}}{\text{Number of Level}}$$

$$\text{Class Interval} = \frac{5-1}{3} = \frac{4}{3} = 1.33$$

The Low degree from 1- less than 2.33

The Median degree from 2.33 – 3.66

The High degree from 3.67 above.

(3-6): Validity and Reliability

(A) Validation

To test the questionnaire for clarity and to provide a coherent research questionnaire, a macro review covers all the research constructs was accurately performed by academic reviewers-from Jordanian universities - specialized in management information systems, Total Qquality Management; Production and Operation Management, and Statistical science. Some items were added based on their valuable recommendations .Some other were reformulated to become more

accurate which is expected therefore to enhance the research instrument. The academic reviewer's amount (7), and the overall percent of respond (100%), (see appendix "2").

(B) Study Tool Reliability

The reliability analysis applied the level of Cronbach Alpha (α) as the criteria of internal consistency. Which were at a minimum acceptable level **(Alpha ≥ 0.65)** suggested by **(Sekaran, 2003).** The overall Cronbach Alpha (α) =equaled(88.8). Wheres the high level of Cronbach Alpha (α) is to Technical infrastructure = (83.1). The lowest level of Cronbach Alpha (α) is to Raw Materials = (67.3). These results are an acceptable level suggested by **(Sekaran, 2003).** The results were shown in Table (3-3).

Table (3-3)

Reliability for the Questionnaire Dimensions

	No.	Dimensions	Alpha Value (α)
Cause & Effect Factors	1	Raw Materials	67.3
	2	Technical infrastructure	83.1
	3	Work Methods	75.4
	4	Measurements Methods	75.9
	5	Skillful Workers	79.8
	6	Performance Improve	76.6
	7	Productivity Improved	82
ALL Questionnaire			88.8

CHAPTER FOUR

ANALYSIS RESULTS & HYPOTHESIS TEST

(4-1): Introduction

(4-2): Study Questions Answers

(4-3): Study Hypothesis Testing

(4-1): Introduction

According to the research purpose and research framework presented in previous chapter, this chapter describes the results of the statistical analysis of the data collection for research question and research hypothesis. The data analysis included a description of the the means and standard deviations for study questions. Finally, the Path Analysis is applied to identify direct and indirect effect between Casue and Effect Factors and productivity through improving Performance.

(4-2): Study Questions Answer

***Question One*: How important are the Study Variables in the Jordanian Human Pharmaceutical Manufacturing Companies? To answer these questions the researcher has assigned to seven subquestions:**

***Subquestion One*: How important is the optimization of using the Raw Materials in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item importance and importance level as shown in Table (4-1).

Table (4-1)

Arithmetic mean, standard deviation, item important and important level to optimization of using the Raw Materials

No.	Optimization of using the Raw Materials	Mean	Standard deviation	Item importanc	Important level
1	My Company utilize a documented system for assessment of your suppliers, including surveys/audits and corrective action records	4.26	0.63	4	high
2	My Company verify that quality-critical materials you receive conform to your specifications	4.27	0.64	3	high
3	My Company segregate non-conforming products received, and have a procedure for timely disposition	4.34	0.66	1	high
4	My Company used the Chemical composition to ensure that the products is appropriate to the customers	4.31	0.58	2	high
5	In my Company lab, the raw materials checked to ensure of the Percentage defects	4.11	0.73	5	high
General Arithmetic mean and standard deviation		4.26	0.43		

Table (4-1) Clearify the important level of optimization of using the Raw Materials, where the arithmetic means range between (**4.11 - 4.34**) comparing with General Arithmetic mean amount of (**4.26**). We observe that the high mean for item "**My Company segregate non-conforming products received, and have a procedure for timely disposition**" with arithmetic mean (**4.34**) and Standerd deviation (**0.66**). While the lowest arithmetic mean was for item "**In my Company lab, the raw materials checked to ensure of the Percentage defects**" With Average (**4.11**) and Standerd deviation (**0.73**). In general the importance level of optimization of using the Raw Materials in Jordanian Human Pharmaceutical manufacturing Companies was high.

***Subquestion Two*: How important is the optimization of using the Technical infrastructure in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-2).

Table (4-2)

Arithmetic mean, standard deviation, item important and important level to optimization of using the Technical infrastructure

No.	Optimization of using the Technical infrastructure	Mean	Standard deviation	Item important	Important level
6	My Company provides the relevant technical capabilities for Technical Infrastructure practice	3.57	1.07	6	Median
7	My Company provides a standardized communication network to transfer knowledge among employees	3.81	0.82	3	high
8	My Company provides a standardized software to codify knowledge	3.91	0.86	2	high
9	My Company provides technology that allows employees to collaborate with others inside and outside the company	3.64	0.83	5	Median
10	My Company provides technology to map the location (e.g., an individual, a specific system, a database) of specific types of knowledge	3.67	0.96	4	high
11	My Company provides technology that allows employees to search and retrieve stored knowledge	4.01	0.50	1	high
General Arithmetic mean and standard deviation		3.77	0.63		

Table (4-1) Clearify the important level of optimization of using the Technical infrastructure, where the arithmetic means range between (**3.57 - 4.01**) comparing with General Arithmetic mean amount of (**3.77**). We observe that the high mean was to item "**My Company provides technology that allows employees to search and retrieve stored knowledge**" with arithmetic mean (**4.01**) and Standerd deviation (**0.50**). While the lowest arithmetic mean was to item"**My Company provides the relevant technical capabilities for Technical**

Infrastructure practice" With Average (**3.57**) and Standerd deviation (**1.07**). In general the important level of optimization of using the Technical infrastructure in Jordanian Human Pharmaceutical manufacturing Companies was high.

***Subquestion Three*: How important is the optimization of using the Work Methods in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-3).

Table (4-3)

Arithmetic mean, standard deviation, item important and important level to optimization of using the Work Methods

No.	Optimization of using the Work Methods	Mean	Standard deviation	Item important	Important level
12	In my company, information flows quickly, freely	3.87	0.74	2	high
13	In my company, there is high synergy among SBU is achieved	2.97	1.06	6	Median
14	Marketing activities; Operations and Engineering is linked to one team in my company	3.70	0.92	4	high
15	Functional synergy in my company achieves distinct results	3.57	0.94	5	Median
16	In my company, there is appropriate ongoing development	3.89	0.73	1	high
17	In my company, there is various management styles allowed	3.81	0.71	3	high
General Arithmetic mean and standard deviation		3.64	0.58		

Table (4-3) Clearify the important level of optimization of using the Work Methods, where the arithmetic means range between (**2.97 - 3.89**) comparing with General Arithmetic mean amount of (**3.64**). We observe that the high mean was to item "**In my company, there is appropriate ongoing development**" with arithmetic mean (**3.89**) and Standerd deviation (**0.73**). While the lowest arithmetic mean was to item"**In my company, there is high synergy among SBU is achieved**" With Average (**2.97**) and Standerd deviation (**1.06**). In the general the important level of optimization of using the Work Methods in Jordanian Human Pharmaceutical manufacturing Companies was Median.

***Subquestion Four*: How important is the optimization of using the Measurements Methods in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-4).

Table (4-4)

Arithmetic mean, standard deviation, item important and important level to optimization of using the Measurements Methods

No.	Optimization of using the Measurements Methods	Mean	Standard deviation	Item important	Important level
18	In my company, we have some customers who are market leaders	3.86	0.73	3	high
19	In my company, Accurately predict customers demands	3.56	0.90	6	Median
20	Top management in my company thorough knowledge of competitors products	3.71	0.80	5	high
21	Top management in my company thorough knowledge of competitors pricing	4.29	0.57	1	high
22	Top management in my company hold regular, effective business reviews	4.11	0.58	2	high
23	Top management in my company optimally manage partners and suppliers	3.86	0.82	3	high
24	In my company, manage product/ service costs effectively	3.76	0.84	4	high
25	Have little wasted expense in my company	3.71	0.95	5	high
General Arithmetic mean and standard deviation		3.86	0.48		

Table (4-4) Clearify the important level of optimization of using the Measurements Methods, where the arithmetic means range between (**3.56 - 4.29**) comparing with General Arithmetic mean amount of (**3.86**). We observe that the high mean was to item "**Top management in my company thorough knowledge of competitors pricing**" with arithmetic mean (**4.29**) and Standerd

deviation (**0.57**). While the lowest arithmetic mean was to item"**In my company, accurately predict customer's demands**" With Average (**3.56**) and Standerd deviation (**0.90**). In the general the important level of optimization of using the Measurements Methods in Jordanian Human Pharmaceutical manufacturing Companies was high.

***Subquestion Five*: How important is the optimization of using the Skillful Workers in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-5).

Table (4-5)

Arithmetic mean, standard deviation, item important and important level to optimization of using the Skillful Workers

No.	Optimization of using the Skillful Workers	Mean	Standard deviation	Item important	Important level
26	In my company, rewards and pay based on performance	4.36	0.72	1	high
27	Measure employee efficiency and effectiveness in my company	4.09	0.93	3	Median
28	In my company, Subordinates usually conferred with	4.10	0.80	2	high
29	In my company, Employees involved in decision	3.73	0.93	5	high
30	In my company, Strong support and leadership skills of management	3.86	0.94	4	high
General Arithmetic mean and standard deviation		4.03	0.65		

Table (4-5) Clearify the important level of optimization of using the Skillful Workers, where the arithmetic means range between (**3.73 - 4.36**) comparing with General Arithmetic mean amount of (**4.03**). We observe that the high mean was to item "**In my company, rewards and pay based on performance**" with arithmetic mean (**4.36**) and Standerd deviation (**0.72**). While the lowest arithmetic mean was to item"**In my company, Employees involved in decision**" With Average (**3.73**) and Standerd deviation (**0.93**). In the general the important level of optimization of using the Skillful Workers in Jordanian Human Pharmaceutical manufacturing Companies was high.

***Subquestion Six*: How important is the Performance Improved in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-6).

Table (4-6)

Arithmetic mean, standard deviation, item important and important level to Performance Improved

No.	Performance Improved item	Mean	Standard deviation	Item important	Important level
31	Cause & Effect Factors improves organizational efficiency	4.06	0.61	1	high
32	Cause & Effect Factors improves customer satisfaction	4.06	0.56	1	Median
33	Cause & Effect Factors improves organizational decision making	3.83	0.76	3	high
34	Cause & Effect Factors improves work quality	3.77	0.75	4	high
35	The company achieves direct financial benefits from Cause & Effect Factors	4.00	0.66	2	high
General Arithmetic mean and standard deviation		3.94	0.48		

Table (4-6) Clearify the important level of Performance Improved, where the arithmetic means range between (**3.77 - 4.06**) comparing with General Arithmetic mean amount of (**3.94**). We observe that the high mean was to item "**Cause & Effect Factors improves organizational efficiency ; Cause & Effect Factors improves customer satisfaction**" with arithmetic mean (**4.06**) and Standerd deviation (**0.61**) and (**0.56**) on followings. While the lowest arithmetic mean was to item"**Cause & Effect Factors improves work quality**" With Average (**3.77**) and Standerd deviation (**0.75**). In the general the important level of Performance

Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.

***Subquestion Seven*: How important is the Productivity Improved in the Jordanian Human Pharmaceutical manufacturing Companies?**

To answer this question the researcher uses the arithmetic mean, standard deviation, item important and important level as shown in Table (4-7).

Table (4-7)

Arithmetic mean, standard deviation, item important and important level to Productivity Improved

No.	Productivity Improved item	Mean	Standard deviation	Item important	Important level
36	Improves Productivity is reflected to improves organizational efficiency.	3.96	0.75	2	high
37	Improves Productivity is reflected to improves customer satisfaction.	3.76	0.73	4	Median
38	Improves Productivity is reflected to improves organizational decision making.	3.99	0.77	1	high
39	Improves Productivity is reflected to improves work quality.	3.87	0.78	3	high
40	Improves Productivity is reflected to company achieves direct financial benefits.	3.60	0.91	5	Median
General Arithmetic mean and standard deviation		3.83	0.60		

Table (4-7) Clearify the important level of Productivity Improved, where the arithmetic means range between (**3.60 - 3.99**) comparing with

General Arithmetic mean amount of (**3.83**). We observe that the high mean was to item "**Improves Productivity is reflected to improve organizational decision making**" with arithmetic mean (**3.99**) and Standerd deviation (**0.77**). While the lowest arithmetic mean was to item"**Improves Productivity is reflected to company achieves direct financial benefits**" With Average (**3.60**) and Standerd deviation (**0.91**). In the general the important level of Productivity Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.

(4-3): Study Hypothesis Testing

The researcher in this section tested the main hypothesis and study subhypothesis. Through Simple Liner, Multiple Regression analysis with (F) test using ANOVA table and path Analysis the direct and indirect effect between study variables were identified:

HO1: **There is no significant statistically impact of using Cause and Effect Factors (*Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers*) on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the multiple regression analysis to ensure the impact of Cause and Effect Factors on improved

performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-8).

Table (4-8)

Multiple regression analysis test results to the impact of Cause and Effect Factors on improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Cause and Effect Factors on improved performance	0.721	0.520	73.809	4.00	0.799	1 68 69	0.000

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-8) we observe that there is significant impact of Cause and Effect Factors as awhole on improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.721**) at level ($\alpha \leq$ **0.05**). Wheres the R^2 was (**0.520**). This means the (**0.520**) of Performance improved changeabilities resulting from the changeability in Cause and Effect Factors. As ***β*** was (**0.799**) this means the increase one unit in Cause and Effect Factors concerning will increase Performance improved value (**0.799**). Assuring significant impact $F_{Calculate}$ was (**73.809**) and it's significance at level ($\alpha \leq$ **0.05**) comparing with F_{Tabled} was (**4.00**), and that Assuring unvalid first main hypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact of using Cause and Effect Factors on improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

To ensure the impact of Cause and Effect Factors on improved performance in Jordanian Human Pharmaceutical manufacturing Companies, the researcher dividing the first main hypothesis to five subhypothesis, and uses the Simple Regression analysis to test each subhypothesis. As a following:

***HO1-1*: There is no significant impact in Optimizing the Usage of Raw Materials in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the Simple regression analysis to ensure the impact of Optimizing the Usage of Raw Materials in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-9).

Table (4-9)

Simple regression analysis test results to the impact of Optimizing the Usage of Raw Materials in improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Optimizing the Usage of Raw Materials in improved performance	0.360	0.129	10.109	4.00	0.407	1 68 69	0.002

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-9) we observe that there is significant impact of Optimizing the Usage of Raw Materials in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.360**) at level ($\alpha \leq 0.05$). Wheres the R^2 was (**0.129**). This means the (**0.129**) of Performance improved changeabilities resulting from the changeability in Optimizing the Usage of Raw Materials. As β was (**0.407**) this means the increase one unit in Optimizing the Usage of Raw Materials concerning will be increase Performance improved value (**0.407**). Assuring significant impact $F_{Calculate}$ was (**10.109**) and it's significant at level ($\alpha \leq 0.05$) comparing with F_{Tabled} was (**4.00**), and that Assuring unvalid first subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Raw Materials in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO1-2*: There is no significant impact in Optimizing the Usage of Technical Infrastructure in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the Simple regression analysis to ensure the impact of Optimizing the Usage of Technical Infrastructure in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-10).

Table (4-10)

Simple regression analysis test results to the impact of Optimizing the Usage of Technical Infrastructure in improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Optimizing the Usage of Technical Infrastructure in improved performance	0.646	0.417	48.701	4.00	0.493	1 68 69	0.000

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-10) we observe that there is significant impact of Optimizing the Usage of Technical Infrastructure in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.646**) at level ($\alpha \leq$

0.05). Wheres the R^2 was **(0.417).** This means the **(0.417)** of Performance improved changeabilities resulting from the changeability in Optimizing the Usage of Technical Infrastructure Technical Infrastructure. As β was **(0.493)** this means the increase one unit in Optimizing the Usage of Technical Infrastructure concerning will be increase Performance improved value **(0.493)**. Assuring significant impact $F_{Calculate}$ was **(48.701)** and it's significant at level **($\alpha \leq 0.05$)** comparing with F_{Tabled} was **(4.00)**, and that Assuring unvalid second subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Technical Infrastructure in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO1-3*: There is no significant impact in Optimizing the Work Methods in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the Simple regression analysis to ensure the impact of Optimizing the Usage of Work Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-11).

Table (4-11)

Simple regression analysis test results to the impact of Optimizing the Usage of Work Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Optimizing the Usage of Work Methods in improved performance	0.607	0.369	39.765	4.00	0.509	1 68 69	0.000

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-11) we observe that there is significant impact of Optimizing the Usage of Work Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.607**) at level ($\alpha \leq 0.05$). Wheres the R^2 was (**0.369**). This means the (**0.369**) of Performance improved changeabilities resulting from the changeability in Optimizing the Usage of Work Methods. As β was (**0.509**) this means the increase one unit in Optimizing the Usage of Work Methods concerning will be increase Performance improved value (**0.509**). Assuring significant impact $F_{Calculate}$ was (**39.765**) and it's significant at level ($\alpha \leq 0.05$) comparing with F_{Tabled} was (**4.00**), and that Assuring unvalid third subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Work Methods in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO1-4*: There is no significant impact in Optimizing the Measurements Methods in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the Simple regression analysis to ensure the impact of Optimizing the Usage of Measurements Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-12).

Table (4-12)

Simple regression analysis test results to the impact of Optimizing the Usage of Measurements Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Optimizing the Usage of Measurements Methods in improved performance	0.593	0.352	36.895	4.00	0.599	1 68 69	0.000

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-12) we observe that there is significant impact of Optimizing the Usage of Measurements Methods in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.593**) at level ($\alpha \leq 0.05$). Wheres the R^2 was (**0.352**). This means the (**0.352**) of Performance improved changeabilities resulting from the changeability in Optimizing the Usage of Measurements Methods. As β was (**0.599**) this means the increase one unit in

Optimizing the Usage of Measurements Methods concerning will be increase Performance improved value (**0.599**). Assuring significant impact $F_{Calculate}$ was (**36.895**) and it's significant at level ($\alpha \leq 0.05$) comparing with F_{Tabled} was (**4.00**), and that Assuring unvalid fourth subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Measurements Methods in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO1-5*: There is no significant impact in Optimizing the Skillful Workers in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the Simple regression analysis to ensure the impact of Optimizing the Usage of Skillful Workers in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. As shown in Table (4-13).

Table (4-13)

Simple regression analysis test results to the impact of Optimizing the Usage of Skillful Workers in improved performance in Jordanian Human Pharmaceutical manufacturing Companies

	(R)	(R^2)	F Calculate	F Tabulated	β	Degree of freedom	Sig*
Impact of Optimizing the Usage of Skillful Workers in improved performance	0.570	0.325	32.675	4.00	0.426	1 68 69	0.000

* the impact is significant at level ($\alpha \leq 0.05$)

From table (4-13) we observe that there is significant impact of Optimizing the Usage of Skillful Workers in improved performance in Jordanian Human Pharmaceutical manufacturing Companies. The ***R*** was (**0.570**) at level ($\alpha \leq 0.05$). Wheres the R^2 was (**0.325**). This means the (**0.325**) of Performance improved changeabilities resulting from the changeability in Optimizing the Usage of Skillful Workers. As ***β*** was (**0.426**) this means the increase one unit in Optimizing the Usage of Skillful Workers concerning will be increase Performance improved value (**0.426**). Assuring significant impact $F_{Calculate}$ was (**32.675**) and it's significant at level ($\alpha \leq 0.05$) comparing with F_{Tabled} was (**4.00**), and that Assuring unvalid fifth subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Skillful Workers in improving the performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

HO_2: There is no significant impact of using Cause and Effect Factors (*Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers*) on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Cause and Effect Factors on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-14).

Table (4-14)

Path analysis test results to the impact of Cause and Effect Factors on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi^2 Calculate	Chi^2 Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Cause and Effect Factors on improving the productivity through improving Performance	18.99	3.841	0.862	0.804	0.5111	Cause and Effect Factors on performance	0.721	0.397	0.000
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-14) we observe that there is significant impact of Cause and Effect Factors on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was **(18.994)** at level **($\alpha \leq 0.05$).** Wheres the ***GFI*** was **(0.862)** approaching to one. In same side the ***CFI*** was **(0.804)** approaching to one. As ***Direct Effect*** was **(0.721)** between Cause and Effect Factors on performance and **(0.551)** between Performance on Productivity. As well as, the ***Indirect Effect*** was **(0.397)** between Cause and Effect Factors on Productivity. That Assuring unvalid Second main hypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact of Cause and Effect Factors on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

To ensure the impact of Cause and Effect Factors on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies, the researcher dividing the Second main hypothesis to five subhypothesis, and uses the path analysis (Amos Programming) to test each subhypothesis. As a following:

***HO2-1*: There is no significant impact in Optimizing the Usage of Raw Materials in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Optimizing the Usage of Raw Materials in improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-15).

Table (4-15)

Path analysis test results to the impact of Optimizing the Usage of Raw Materials on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi^2 Calculate	Chi^2 Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Optimizing the Usage of Raw Materials on improving the productivity through improving Performance	1.313	3.841	0.988	0.990	0.067	Usage of Raw Materials on performance	0.360	0.198	0.252
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-15) we observe that there is no significant impact of optimizing the Usage of Raw Materials on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was (**1.313**) at level ($\alpha \leq$ **0.05**). Wheres the ***GFI*** was (**0.988**) approaching to one. In same side the ***CFI*** was (**0.990**) approaching to one. As ***Direct Effect*** was (**0.360**) between optimizing the Usage of Raw Materials on performance

and (0.551) between Performance on Productivity. As well as, the ***Indirect Effect*** was (0.397) between optimizing the Usage of Raw Materials on Productivity. That Assuring valid first subhypothesis. Accepted null hypotheses:

There is no significant impact in Optimizing the Usage of Raw Materials in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO2-2*: There is no significant impact in Optimizing the Usage of Technical Infrastructure in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Optimizing the Usage of Technical Infrastructure in improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-16).

Table (4-16)

Path analysis test results to the impact of Optimizing the Usage of Technical Infrastructure on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi^2 Calculate	Chi^2 Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Optimizing the Usage of Technical Infrastructure on improving the productivity through improving Performance	4.030	3.841	0.964	0.952	0.210	Usage of Technical Infrastructure on performance	0.646	0.356	0.045
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-16) we observe that there is significant impact of optimizing the Usage of Technical Infrastructure on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was **(4.030)** at level **($\alpha \leq 0.05$).** Wheres the ***GFI*** was **(0.964)** approaching to one**.** In same side the ***CFI*** was **(0.952)** approaching to one**.** As ***Direct Effect*** was **(0.646)** between optimizing the Usage of Technical Infrastructure on performance and **(0.551)** between Performance on Productivity. As well as, the ***Indirect Effect*** was **(0.397)** between optimizing the Usage of Technical Infrastructure on Productivity. That

Assuring unvalid Second subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Technical Infrastructure in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO2-3*: There is no significant impact in Optimizing the Usage of Work Methods in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Optimizing the Usage of Work Methods in improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-17).

Table (4-17)

Path analysis test results to the impact of Optimizing the Usage of Work Methods on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi² Calculate	Chi² Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Optimizing the Usage of Work Methods on improving the productivity through improving Performance	15.603	3.841	0.881	0.789	0.460	Usage of Work Methods on performance	0.607	0.335	0.000
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-17) we observe that there is significant impact of optimizing the Usage of Work Methods on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was (**15.603**) at level ($\alpha \leq$ **0.05**). Wheres the ***GFI*** was (**0.881**) approaching to one. In same side the ***CFI*** was (**0.789**) approaching to one. As ***Direct Effect*** was (**0.607**) between optimizing the Usage of Work Methods on performance and (**0.551**) between Performance on Productivity. As well as, the ***Indirect Effect*** was (**0.335**) between optimizing the Usage of Work Methods on Productivity. That Assuring unvalid thrid

subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Work Methods in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO2-4*: There is no significant impact in Optimizing the Usage of Measurements Methods in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Optimizing the Usage of Measurements Methods in improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-18).

Table (4-18)

Path analysis test results to the impact of Optimizing the Usage of Measurements Methods on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi^2 Calculate	Chi^2 Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Optimizing the Usage of Measurements Methods on improving the productivity through improving Performance	19.112	3.841	0.861	0.745	0.512	Usage of Measurements Methods on performance	0.593	0.327	0.000
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-18) we observe that there is significant impact of optimizing the Usage of Measurements Methods on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was **(19.112)** at level **($\alpha \leq 0.05$).** Wheres the ***GFI*** was **(0.861)** approaching to one**.** In same side the ***CFI*** was **(0.745)** approaching to one**.** As ***Direct Effect*** was **(0.593)** between optimizing the Usage of Measurements Methods on performance and **(0.551)** between Performance on Productivity. As well as, the ***Indirect Effect*** was **(0.327)** between optimizing the Usage of Measurements Methods on Productivity. That

Assuring unvalid fourth subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Measurements Methods in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

***HO2-5*: There is no significant impact in Optimizing the Usage of Skillful Workers in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).**

To test this hypothesis the researcher uses the path analysis (Amos Programming) to ensure the impact of Optimizing the Usage of Skillful Workers in improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. Table (4-19).

Table (4-19)

Path analysis test results to the impact of Optimizing the Usage of Skillful Workers on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies

	Chi^2 Calculate	Chi^2 Tabled	GFI	CFI	RMSEA	Direct Effect		Indirect Effect	Sig.*
Optimizing the Usage of Skillful Workers on improving the productivity through improving Performance	5.353	3.841	0.953	0.920	0.251	Usage of Skillful Workers on performance	0.570	0.314	0.021
						Performance on Productivity	0.551		

RMSEA: Root Mean Square Error of Approximation must Proximity to one
GFI: Goodness of Fit Index must Proximity to one
CFI: Comparative Fit Index must Proximity to one

From table (4-19) we observe that there is significant impact of optimizing the Usage of Skillful Workers on improving the productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies. The ***Chi²*** was **(5.353)** at level **($\alpha \leq 0.05$).** Wheres the ***GFI*** was **(0.953)** approaching to one**.** In same side the ***CFI*** was **(0.920)** approaching to one**.** As ***Direct Effect*** was **(0.570)** between optimizing the Usage of Skillful Workers on performance and **(0.551)** between Performance on Productivity. As well as, the ***Indirect Effect*** was **(0.314)** between optimizing the Usage of Skillful Workers on Productivity. That Assuring unvalid fifth

subhypothesis. Unaccepted null hypotheses and accepted alternative hypotheses:

There is significant impact in Optimizing the Usage of Skillful Workers in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level ($\alpha \leq 0.05$).

CHAPTER FIVE

RESULTS & RECOMMENDATION

(5-1): Results

(5-2): Recommendation

(5-1): Results

The current study asking set of questions, put hypothesis related to the impact nature between study variables. The study arrived at many results that contribute to solve the study problem, answer the study questions and hypothesis. The main results are:

- The importance level of optimization of using the Raw Materials; optimization of using the Technical infrastructure; optimization of using the Measurements Methods; optimization of using the Skillful Workers in Jordanian Human Pharmaceutical manufacturing Companies was high.

- The importance level of optimization of using the Work Methods in Jordanian Human Pharmaceutical manufacturing Companies was Medium.

- The importance level of Performance Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.

- The importance level of Productivity Improved in Jordanian Human Pharmaceutical manufacturing Companies was high.

- There is significant impact in Optimizing the Usage of Raw Materials; Optimizing the Usage of Technical Infrastructure; Optimizing the Usage of Work Methods; Optimizing the Usage of Measurements Methods; Optimizing the Usage of Skillful Workers in improving the performance

of the Jordanian Human Pharmaceutical manufacturing Companies at level **(α ≤ 0.05)**.

- There is significant impact in Optimizing the Usage of Technical Infrastructure; Optimizing the Usage of Work Methods; Optimizing the Usage of Measurements Methods; Optimizing the Usage of Skillful Workers Optimizing the Usage of Skillful Workers in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level **(α ≤ 0.05)**.

- There is no significant impact in optimizing the Usage of Raw Materials in improving the Productivity through improving Performance of the Jordanian Human Pharmaceutical manufacturing Companies at level **(α ≤ 0.05)**.

(5-2): Recommendation

Due to the results, the reaseracher put some of Recommendation as:

- Enhance the Company capabilities to provide the relevant technical for Technical Infrastructure practice.

- Enhance the Company capabilities to provide technology that allows employees to collaborate with others inside and outside the company.

- Emphasis the high synergy among SBU in the company.

- Emphasis the Functional synergy in the company to achieves distinct results.

- Interest in high technology from the Companies that allows employees to collaborate with others inside and outside the company.

- Emphasis on improving productivity because of its implications on the financial performance.

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APPENDIX

Appendix (1)

Questionnaire to Study the

Bottlenecks in Operations Management Using Casue and Effect Diagram

Applied Study on the Jordanian Human Drug manufacturing Companies (JPM & AlHikma)

As a part of Thesis Submitted in Partial Fulfillment of the Requirements for the Master degree of business Administration

Rawan Husam ALKhatib

Supervisors

Prof. Mohammad Al - Nuiami

Mr/Mrs …….. Greeting

The researcher purposed to ***Analyses the Bottlenecks in Operations Management Using Casue and Effect Diagram in the Jordanian Human Drugs manufacturing Companies.***

This Questionnaire is designed to collect information about your organization's Bottlenecks in Operations Management. I would be very grateful if you could answer ALL questions as completely and accurately as possible.

Thanks for answer all the items in the Questionnaire

Rawan Husam ALKhatib

Part (1): Demographics Information

(1) Gender

Male ☐ Female ☐

(2) Age

Less than 30 years ☐ Between 30 – 40 Years ☐

Between 41 – 50 years ☐ Above 51 Years ☐

(3) Education Level

BSc ☐ High Diploma ☐

Master ☐ PhD ☐

(4) Specialization

Chemical Sciences ☐ Engineering ☐

Pharmaceutical ☐ Administrative Sciences ☐

(5) Experience

Less than 5 years ☐ Between 5 – 10 Years ☐

Between 11 – 15 years ☐ Above 16 Years ☐

Part (2): Cause & Effect Factors

First Factor: Raw Materials

1. My Company utilize a documented system for assessment of your suppliers, including surveys/audits and corrective action records

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

2. My Company verify that quality-critical materials you receive conform to your specifications

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

3. My Company segregate non-conforming products received, and have a procedure for timely disposition

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

4. My Company used the Chemical composition to ensure that the products is appropriate to the customers

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

5. In my Company lab, the raw materials checked to ensure of the Percentage defects

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Second Factor: Technical Infrastructure

6. My Company provides the relevant technical capabilities for Technical Infrastructure practice

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

7. My Company provides a standardized communication network to transfer knowledge among employees

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

8. My Company provides a standardized software to codify knowledge

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

9. My Company provides technology that allows employees to collaborate with others inside and outside the company

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

10. My Company provides technology to map the location (e.g., an individual, a specific system, a database) of specific types of knowledge

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

11. My Company provides technology that allows employees to search and retrieve stored knowledge

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Third Factor: Work Methods

12. In my company, information flows quickly, freely

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

13. In my company, there is high synergy among SBU is achieved

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

14. Marketing activities; Operations and Engineering is linked to one team in my company

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

15. Functional synergy in my company achieves distinct results

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

16. In my company, there is appropriate ongoing development

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

17. In my company, there is various management styles allowed

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Fourth Factor: Measurements Methods

18. In my company, we have some customers who are market leaders

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

19. In my company, Accurately predict customers demands

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

20. Top management in my company thorough knowledge of competitors products

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

21. Top management in my company thorough knowledge of competitors pricing

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

22. Top management in my company hold regular, effective business reviews

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

23. Top management in my company optimally manage partners and suppliers

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

24. In my company, manage product/ service costs effectively

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

25. Have little wasted expense in my company

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Fifth Factor: Skillful Workers

26. In my company, rewards and pay based on performance

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

27. Measure employee efficiency and effectiveness in my company

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

28. In my company, Subordinates usually conferred with

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

29. In my company, Employees involved in decision

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

30. In my company, Strong support and leadership skills of management

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Part (3): Performance Improved

31. Cause & Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers) improves organizational efficiency.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

32. Cause & Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers) improves customer satisfaction.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

33. Cause & Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers) improves organizational decision making.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

34. Cause & Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers) improves work quality.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

35. The company achieves direct financial benefits from Cause & Effect Factors (Optimize Raw Materials; Optimize Technical infrastructure; Optimize Work Methods; Optimize Measurements Methods; Optimize Skillful Workers).

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

Part (4): Productivity Improved

36. Improves Productivity is reflected to improves organizational efficiency.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

37. Improves Productivity is reflected to improves customer satisfaction.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

38. Improves Productivity is reflected to improves organizational decision making.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

39. Improves Productivity is reflected to improves work quality.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐

40. Improves Productivity is reflected to company achieves direct financial benefits.

Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree ☐