

The Effect of Applying Lean Manufacturing On the Performance of Engineering Industries Institutions through Human Resources Performance (Applied to Shield Armored Glass Factory)

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Abstract— the study focused on the relationship between theoretical curricula in its various dimensions and engineering industries institutions. In an attempt by researchers to find a strong relationship between familiarity and application of human resources to Lean manufacturing principles and project performance that leads to achieving the company's goals of survival and growth; For this reason, during this study, two main questions will be answered: (Do the conditions surrounding engineering industries institutions require the application of Lean manufacturing principles?) - [Do human resources in engineering projects of various sizes have full knowledge or required of the Lean manufacturing concept / principles (regardless of the success or failure of their projects?)]; To answer these two questions, we reviewed the concept of Lean manufacturing, its various dimensions and its contribution to achieving competitive advantage. On the other hand, the study was exposed to the concept of human resources, its components, dimensions and factors affecting it. Some conclusions were reached and some recommendations were proposed that aim to maximize the use of Lean manufacturing in order to improve the performance of engineering industries enterprises.

Index Terms— Lean Manufacturing, Lean Approach, Work Site Organization, Total Productive Maintenance, Cellular Manufacturing, Continuous Improvement, Project, Armored Glass, Protection level, Human Recourse.

1 INTRODUCTION

Lean manufacturing (Toyota Production System) is the waste elimination system which focused in cutting Waste from production activities. It has also been successfully applied to administrative and engineering activities as well." [1].

"Waste is anything (activities, processes, tools, materials, personnel,...) that does not add value to the product or service and Support achieving competition and development strategy". [2]

"Project is a temporary endeavor undertaken to create a unique product, service, or result also is a series of tasks that need to be completed in order to reach a specific outcome. Also be defined as a set of inputs and outputs required to achieve a particular goal." [3]

" Many institutions manage different projects and also people may perform many projects during daily life and they do not feel that what is being performed may be called a project also There are actual projects that are carried out without systematic management / planning, so They may be subject to risks that dealt with it according to Its conditions."

Human Resources are the most important assets of institutions, Therefore, Their affairs must be taken into account for the benefit of the institution, needs and benefit to the whole society."

"The armored glass industry is one of the most important national activities that contribute to many important fields of industry in the country, such as armored vehicles and secure installations.

Shield armored glass factory is one of the most important factories operating in this field."

"The research Aim is to apply the principles of lean manufacturing to the factories under study by introducing lean culture, goals principles and importance to the Human Re-sources and make them feel the extent of moral and practical return to the organization and themselves when applying this methodology."

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Mankind to discover their skills.

2 STUDY CONCEPTS AND TERMINOLOGY:

Lean Manufacturing:

Is an approach synergistically addressing to improve operations Performance and business performance through waste elimination? [4] and also An integrated system for human development, technical tools, and systematic management that creates a culture of waste-free manufacturing in the organization, and is concerned with eliminating waste in the production process and respect

human resources, and this is done through five principles (determining value from the end customer's viewpoint - identifying all steps in the value path - Remove any step that does not add value - Make steps that add value take place in an Integrated sequence so that work flows safely - allow customers to withdraw value - strive for perfection through continuous improvement) .

Lean Approach:

It represents an organizational philosophy that includes a set of principles and practices aimed at reducing activities that do not add value, excluding waste and loss, simplifying operations, adding value to the customer / human resources and achieving financial and competitive advantages for the organization. [5]

Work site organization

A methodology for organizing, cleaning, developing and maintaining a safe and productive work environment.

Total productive maintenance

is to carry out maintenance on a regular basis to avoid any malfunction or machine breakdown. By following TPM, the focus of the organization will be changed from "fixing" to "prevent" equipment faults, which will save time and money for the organization [6]

Also it A system that aims to improve the effectiveness of the equipment by participating all workers in the organization in the process of maintenance and continuous improvement.

Cellular manufacturing

A technique whereby equipment and components are assembled represented by production cells to produce one family of products so that the equipment and workstations are U-shaped sequentially facilitating the flow of materials and components during the production process while maintaining the minimum delivery and delay.

Continuous improvement

A philosophy based on continuous small, gradual and continuous improvements to products, services, and processes aimed at reducing costs and reducing waste and waste of resources. [7]

Project.

A time-bound process or activity, that is, it has a start and end date, which is done once to provide a product or service with the goal of achieving a beneficial change or creating added value. [3]

Armored glass

Layers of glass Determine their number according to the level of protection required, including adhesives and anti-fragmentation layer material that combines and heat treated, where the Shots protection is achieved and may extend to prevent the impact of the explosive wave effect.

Protection level

The absorptive capacity of the vehicle body / facility to withstand various hostilities (gunshots - explosions) that would achieve human and purpose protection.

Human recourse

The implementation component of all activities / operations / services within the institutions which are the most

influencing factors in the success of work and increase production, which organized by a number of Processes (planning - organization - guidance - monitoring - development - training - ...) that increase organizational effectiveness and satisfy the needs Individuals.

3 PREVIOUS STUDIES

Several previous studies were reviewed, which are one of the main pillars upon which the subject of the current study in the field of lean manufacturing and its role in improving the performance of engineering industries organizations, In order to use it to develop the theoretical side of the current study

the study presents some Arab and foreign studies related to the subject of the study, taking into account that these studies will be analyzed in terms of the most important goals, the most important results, the most important recommendations and comment on them through aspects of agreement and difference - Through several axes (Lean Manufacturing - Human Resources Studies - The armored glass industry) as follows:

3.1 A study of Mina George Boutros Ghali (2018) entitled (Metrics for Assessment and Management of Lean Manufacturing Implementation) [8]

3.1.1 Objectives of the study

As stated in the engineering problem statement, the objectives of this research are:

- To translate the qualitative parameters to quantitative measures.
- To demonstrate the translation in a specific but not limited, and expandable system.
- To develop metrics which demonstrate progress in implementing Lean Manufacturing in the form of a numeric scoring system The developed metrics are designed to project the current state through a numeric Score to use in comparing with a target score of future state .
- To attain a level of waste reduction in the system which could be applied to different Industries.

3.1.2 Results of the study

With the increasing customer demands, companies are shifting to applying the Lean philosophy in their day-to-day operations in order to lower the cost of production, reduce wastes and defects while improving the quality level. Although Lean has been around for more than multiple decades now, the philosophy's implementation has been a hit or miss in many of the industries. Many organizations had their share of trial and error to come up with their lean implementation structure and plan. Different systems had been developed to asses and audit the lean manufacturing implementation in organizations. However, these were not really applicable to be implemented in the daily operations of the different industries. Hence, in this research, the proposed Metric models for the 3 Lean Manufacturing tools would help in assessing and auditing lean implementation while keeping the ease to be applied in an organization daily routine of work. In the research, these metrics were implemented in hypothetical and actual examples and cases. One of those cases was the subject of an assessment of

a different system. The data were used to reflect the metrics application.

The three chosen lean tools included in this research are chosen based on the researcher's industrial experience. The experience highlighted the uncertainty in the assessment of the implementation of these three lean manufacturing tools. While, as mentioned, organizations in different industries try to assess their efforts in lean implementation, this research serves to set guidelines for consistent and reliable method for assessment, yet easy and flexible to be applied in the daily operations of different organizations and industries.

3.1.3 Recommendations of the study

In this research, three Lean manufacturing tools were included and three different metrics were developed for each. A fourth was developed to combine those metrics in one, further development could be used to further improve the usability, efficiency, and accuracy of the metrics. Further work would also include implementing the similar development of metrics for other different lean manufacturing tools used in organizations. It would also be beneficial if these simple metrics were implemented in an independent industry and comparing the results. Moreover, studying and exploring the factors that would have an effect on the metrics and its scoring would be required. These include determining the combination of the organization and customer perspectives in developing and their effects on the metrics, and by sequence the metrics' scores. Also, acquiring more real data and applying the metrics model on this data would further improve and expose the limitations and undetermined factors of the metrics. Another field of expansion for this research would be building up a bank for the 5S categorized items to better define mass customized 5S checklists for different areas in organizations. Those items could be related to the seven types of wastes (i.e. Mudras) in a form of a matrix. This way a checklist would cover the five main principles of 5S, eliminating the seven types of wastes.

3.2 A study of Yasmen Hatem Elhalmosh (2017) entitled (The Effect of Applying the Fundamentals of Lean Manufacturing on Competitive Advantage Strategies in the Jordanian Pharmaceutical Manufacturing Companies) [9]

3.2.1 Objectives of the study

- Explain the effect of Lean manufacturing foundations on job site organization, comprehensive productive maintenance, on-time production, cellular manufacturing, and continuous improvement in competitive advantage strategy.
- 2 knowing the level of application of the pillars of Lean manufacturing in pharmaceutical companies.
- the effect of the scientific field in presenting a theoretical framework on one of the most important modern manufacturing systems, which is the Lean manufacturing system.
- providing recommendations to officials and decision-makers on the importance of Lean manufacturing and its impact on enhancing competitive advantage strategies.

3.2.2 Results of the study

- there is almost agreement on the high application of the pillars of Lean manufacturing. The site organization came first, followed by production on time,

comprehensive production maintenance, then continuous improvement, then cellular manufacturing.

- For the dependent variable, which is the strategy of competitive advantage, the application was also high, and the strategy of driving the highest cost came applied, then differentiation, then focus strategy.
- As for the relationship between the variables, it has been shown that there is a medium to strong relationship between the independent variables as well as the relationship between the dependent variables is strong to very strong, and it turns out that the relationship between the independent variables and dependent variables is very strong. And that Lean manufacturing has an impact on overall competitive advantage strategies.

3.2.3 Recommendations of the study

- Corporate management to adopt the good and proper application of the philosophy of Lean manufacturing and work to ensure the success of this application because of its great impact in reducing costs and achieving a competitive advantage for the company.
- Special training procedures for managers and workers in industrial companies on how to implement the Lean manufacturing system.
- Pay sufficient attention to achieve integration between all the pillars of Lean manufacturing because one of them complements the other in order to achieve a direct and effective impact for all of these pillars in achieving the competitive advantage.
- Increasing cooperation between companies and the teaching staff in universities with specialization in the field of modern manufacturing systems, in order to benefit from their expertise.
- Conducting other studies on other sectors to know the extent of applying the pillars of Lean manufacturing and its effect on achieving a strategy of competitive advantage in these sectors.
- Encouraging researchers to conduct test studies aimed at determining the extent of application of manufacturing foundations in the various companies operating in the industrial companies sector in order to increase competitiveness and raise the efficiency of this sector.
- conducting studies on other Lean manufacturing foundations that were not covered by this study.
- carrying out more studies on cellular manufacturing and the obstacles to its application in pharmaceutical factories.

3.3 A study of Gusman Nawarir (2016) entitled (The Effect of Lean Manufacturing on Operation Performance and Business Performance in Manufacturing Companies in Indonesia) [10]

3.3.1 Objectives of the study

The intent of this two-phase mixed methods study was to understand the impact of lean manufacturing practices on organizational performance in both quantitative and qualitative perspectives. In the first phase, in the context of manufacturing companies in Indonesia, the quantitative research was addressed to:

- Investigate the relationship between lean manufacturing and operations performance.
- Investigate the relationship between lean manufacturing and business performance.
- Investigate the relationship between operations performance and business performance.
- Examine the interrelationship between lean manufacturing, operations performance, and business performance. Results obtained from the first phase were discovered further in the second phase (i.e., qualitative phase). In this phase, a case study method was used to probe the quantitative results through an exploration on how the lean manufacturing implementation affects the business performance. The reason for following up with qualitative stance in the second phase was to understand deeper, explain further, and triangulate the quantitative findings

3.3.2 Results of the study

His study contributes toward the understanding regarding the potential effect of lean manufacturing on operations performance and business performance. It was indicated that in order to achieve potential benefits of lean manufacturing, it must be implemented holistically, not piecemeal. Applying lean manufacturing practices in isolation or in a limited subset could be unsuccessful in achieving the desired performance, it even causes failures. The holistic implementation of lean manufacturing positively affects operations performance and business performance. In addition, operations performance positively contributes to the enhancement of business performance of the companies. More importantly, operations performance Complementary mediates the relationship between lean manufacturing and business performance, in which both direct and indirect effects do exist and point at the same direction (i.e., positive relationship). Hence, the higher the level of lean manufacturing implementation, the higher the operations performance and business performance. The findings of the study partially explain the mixed results from prior studies examining performance effects of lean manufacturing. Confidently, the present study could be a stepping stone in dealing with manufacturing issues, especially in the developing countries like Indonesia. It is also expected; the study can contribute theoretically and practically to the manufacturers throughout the world with the significant and necessary advantages to compete globally.

3.3.3 Recommendations of the study

This study involved large manufacturers categorized under discrete process industries in a single country. The qualitative phase of this study tends to suggest that implementation of lean manufacturing, and its effect on organizational performance could be influenced by a number of contextual factors beyond the manufacturing process. Type of production process, size of company, type of product, technology used, etc. could affect the results of study. As it is habitual when data used in a study are from a particular context, the findings are probably irrelevant in other contexts. To some extent, the results may not be applicable beyond the context of the study. Undoubtedly, it would be advantageous to investigate the lean manufacturing implementation and its

effect on organizational performance by considering those contextual factors. Related to the context of the study, the case study was conducted in a single company (i.e., Toyota Indonesia). Even though the study was conducted in four different plants, the implementations of lean manufacturing in each plant are closely resembled because the plants are still under the same umbrella. It is well-known that Toyota was the pioneer of lean manufacturing philosophy, and surely it had been implementing lean manufacturing for a long time, and more importantly; lean manufacturing has become a culture within the company. It is undeniable that the implementation of lean manufacturing in Toyota had been perfectly done, and the benefits of its implementation had been fully realized. The implementation of lean manufacturing and its effect on performance are varied across the companies. Therefore, conducting a case study in other companies could be valuable. It is also suggested to conduct multiple case studies, so that the cross-comparison could be performed to obtain a more comprehensive understanding regarding the phenomena. The quantitative phase of the study was a cross-sectional study, in which the data was collected once and represented a snapshot at one point in time. As discussed in the literature and supported by the result of qualitative phase of this study; lean manufacturing is a long-term initiative, and requires a long-term commitment. Thus, the benefits of lean manufacturing implementation could not be realized in a short-term. Given that, implications of lean manufacturing on operations performance and business performance may be relative at the time of its implementation. So that, conducting a longitudinal study in a long term would be important to accurately investigate the relationship among the variables of the study.

3.4 A study of Zaher Hisne Kasem (2015) entitled (The use of the Value Stream Costing Model for the purpose of supporting the Sustainability Strategy in Lean Manufacturing Environment "An Empirical Study ") [11]

3.4.1 Objectives of the study

Measuring the relationship of management with Lean manufacturing and their impact (improving production quality - optimizing the company's resources - achieving employee satisfaction and loyalty - attracting and retaining the best customers - improving facility growth rates)

3.4.2 Results of the study

- The successful application of the rationalization approach requires open economic and political conditions, as it depends on some concepts such as continuous flow, zero stock, and unit-by-unit flow and the exclusion of production constraints.
- The application of lean manufacturing system with rationalization accounting system uses the withdrawal system, the method of production on time and the method of reducing the value of the stock, One Piece Flow production.

3.4.3 Recommendations of the study

- The researcher recommends business establishments shift to the application of the rationalized manufacturing system because of the advantages it provides in rationalizing the use of resources, limiting activities that

are not adding to value, excluding losses in all its forms, and improving the efficiency of machines, which positively reflects on the sustainability of society.

- The researcher recommends companies that think about applying the rationalization approach, developing the skills of human cadres in all the jobs and departments of the facility on the culture of rationalization.
- The researcher recommends companies to pay constant attention to the value current maps of the current and future situation in order to constantly identify production obstacles and remove them and achieve continuous improvement of the value flow within value streams.
- It is necessary to involve accountants and administrators in preparing, implementing and monitoring the sustainability strategy.

3.5 A study of Mohamad AL-Najem (2014) entitled (Investigating the factors affecting readiness for lean system adoption within Kuwaiti small and medium-sized manufacturing industries) [12]

3.5.1 Objectives of the study

This research project aims to consider the general situations of Industries to identify their readiness for adopting lean systems, and to identify the factors that are affecting this readiness. The study further aims to examine how the introduction of lean systems to Industries could create awareness about the benefits that lean systems could bring, and help them to improve their businesses.

In order to achieve the aims of this research, the main objectives are outlined as follows:

- To identify the essential factors required by lean systems.
- To investigate the general state of Industries.
- To get a clear understanding of current quality and management practices used by Industries.
- To develop an Lean framework to measure Industries' readiness towards lean systems.
- To identify and analyses the different barriers and enablers for implementation of lean systems in Industries.

3.5.2 Results of the study

Supporting Industries could be key to achieving this vision. Thus, in order to ensure the success of lean systems and to enhance the role of Industries, the government needs to pay attention to this sector by encouraging firms to adopt Lean System , and developing awareness campaigns that highlight the importance of lean systems and explain the requirements for the implementation process. This can be done by providing Industries with appropriate training and workshops. The findings of this study show the weaknesses of Industries and the requirements for lean systems, which can be used by the government to formulate some action points in this direction.

3.5.3 Recommendations of the study

Need to educate themselves in lean systems, as it can help them to manage their resources more efficiently. They should rely on quality laborers, and need to understand the importance of empowerment, Continuous Improvement, involvement, training, and most of the other issues that have been identified in this study. Equally important is the need

for them to be aware of the use of essential tools, as these will help them to better manage their processes, which will in turn reflect in their production rate

3.6 A study of Jaiprakash Bhamu (2013) entitled (Development and Validation of Lean Manufacturing Drivers Barriers and Framework with a Focus on Ceramic Industry) [13]

3.5.1 Objectives of the study

The study aims at developing and validating a lean manufacturing implementation Framework. A lean manufacturing implementation model will be developed after the Review of existing frameworks. The framework will be validated by a case study of Ceramic industry. This study also focuses on the review of literature in lean Manufacturing to understand its evolution and current research issues. Development Of the implementation framework will not be worthy without developing the drivers and barriers of any philosophy, technique, system, etc. Therefore, the thesis also aims at developing and validating the drivers and barriers of lean manufacturing.

3.5.2 Results of the study

It has shown that the external lean Consultants/facilitators are more effective in removing the resistance of the employees to change. The study has shown the importance of value stream mapping, 5S, kaizen, And TPM in lean manufacturing implementation in ceramic industry. The productivity and quality of the case organization has improved. The organization has also become Flexible by eliminating wastes at various processes/workstations and responds to fluctuating customer demands quickly and efficiently. The important tools used for The case study in implementation phase are, TPM, 5S, and kaizens.The reimplementation and post implementation performance measure validate the Lean manufacturing benefits.

3.5.3 Recommendations of the study

The present study has concentrated on ceramic industry to test the wider validity of the instrument, the work can be extended to other types of industries, different size of industries and at different places. One specific limitation of the study is also non-homogeneous sample. Research may be also carried out to correlate overall Change with employee and customer satisfaction.

3.7 A study of Mohammed Sufian AbuShaaban (2012) entitled (Wastes Elimination as the First Step for Lean Manufacturing "An Empirical Study for Gaza Strip Manufacturing Firms") [14]

3.7.1 Objectives of the study

The main goal of this research is to investigate the current situation of wastes Elimination in the manufacturing firms in the Gaza Strip and its important role for reducing the production cost. Other research objectives are:

- Exploring the wastes elimination procedures used by the manufacturing Firms in the Gaza Strip
- Highlighting the best ways of eliminating wastes.
- Analyzing the production wastes in the Gaza Strip factories.
- Dissemination and promotion of Lean thinking to the managers of Gaza Strip manufacturing firms.

3.7.2 Results of the study

About the Importance of Lean Manufacturing on the Production Cost for the Manufacturing Firms in the Gaza Strip:

- Lean manufacturing (wastes elimination) affects positively on reducing the production cost.
- The ranking nearly converged of the most wastes affecting the production cost between the two used primary sources as shown in table
- About Respondents Perception Regarding Lean Manufacturing Attributed to Personal Variables in the Gaza Strip Manufacturing Firms:
- There is no significant statistical difference among respondents perception regarding lean manufacturing attributed to age, specialization, and scientific qualification.
- Attributed to position, there is a significant statistical difference among respondents.

Perception regarding overproduction, inventory, motion, defects, and transportation wastes, and there is no significant statistical difference among respondents perception regarding over-processing and waiting wastes.

3.7.3 Recommendations of the study

- It is hoped that this research will provide the manufacturing managers within the suitable tools and techniques of eliminating wastes, such as, 5S's system, VSM, TPM, and JIT. Also, it is so necessary for them to implement these techniques which lead to huge improvement in their production.
- Managers should train all of their employees in all of the managerial levels about applying lean manufacturing tools and techniques
- All of the wastes in the manufacturing firm have to be studied and analyzed separately to be able to apply lean manufacturing tools and techniques to reduce the production cost.
- More intensive manufacturing education is needed for the heads of the manufacturing business to develop their techniques of managing their firms.
- The manufacturing firms should develop their general plans and schedules according to the nature of their production to be able to reduce production costs.
- The production cost management must be included into the tasks of a department in the manufacturing firm. Sometimes, it is needed to be a special department.
- Special plans and specialist(s) for following up the product cost from the starting point to the ending point have to be developed.
- The common individual-owner form in the Gaza manufacturing business needs to be extended into partnership, private joint stock, and public forms to enhance the related firms and develop their production and increase profitability.

4 LITERATURE REVIEW

4.1 commenting on previous studies

Lean manufacturing methodology, with its various dimensions, is of great importance to all areas of life, especially industry and engineering projects. This is what I focused on previous studies, and in that many studies, including the study

A study of (Mina George Boutros Ghali 2018) this research is to introduce a new concept of auditing and implementing Lean Manufacturing by translating qualitative criteria to quantitative metrics. Therefore, quantitative formulas were developed to produce a numeric score, representing the progress of three lean manufacturing Tools implementation. The tools are 5S, Kaizen, and Value Stream Mapping. The scores could then be compared to an ideal state or a standard set by industrial studies (i.e. baseline).

A study of (Yasmen Hatem Elhalmosh 2017) This study aimed to demonstrate the impact of the application of lean manufacturing in the strategies of competitive advantage in Jordanian pharmaceutical companies. This study is descriptive and causal. Data were collected through a questionnaire that was built on the basis of previous studies and developed with the help of the jury. The results showed that there is a high application of the lean manufacturing pillar and competitive advantage strategies in Jordanian pharmaceutical companies.

A study of (Gusman Nawanir 2016) The purpose of this mixed methods sequentia explanatory study was to understand the effect of lean manufacturing on operations performance and business performance in the context of manufacturing companies in Indonesia. Hypotheses. The findings of the quantitative data analysis indicate that all the lean manufacturing practices are highly correlated and interdependent. The results provide evidence that lean manufacturing should be implemented holistically, because the practices are mutually supportive and complement each other. Lean manufacturing is also positively related with operations performance and business performance. More importantly, operations performance complementary mediates the relationship between lean manufacturing and business performance.

A study of (Zaher Hisne Kasem 2015) The study aims to develop a theoretical explanation explaining each of the Lean manufacturing system, the value stream cost measurement model and the sustainability strategy, then measure the relationship between the application of the value stream cost measurement model and the Lean manufacturing system to business enterprises and the strengthening of the sustainability strategy.

A study of (Mohamad AL-Najem 2014) In this study, a measurement framework to evaluate the lean readiness within Kuwaiti small and medium-sized manufacturing industries has been developed. This measurement framework encompasses the quality and management practices related to Lean System (processes; planning and control; human resources; top management and leadership; customer relations; and supplier relations) to assess the practices and determine whether they have the foundation to implement Lean System.

A study of (Jaiprakash Bhamu 2013) The study aims at developing and validating drivers, barriers and framework of lean manufacturing implementation with a focus on the ceramic industries. This study also focuses on the review of literature in lean manufacturing to understand its evolution and current research issues study provides an extensive literature review of lean definitions, contributors, type of

research methodologies used, types of industries implementing lean, lean tools and techniques, and lean implementation frameworks

A study of (Mohammed Sufian AbuShaaban 2012) This Research aims to investigate the current situation of wastes elimination in the manufacturing firms in the Gaza Strip and its important role for reducing the production cost. This research considers the best ways of eliminating wastes, investigates and analyzes the production wastes in the Gaza Strip factories, and promotes for lean thinking through studying the seven wastes that are targeted by the lean manufacturing philosophy, which are: Overproduction, Inventory, Over processing, Motion, Waiting, Defects, and Transportation. It also addresses the concept of identification and elimination of wasteful activities.

4.2 Similarities between the previous studies and the current study

- The current study and some previous studies aim to high- light the The importance of Lean manufacturing and the extent of its impact on the work of engineering industries establishments and achieving competitive advantage.
- The current study is consistent with previous studies on the dimensions of lean manufacturing and the importance of human resources for industrial enterprises.

4.3 The differences between the previous studies and the current study

- The current study deals with the theoretical side of lean manufacturing and the impact of human resources on the success of engineering industries projects.
- There are many projects of engineering industries that are managed in an ordinary way without relying on methodological theories, including lean manufacturing, regardless of the success or failure of these projects.
- The current research aims to provide a simplified model or pattern for managing engineering industries projects using human resources.
- Current research aims to create human cadres within the institutions responsible for implementing and monitoring the principles of lean manufacturing .

4.4 Benefits from the Previous Studies

- Formulating the theoretical framework for the study and reviewing recent experiences of these studies, paves the way for the current study to try to reach its goals.
- Help the researcher define the study problem and formulate hypotheses.
- The books and references section directed the researcher towards the sources of information related to the problem.
- Benefit from the results of studies and statistical analyzes in choosing the appropriate research methodology and refer to these results when discussing and analyzing the results that this study will produce for us, recommendations and proposals.

5 STUDY PROBLEM

All institutions strive to achieve excellence in their activities and develop their performance, and this varies according to the management style and strategy, so following the practical approaches of management in its applied concept has become a necessity for engineering industries projects, especially national projects, Therefore, the problem of study is focused through answering the following questions:

- Are engineering industries institutions facing obstacles / challenges (equipment - inventory - materials - infrastructure - Human Resources - ...)?
- Are the conditions surrounding engineering industries institutions (the factory being researched) require to apply the lean manufacturing principles?
- Do the Human Resources in engineering projects of all level have full or required knowledge of the lean manufacturing concept / principles (regardless of the success or failure of those projects)?

6 THE IMPORTANCE OF THE STUDY

All institutions are interested in achieving success in their activities and developing their performance, and this varies according to the method and strategy of management, and following optimal standards of management in its scientific concept has become an imperative for engineering industries projects, so the importance of the study is due to the following points:

- Provide theoretical framework on some of the project management concepts for engineering industries.
- Offering the possibility to improve products and reduce manufacturing waste.
- Creating qualified human cadres through which growth and excellence is achieved in the field of engineering industries at various levels.
- Solve some technical and administrative problems facing the armored glass industry in Egypt.

7 STUDY OBJECTIVES

- Presenting the concept / principles of Lean Manufacturing, its components, importance, and reasons to applied engineering industries projects.
- Identify the aspects of waste - the requirements of evaluating the manufacturing processes / the performance of human resources in the organization.
- Submit a suggested model for Human Resources in engineering industries institutions to be familiar with the principles of lean Manufacturing.
- Give \ show the effect of applying theoretical principles (lean Manufacturing) on the practical fields (armored glass industry) to obtain a positive return.
- Develop a proposed vision for the requirements of applying Lean manufacturing approach to human resources in engineering industries institutions and its importance and its impact on enhancing the competitive advantage of institutions.

8 STUDY METHODOLOGY

- Deductive approach
Arab and foreign sources
Previous studies
Global Information Network (INTERNET) .

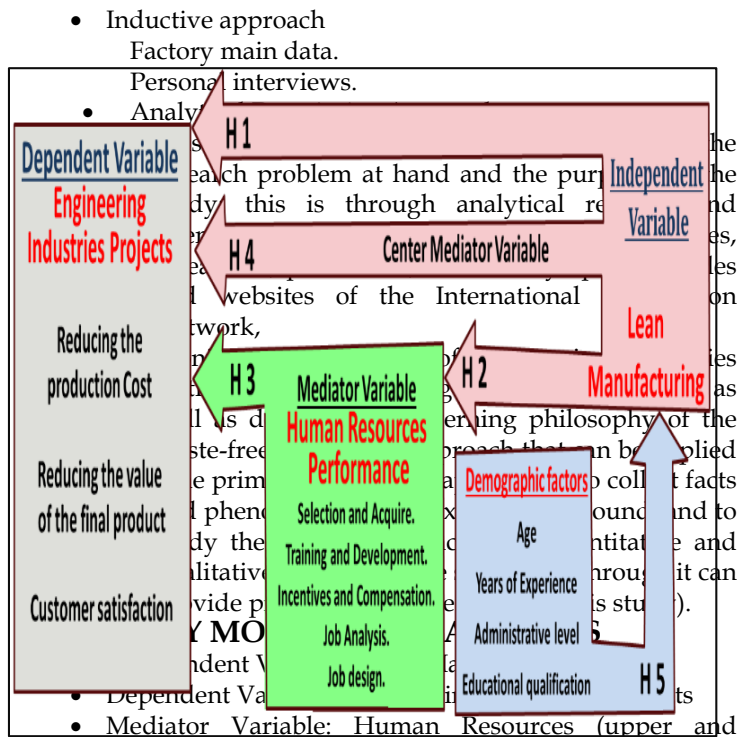


Fig. 1. Suggested study model (Source: Prepared by researchers based on previous studies) .

- Inductive approach
Factory main data.

- Mediator Variable: Human Resources (upper and middle management) Performance.

- The effect of the independent variable on the dependent variable It aims to achieve the following:
Best use of manpower / equipment / materials.
Organizing manufacturing processes / procedures.
Organizing work paths and administrative procedures.
Positive impact on the final product and customer satisfaction. Positive moral impact on workers in engineering projects.

- Research Scope:
For the independent variable (Lean Manufacturing):
Lean manufacturing methodology
For the dependent variable (Engineering Industries Projects):

- Reducing the production Cost.
- Reducing the value of the final product.
- Customer satisfaction.

For the intermediate variable HR (upper and middle management):

- Selection and Acquire.
- Training and Development.
- Incentives and Compensation.
- Job Analysis.
- Job design.

Demographic factors:

- Administrative level.
- Educational qualification.
- Years of Experience.
- Age.

10 STUDY HYPOTHESES

Based on the study's questions and objectives, the researcher formulated the researcher formulated (5) main hypotheses and (11) sub hypotheses as follows:

The first main hypothesis:

There was no significant relationship between the lean manufacturing application in Shield Armored glass factory and the performance of engineering industries projects and its three dimensions(reducing the cost of production Final product devaluation, customer satisfaction) from this assumption, a number of (3) subcultures emerged as follows

- ,1First sub-hypothesis: "There is no significant relationship between the application of Lean manufacturing in Shield Armored glass factory and reduce the cost of production
- Second sub-hypothesis: "There is no significant relationship between the application of Lean manufacturing in Shield Armored glass factory and the final product devaluation
- The third hypothesis: "There is no significant relationship between the application of Lean manufacturing in Shield Armored glass factory and customer satisfaction

The second main hypothesis

" "There is no significant relationship between the lean manufacturing application in Shield Armored glass factory and human resource performance and its five dimensions (selection, appointment, training Development, job analysis, incentives and compensation, job design)

From this assumption, number (5) sub-assumptions emerged from their statement as follows:

- First sub-hypothesis: "There is no significant relationship between Lean manufacturing application in Shield Armored glass factory dimension selection and appointment
- Second sub-hypothesis: "There is no significant relationship between Lean manufacturing application in Shield Armored glass factory and training and development dimension "
- The third hypothesis: "There is no significant relationship between the application of Lean manufacturing In Shield Armored glass factory and Post Function Analysis "
- Quarterly Sub-Hypothesis: "There is no significant relationship between lean manufacturing application in Shield Armored glass factory has dimension incentives and compensation. "
- Fifth hypothesis: "There is no significant relationship between the application of Lean manufacturing in Shield Armored glass factory and Dimension Job Design "

The third main hypothesis

"There is no significant relationship between the dimensions of human resource performance and project performance Engineering industries and its three dimensions) reducing the cost of production, reducing the value of the final product, Customer satisfaction From this assumption, number (3) sub-assumptions emerged as follows:

- First hypothesis: "There is no significant relationship between the dimensions of resource performance Humanity and dimension reduce the cost of production. "
- Second sub-hypothesis: "There is no significant relationship between the dimensions of resource performance Mankind and dimension reduce the value of the final product. "
- The third hypothesis: "There is no significant relationship between the dimensions of resource performance Humanity and dimension customer satisfaction.

The fourth main hypothesis

"The impact of the lean manufacturing application in the armored glass manufacturing plant does not increase on performance engineering industries projects when centering human resource performance

Fifth main hypothesis:

"There are no material differences between the employees of the armored glass manufacturing plant in their cognition Lean manufacturing according to rural demographic factors (age, administrative level, educational qualification, Years of Experience)

11 DATA COLLECTION SOURCES

• Secondary sources

Arabic and foreign books and references.
Periodicals, bulletins and articles
Research published and unpublished

• Primary sources

The questionnaire to obtain the necessary data for this study.

Personal interviews to inquire and obtain some information about the study.

12 SOCIETY AND STUDY SAMPLE

• Study Population

For workers (Shield armored glass factory).

For clients (Armed Forces Factory - Factory of the Arab Organization for Industrialization -Factory of the Ministry of Military Production)

• Study sample

For workers (The human resources working in the Shield armored glass factory, which number (245), with their different job levels).

For clients [Armed Forces (18) units -The Ministry of Interior has 12 units - Some foreign embassies inside Egypt number (8)]

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