

# **The Impact of Lean System Implementation on Organizational Sustainability: An Applied Study on the King Hussein Bin Talal Development Area**

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**Abstract:** - Nowadays, manufacturing organizations are under growing pressure from government bodies, non-governmental organizations, and consumers to become more sustainable. Although lean practices can bring environmental, social, and economic benefits, their effect on the long-term sustainable performance is not exactly clear. This paper attempts to clarify the impact of lean system (LP) implementation on organizational sustainability (OS), Data were gathered through a survey of 160 employees in manufacturing firms in Jordan and were analyzed using the Statistical Package for the Social Sciences (SPSS), the results indicate that remove waste, total productive maintenance, quick set up have a significant effect on organizational sustainability, these results have important implications for enhancing the sustainability of manufacturing firms through lean system practices. The study aims to improve the setup time, as well as environmental and social sustainability.

**Key-Words:** - lean system, remove waste, quick setup, total productive maintenance, organizational sustainability, economic sustainability, social sustainability, environmental sustainability.

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## 1 Introduction

Businesses operate in an ever-changing environment; every company, big or small, is expected to respond swiftly to change. Industrial producers in particular have experienced several variations in evolving industrial processes to increase productivity and reduce costs

In industrial environments, the lean system is regarded as one of the most advanced systems, developed to achieve greater resilience with available resources and minimize waste. By emphasizing the use of certain instruments or tools of lean systems and procedures that ensure the application's success.

**Lean production** refers to a collection of management ideas and strategies that are designed to eliminate waste in the manufacturing process and enhance the flow of activities that enhance the product's value from the consumers' viewpoint [1]. Lean manufacturing methods (LMP) are a set of strategies used to decrease manufacturing costs, increase productivity, and minimize environmental impacts, as well as improve social sustainability [2]. Lean production's fundamental concept is to develop lean processes by getting rid of waste [3]. The Lean production processes have positive effects on business organizations, their supply chains and the operational performance of the business [4].

**Remove waste** means the ability to reduce waste to the minimum by creating high-quality products that meet the needs of the end customer. The Japanese concept of "Muda" refers to waste and identifies seven common types: overproduction, unnecessary motion, excess inventory, unnecessary transportation, defects or rejected products, rework, waiting time, and excessive processing or production operations [5].

**Quick setup** plays a critical role in manufacturing lead time, and Quick Changeover (QCO) is a Lean Manufacturing (LM) approach that enhances production efficiency while minimizing changeover time (COT). Quick setup simplifies and streamlines subsequent processes to optimize production and reduce model COT by performing as many tasks as possible while the equipment is still in operation. It eliminates non-value-added activities and consists of four steps: the preliminary stage, separating internal and external activities, converting internal activities to external ones, and simplifying all preparation tasks [6].

Quick setup leads to shorter lead times and improved competitiveness. It offers several benefits, including minimizing costs while maintaining an acceptable level of quality [7], [8], and waste reduction, increased production capacity, enhanced

equipment flexibility, better machine efficiency, improved customer satisfaction, and a higher Overall Equipment Effectiveness (OEE) index. The implementation of 5S can reduce these times to nearly zero.

**Total productive maintenance (TPM)** increases employee and equipment productivity while substantially reducing manufacturing losses, material waste, and machine downtime. Through the detection of equipment errors and breakdowns, TPM facilitates autonomous and predictive maintenance [9]. By implementing TPM, worker productivity is increased through controlled maintenance, reduced maintenance expenditures, production stoppages, and downtime [10], which means attaining environmental, social, and economic sustainability [11]. The term "economic performance" describes the company's financial and/or operational outcomes. Many scholars have presented that the top five TPM key success factors that have an impact on social sustainability are employee engagement, organizational culture, top management commitment, employee health and safety, and efficient workplace management. Furthermore, the least important TPM critical component influencing societal sustainability is efficient equipment utilization [12].

**Sustainability** is a process focused on achieving a balance between environmental protection and the use of natural resources. Due to the degradation of natural resources by human activity, it is now essential to manage their consumption in a way that ensures their availability for future generations [13]. **Similarly, organizational sustainability** is the ability of an organization to survive by achieving future success and prosperity by relying on an intense focus on the three dimensions of performance at the same time, which are the economic, social, and environmental performance of the organization; also called the Triple Bottom Line (TBL), which includes:

**Economic sustainability** means the optimal exploitation of resources, ensuring the flow of resources between stakeholders, and maintaining the continuity of work without interruption. Optimize the use of available resources like time and energy, and minimize waste of materials and other resources. This approach aims to enhance overall performance, adapt to the environment, and ensure continued survival and stability. Sustainable businesses blended economic efficiency with the conservation of the environment and the application of ethical values and sustainable development in the future [14].

**Social sustainability** means Workers' well-being results from the application of equal opportunities and equality among workers, the absence of bias and discrimination in the workplace, and empowering employees through education and training.

**Environmental sustainability** means The company relies on renewable energy such as solar energy for its production, The company works to reduce the consumption of non-renewable energy such as electricity and natural gas Preserve the environment by reducing danger, risks, damage, and environmental pollution caused by some organizations' practices, by reducing the use of some materials and by reducing air, land, and soil pollution as a result of the leakage of gas emissions and waste from some industrial organizations. The researchers believe that the lean system enhances organizational sustainability, so this study came to prove that by applying it to the King Hussein Bin Talal Development Area [13].

## 2 Problem Formulation

The countries around the world have experienced time lags and difficulties in adopting new production systems. Many factors lead to this, including the weakness of implementation methods and appropriate technical competencies available to support the changes, as well as difficulties shifting to non-traditional ways of production. Organizations often struggle to find tools that keep up with changes in both local and global markets. Take the King Hussein Bin Talal Development Area in Mafrq City, for example. This new industrial zone was built with one big goal: to drive economic growth by bringing in investors to boost the manufacturing sector. The newly implemented changes in the area allow this case to focus on studying non-traditional ways of production.

The research investigates the introduction and adoption of Lean Manufacturing Systems within this development area. It seeks to assess the extent to which the Lean approach has been implemented, how it promotes environmental sustainability, and its contribution to achieving organizational sustainability, as shown in Figure 1 (Appendix). By doing so, the study aims to offer valuable insights for policymakers and industry stakeholders regarding the potential of Lean Manufacturing as a transformative production strategy in emerging economies."

## 2.1 Literature Review and Hypotheses Development

Some researchers investigated the connection between lean production and Industry 4.0 in small and medium enterprises (SMEs) in Japan and Brazil. The authors conducted qualitative interviews with two companies in Japan and fifteen in Brazil, alongside a quantitative survey involving 20 Brazilian and 30 Japanese firms. Results show that 90% of companies use lean manufacturing, while 40% use Industry 4.0 technologies. According to four Brazilian managers, lean manufacturing is essential for Industry 4.0, as inefficient production processes remain unproductive even with advanced digital technologies [16].

Others examine the impacts of lean practices and digitalization on operational performance through organizational learning. It focuses on lean dimensions such as lot size reductions, continuous flow production, pull systems, cellular manufacturing, cycle time reductions, focused factory systems, agile strategies, quick changeover techniques, reengineered processes, and total preventive maintenance (TPM). A questionnaire distributed to 209 manufacturing companies revealed that organizational learning connects lean practices to operational performance but does not establish a similar link for digitalization [17].

Another study identifies factors that facilitate the successful implementation of lean methodologies in South American manufacturing firms. Using structural equation modeling and data from 1,809 responses collected through the Global Management Survey, the study found strong relationships between lean practices, performance management, and organizational targets. Lean practices were positively linked to performance management but exhibited an inverse predictive relationship with human capital management (HCM) [18].

While other works apply Lean and Green principles in the agribusiness sector, focusing on environmentally sustainable value stream mapping (Sus-VSM) to assess key indicators for an orange farm in Sergipe, Brazil. By integrating qualitative and quantitative methods, the study proposes inventory analysis frameworks for agricultural processes. Results demonstrate Sus-VSM's effectiveness in improving value and reducing environmental impact. However, process adjustments are needed for successful deployment. The analysis shows that future improvements could yield a 4.08% value gain, while the current state contributes 70.55% more to climate change impacts [19].

## 2.2 Hypotheses Formulation

Based on the previous Literature review, the study suggests this hypothesis:

**H1:** There is no significant impact at the level of significance ( $0.05 \geq \alpha$ ) of the lean system combined (Remove waste , Total Productive Maintenance , Quick setup) on the organizational sustainability dimensions (economic sustainability , social sustainability , environmental performance )

Based on the main hypotheses, the following sub-hypotheses expand out:

**H1a:** There is no significant impact at the level of significance ( $0.05 \geq \alpha$ ) Remove waste combined with organizational sustainability

**H1b:** There is no significant impact at the level of significance ( $0.05 \geq \alpha$ ) of the Total productive maintenance combined with organizational sustainability.

**H1c:** There is no significant impact at the level of significance ( $0.05 \geq \alpha$ ) of quick setup combined with organizational sustainability

## 3 Methods

This study adopted the descriptive quantitative analytical method, as this approach was deemed appropriate for identifying the relationship between the independent variable, the lean system, and the dependent variable, organizational sustainability, in the King Hussein Bin Talal Development Area.

The significance of this study stems from both theoretical and practical aspects, which the researchers believe will contribute to the field of knowledge and enable decision-makers in the King Hussein Bin Talal Development Area to benefit from its findings and recommendations. By Determining the impact of the lean system combined [20], [21] (remove waste, total productive maintenance, quick setup) [22], [23] on the organizational sustainability dimensions (economics sustainability, social sustainability, environmental performance), the study model consists of one independent variable, which is a lean system, and one dependent variable which is organizational sustainability (Figure 1, Appendix).

### 3.1 Research Methodology

The design of this research is descriptive and quantitative in nature; the primary data were a self-administered questionnaire that was designed and distributed to the study's sample. However, secondary data were collected from various resources such as books, journals, newspapers, and

the Internet [24]. The main advantage of secondary data is saving time and money since it is much less expensive to use secondary data than to collect the same, all statistical analyses were conducted using SPSS version 30 for Windows. The questionnaire consisted of many statements representing elements of the lean system and organizational sustainability. For this purpose, some measurements related to the lean system were used by others [25]. Likert criterion, which consists of five degrees, was applied using a scale from one to five, where one means strongly disagree or very unknown and five means strongly agree or well known [26].

### 3.2 Population and Sampling

The study population consisted of employees from the different companies in the King Hussein Bin Talal Development Area. A convenience sample of 160 elements was chosen from each company, and 150 questionnaires were valid for statistical analysis. The main reasons for choosing this sample were as follows.

- To explore the awareness of organizational sustainability.
- To measure the effect of the lean system on organizational sustainability.

### 3.3 Statistical Methods Used in the Study

To describe the characteristics of the study sample, analyze respondents' opinions regarding the questionnaire statements, assess the validity and reliability of the tool, and test the study hypotheses, the following statistical methods were applied:

[1] **Descriptive Statistical Measures:** Used to describe the characteristics of the study sample, answer the study questions, and rank the questionnaire items in descending order.

[2] **Reliability Test:** Cronbach's Alpha test was employed to measure the reliability and internal consistency of the study tool.

[3] **Multicollinearity Matrix:** Checked using the Variance Inflation Factor (VIF) and tolerance test to ensure no high correlation among independent variables.

[4] **Autocorrelation Test:** The Durbin-Watson (D-W) test was applied to detect autocorrelation in the data.

[5] **Multiple Regression Analysis:** Used to test the validity of the study model and the significance of the impact of independent variables on the dependent variable.

[6] **The F-test:** is a statistical test used to determine whether there are significant differences between group variances or to assess the overall significance of a regression model. It helps to test

whether a set of independent variables has a joint effect on the dependent variable in regression analysis.

### 3.4 Data Analysis

#### 3.4.1 Test of Reliability

Before performing data analysis have to ensure the reliability of the data collection tool. Using Cronbach's Alpha test, the reliability was measured by means of data collection, as can be seen in Table 1 (Appendix). The value of Cronbach's alpha is 0.939 for the questionnaire, so all the variables' Cronbach's alpha is greater than 0.6, and reliability is confirmed.

#### 3.4.2 Description of Sample Characteristics

Table 2 (Appendix) indicates that a significant portion of the sample consists of males (83.4%), the majority of whom are between the ages of 30 and 50 (71.5%). In terms of education, most hold a master's degree(67,5%), with experience ranging from 5 to 10 years (43,7%).

#### 3.4.3 Descriptive Analysis

Means and Standard Deviations were used to describe (L.P & O.C). First, the analysis scale was modified based on the average answers of the sample members in the researched institutions as follows:

1. From 1 to less than or equal to 2.33, low approval.
2. From 2.34 to less than or equal to 3.67, medium approval.
3. From 3.68 to 5, high approval.

Table 3 (Appendix) presents the descriptive statistics of the independent variable 'Lean System.' The results indicate that companies exhibit a high level of approval across the three independent dimensions, with all mean values exceeding the virtual mean of 3.67. This suggests that companies have effectively embraced lean system practices, particularly excelling in the 'Total Productive Maintenance' dimension

This reveals that firms practice predictive maintenance in most cases, which means they are likely engaging in strategies that improve their organization's efficiency during downtimes and production as well as of Table 4 (Appendix) Descriptive Statistics of Dependent Variable Organization Sustainability. The results indicate that companies demonstrate a moderate level of approval across the three dependent dimensions. Specifically, all the mean values fall below the virtual mean of

3.67 and are above 2.34, suggesting that while companies exhibit some alignment with organizational sustainability practices, there is room for improvement. This moderate level of engagement may reflect partial adoption or inconsistent implementation of sustainability initiatives.

Descriptive statistics of the independent variable 'Remove Waste' are given in Table 5 (Appendix). The data suggest that firms approve the attribute at a very high level, as all averages are above the sample mean of 3.67. This indicates that businesses are taking waste removal seriously as one of their operational strategies. These tactics could reduce material waste, improve production procedures, reduce time inefficiency, and improve resource expenditure. The latter successful examples testify to a significant organization's determination for lean principles and operational efficiency, which can contribute to cost savings and enhanced productivity.

Table 6 (Appendix) provides the tree of descriptive statistics for independent variables: The Total Productive Maintenance support from the company – as can be observed, companies demonstrate a great approval sentiment toward this dimension, and all mean values surpass the virtual mean value (3.67) significantly. This indicates that companies consider proactive maintenance focused on optimizing equipment utilization and downtime as very important. The high level of acceptance can probably be attributed to activities such as preventive equipment maintenance, employee participation in maintenance work, and rational problem-solving methods. These efforts likely contribute to improved operational efficiency, enhanced equipment lifespan, and overall production stability

The descriptive statistics of the independent variable 'Quick Setup' are shown in Table 7 (Appendix). The findings reveal that the companies (20) are strongly attuned to this dimension, reflecting their focus on reducing setup times and enhancing production efficiency. However, there is an exception for the last question, which states: 'The company is trying to convert internal configuration to external configuration.' This particular aspect received only an average level of approval, suggesting that companies may face challenges in shifting tasks traditionally performed during machine downtime to be executed externally. Addressing this issue could further optimize production flow and minimize operational interruptions.

The descriptive statistics for the dependent variable 'Economic Sustainability' are presented in Table 8 (Appendix). The findings show that companies have a moderate approval of this dimension, which means companies are aware that economic sustainability is important; however, it has not yet been fully internalized into the core business. This marginal support intensity may indicate the aspects where companies are still developing or increasingly aiming at the adoption of means of ensuring economic sustainability in the long term, like cost control and financial stability, as well as the efficient allocation of resources.

Descriptive statistics for the dependent variable 'Social Sustainability' are reported in Table 9 (Appendix). The outcomes suggest that companies have a moderate approval rating on this dimension, indicating that social sustainability is well known at least in importance, but it might not be the area with the highest priority or an area for actual action within the organisations. This moderate level of support may indicate there are pockets where companies have just begun to accept employee well-being, community, and socially responsible practices. These additional efforts might. Further efforts in these areas could enhance their social impact and contribute to a more sustainable future.

Table 10 in the Appendix shows the basic stats for the dependent variable, "Environmental Sustainability." The data shows most companies sit at a medium level of approval on this front. In other words, they recognize the importance of environmental sustainability, but they're not all-in just yet. They're probably just getting started with things like waste management or improving energy efficiency. Even so, these companies still have a way to go before sustainability becomes part of everything they do. The moderate scores hint that they're moving in the right direction but haven't fully committed across the board

## 4 Findings and Discussion

Multiple regression tests were used to test the study's main hypotheses, but before that, we must use pre-tests to confirm the validity of the study model.

### 4.1 Multicollinearity and Autocorrelation Test

We need to determine whether there is multicollinearity among the independent variables in the model. In addition, the Durbin-Watson test is

used to examine the presence of autocorrelation. The results are presented in Table 11 (Appendix).

Based on the coefficient output- collinearity statistics, obtained tolerance value (0.459-0.356-0.578), and VIF value (2.177-2.809-1.730), meaning that tolerance  $> 0.2$  and  $VIF < 10$ , it can be concluded that there is no multicollinearity. The Durbin-Watson  $d = 2.027$ , which is between the two critical values of  $1.5 < d < 2.5$ . Therefore, we can assume that there is no first-order linear autocorrelation in our multiple linear regression data.

After confirming the validity of the study model, we can test the hypotheses using multiple regression.

Table 12 (Appendix) presents the multiple linear regression model summary and overall fit statistics. The adjusted  $R^2$  value is 0.732, while the  $R^2$  value is 0.737. This indicates that the linear regression model explains 73.2% of the variance in the data. These values suggest a strong fit between the independent and dependent variables, demonstrating that the model effectively captures the relationship within the dataset, though 26.8% of the variance remains unexplained, potentially attributable to other factors not included in the model

### 4.2 Hypotheses Testing

The results of the F-test are presented in Table 13 (Appendix). The linear regression's F-test has the null hypothesis that the model explains zero variance in the dependent variable (in other words,  $R^2 = 0$ ). The F-test is highly significant; thus, we can assume that the model explains a significant amount of the variance in murder rate (the regression model is a good fit for the data).

Table 14 (Appendix) shows the multiple regression analysis among three dimensions who are remove waste , total productive maintenance and quick set up , the results show that there is a positive effect of remove waste on organization sustainability, ( $\beta=0.249$  and  $\text{sig}=0.001$ ) , so the first sub hypothesis is rejected and there is a significantly impact at the level of semantics (  $0.05 \geq \alpha$ ) Remove waste combined with organizational sustainability, for the second independent variable (Total productive maintenance), the results show that there is a positive effect of , total productive maintenance on organization sustainability, ( $\beta=0.882$  and  $\text{sig}=0.001$ ) so the second sub hypothesis is rejected, and there is a significantly impact at the level of semantics ( $0.05 \geq \alpha$ ) of the total productive maintenance combined with organizational sustainability, for the third hypothesis the results show that there is a positive effect of quick set up on

organization sustainability, ( $\beta=0.942$  and  $\text{sig}=0.001$ ), so the third sub-hypothesis is rejected, and there is a **significant impact at the level of significance ( $0.05 \geq \alpha$ ) of the quick setup combined with organizational sustainability**; we can conclude that the main hypothesis is partially supported.

## 5 Conclusion

The study results showed a high implementation of lean system practices, which confirms the findings of previous studies, which indicate that the lean system practices have the potential to be the system that will assist organizations in meeting sustainability requirements.

The lean system practices may contribute to the most effective organizational sustainability. The structured framework of lean system practices includes three steps to promote the rational use of resources and energy while engaging and empowering people. It provides an innovative description of correlations between removing waste, Total productive maintenance, and quick setup requirements with the organizational sustainability principles and tools, including a description of how they can be integrated to create synergies. It was structured to create synergies by considering the difficulties organizations face in conducting sustainability improvement activities; this goal could be achieved by preventing loss of organizational efficiency due to waste, duplication, and excessively bureaucratic processes.

This is followed by the results, which suggest that organisations are finding it problematic to operate sustainably - and one would expect that they would get 'the hang of it' if anything, as their awareness grows around this area, and pressure on them to do so mounts up:

- Many projects in the area of sustainability require significant initial investments, for example in new technologies, equipment or staff education. System rebates are not enough to encourage organizations, especially ones with small budgets and limited resources, to adopt green practices in addition to how they are already operating.

- There are often significant differences across countries (and sometimes within a country or region) on the types and definitions of hosting facility environmental laws, rules & regulations, making compliance expensive and challenging. Adhering to changing regulations takes time, expertise, and constant "watching," something many companies struggle with.

- Much of that is driven by, as it is shown at the beginning, the fact that many have to deliver financial results every quarter. Sustainable projects do not come to fruition overnight, though. The quarterly profit pressure can make it difficult to prioritize investments

- For companies with increasingly complex global supply chains, it's hard to maintain all suppliers at the same high standards for sustainability. Many providers are either not capable of, or incentivized to adhere to, rigorous environmental standards, leaving organizations little control over sustainability practices from beginning to end.

- Executing sustainability initiatives often necessitates expertise in fields such as environmental science, responsible sourcing and regulatory compliance. Most organizations do not possess the in-house know-how and struggle to employ or train their own staff with such expertise.

- There is no defined sustainability strategy, so organisations may adopt a splintered approach that doesn't drive in any direction with impact. An impactful corporate sustainability strategy: the challenge of without targets and plans.

These are some of the challenges that illustrate why, despite all the efforts to promote sustainable development, organizations often stick with the understanding and images they already have.

Additional Lean system implementation practices can enable an organization to substantially improve its sustainability through elimination of waste, Total productive maintenance, and quick setup, as:

1. Lean is a very practical approach, where good and effective practice can make use of resources (material, energy, time) effectively. This minimises environmental impact and is consistent with sustainability objectives.
2. Operational cost is slashed by the eradication of waste and inefficiency within organisations. Revenues generated can be recycled into eco-friendly efforts, which in turn can support existence indefinitely.
3. TPM, quick setup times together with reduction of emissions decrease the amount of downtime, representing the company's global environmental footprint.

The study recommends:

1. Reducing the time taken for setup and preparation of machines/equipment helps to reduce the time required for production.
2. Optimising efficiency and productivity means maximising equipment time on the factory floor.

Focus on maximising social sustainability of employees through training and job satisfaction while in the workplace.

3. It is crucial to concentrate on building environmental sustainability and how it plays a key role in minimizing costs, reducing waste, and optimising energy consumption. Leading to increased profitability, competitive advantage, natural resources and input utilisation, and stakeholder satisfaction.

### Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author(s) utilized artificial intelligence (AI) technologies solely for the purpose of linguistic refinement and grammatical correction. Following the application of these tools, the author(s) comprehensively reviewed, verified, and edited the resulting text. The author(s) maintain full accountability and responsibility for the accuracy, integrity, and final content of the publication.

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## APPENDIX

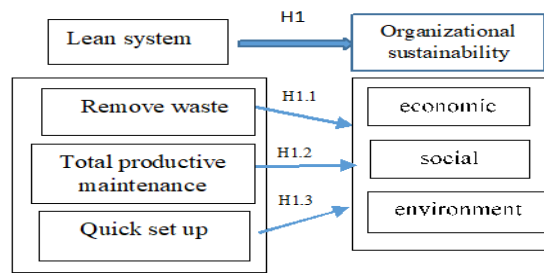


Fig. 1: Study model

Source: Created by the authors

Table 1. Cronbach Alpha value for all the questionnaires

| Dimensions             | Cronbach's alpha | No of items |
|------------------------|------------------|-------------|
| All the questionnaires | 0.939            | 41          |

Source: Produced by the authors, based on the SPSS results.

Table 2. Sample characteristics

| Characteristics and categories |                  | Frequency | Percentage |
|--------------------------------|------------------|-----------|------------|
| Gender                         | Male             | 126       | 83,4       |
|                                | Female           | 24        | 15,9       |
| Age                            | 30-20            | 24        | 15,9       |
|                                | 40-30            | 72        | 47,7       |
|                                | 50-40            | 36        | 23,8       |
|                                | More than 50     | 18        | 11,9       |
|                                |                  |           |            |
| Academic qualification         | PhD              | 30        | 19,9       |
|                                | Master           | 102       | 67,5       |
|                                | BSC              | 12        | 7,9        |
|                                | Other            | 6         | 4,0        |
| Working experience             | Less than 5years | 24        | 15,9       |
|                                | 5- less than 10  | 66        | 43,7       |
|                                | 10-less than 15  | 12        | 7,9        |
|                                | 15- 20           | 12        | 7,9        |
|                                | More than 20     | 36        | 23,8       |

Note: N=150

Source: Produced by the authors, based on the SPSS results.

Table 3. Arithmetic averages, standard deviations, and degree of approval for lean system

| Independent variable | dimension                    | Arithmetic average | Standard deviation | Degree of approval |
|----------------------|------------------------------|--------------------|--------------------|--------------------|
| Lean system          | Remove waste                 | 4,1360             | ,45307             | High               |
|                      | Total productive maintenance | 4,2400             | ,45094             | High               |
|                      | Quick set up                 | 3,8720             | ,41662             | High               |

Source: Produced by the authors, based on the SPSS results.

Table 4. Arithmetic averages, standard deviations, and degree of approval for Organizational sustainability

| Dependent variable            | dimension                    | Arithmetic average | Standard deviation | Degree of approval |
|-------------------------------|------------------------------|--------------------|--------------------|--------------------|
| Organizational sustainability | Economic sustainability      | 3,0067             | 1,24196            | medium             |
|                               | Social sustainability        | 2,9543             | 1,30725            | medium             |
|                               | Environmental sustainability | 2,8286             | 1,25417            | medium             |

Source: Produced by the authors, based on the SPSS results.

Table 5. Computational averages, normative deviations, and degree of consent for removing waste

| No. | Sentence                                                                                                                                                             | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The company works hard to produce defect-free products                                                                                                               | 4,7200             | ,45050             | 1           | High               |
| 2   | Recycling occurs in very small proportions                                                                                                                           | 3,3200             | 1,12518            | 5           | High               |
| 3   | Employees are adequately prepared, ensuring that their qualifications align with the demands of the position.                                                        | 4,0000             | ,94123             | 4           | High               |
| 4   | The company works to reduce the time it takes to transfer equipment and machines from working on a specific product to working on another product (changeover time). | 4,3200             | ,61655             | 2           | High               |
| 5   | The company works to reduce the costs resulting from converting equipment and machines from working on a specific product to working on another product              | 4,3200             | ,61655             | 2           | High               |

Source: (Produced by the author, based on the SPSS results.)

Table 6. Computational averages, normative deviations, and degree of consent for Total productive maintenance

| No. | Sentence                                                                                                                      | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|-------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The company uses preventive maintenance to reduce breakdowns.                                                                 | 4,3600             | ,84568             | 2           | High               |
| 2   | Every employee on a production line receives training in basic maintenance.                                                   | 4,4000             | ,49154             | 1           | High               |
| 3   | Daily maintenance is scheduled and planned.                                                                                   | 4,1200             | ,65457             | 5           | High               |
| 4   | Records relevant to maintenance that include information on the quantity and cost of failures are available.                  | 4,3600             | ,62691             | 2           | High               |
| 5   | The company uses different methods to monitor and follow up on maintenance work                                               | 4,0400             | ,66434             | 7           | High               |
| 6   | The company predicts faults and the kinds of faults using scientific methodologies.                                           | 4,2800             | ,53244             | 4           | High               |
| 7   | Preventive maintenance is planned and scheduled collaboratively by employees to guarantee uninterrupted, regular performance. | 4,1200             | ,71344             | 5           | High               |

Source: (Produced by the author, based on the SPSS results.)

Table 7. Computational averages, normative deviations, and degree of consent for quick setup

| No. | Sentence                                                                                               | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|--------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The employees succeed in constantly reducing the equipment preparation time                            | 4,1600             | ,54440             | 1           | High               |
| 2   | Employees have the time required to set up workplace equipment.                                        | 4,1200             | ,65457             | 2           | High               |
| 3   | The company works to find the appropriate sequence of products so that this reduces configuration time | 4,0800             | ,69049             | 3           | High               |
| 4   | The company relies on using both typical and common general parts for multiple products.               | 4,0400             | ,82641             | 4           | High               |
| 5   | A company is trying From internal configuration to external configuration.                             | 2,9600             | 1,46035            | 5           | Medium             |

Source: (Produced by the author, based on the SPSS results.)

Table 8. Computational averages, normative deviations, and degree of consent for Economic sustainability

| No. | Sentence                                                                                     | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|----------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The company works hard to reduce production costs.                                           | 2,8000             | 1,44705            | 6           | Medium             |
| 2   | The company recycles materials that are damaged.                                             | 3,2400             | 1,61237            | 1           | Medium             |
| 3   | The company is attempting to lower the quantity of returned goods.                           | 2,9200             | 1,13232            | 5           | Medium             |
| 4   | The company seeks to lower waste treatment expenses.                                         | 2,9600             | 1,31527            | 4           | Medium             |
| 5   | The company seeks to decrease administrative penalties associated with environmental issues. | 3,0000             | 1,36101            | 3           | Medium             |
| 6   | The company is attempting to minimize production capacity costs.                             | 3,1200             | 1,51023            | 2           | Medium             |

Source : (Produced by the author, based on the SPSS results.)

Table 9. Computational averages, normative deviations, and degree of consent for Social sustainability

| No. | Sentence                                                                        | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|---------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The company strives to lower the number of workplace accidents.                 | 3,1200             | 1,42800            | 2           | Medium             |
| 2   | The company is making efforts to enhance the working environment.               | 3,1600             | 1,35151            | 1           | Medium             |
| 3   | Work injuries have decreased over the past three years                          | 2,9600             | 1,37514            | 4           | Medium             |
| 4   | Days lost due to work-related injuries have decreased over the past three years | 2,7200             | 1,37631            | 7           | Medium             |
| 5   | The company's workers consider themselves satisfied with their jobs.            | 2,8000             | 1,30049            | 6           | Medium             |
| 6   | The company has been trying to reduce stress at work for the past three years   | 3,0400             | 1,43251            | 3           | Medium             |
| 7   | The company has reduced health and safety incidents over the past three years   | 2,8800             | 1,48333            | 5           | Medium             |

Source: (Produced by the author, based on the SPSS results.)

Table 10. Computational averages, normative deviations, and degree of consent for Environmental sustainability

| No. | Sentence                                                                                                | arithmetic average | Standard deviation | Arrangement | Degree of approval |
|-----|---------------------------------------------------------------------------------------------------------|--------------------|--------------------|-------------|--------------------|
| 1   | The company employs a variety of techniques to lower air pollutants and gases.                          | 2,9600             | 1,54085            | 2           | Medium             |
| 2   | The company uses different methods to reduce the effects of solid waste.                                | 2,8800             | 1,42800            | 5           | Medium             |
| 3   | The company strives to utilize fewer harmful, dangerous, and damaging materials.                        | 2,9600             | 1,54085            | 2           | Medium             |
| 4   | The company tries to cut down on water waste.                                                           | 2,9600             | 1,25254            | 2           | Medium             |
| 5   | The company works to reduce the impact of gas emissions and leaks into the earth and soil.              | 3,0800             | 1,20134            | 1           | Medium             |
| 6   | The company does not dispose of production and material processing waste in sewage.                     | 2,7600             | 1,36927            | 6           | Medium             |
| 7   | The company works to reduce the consumption of non-renewable energy such as electricity and natural gas | 2,2000             | 1,23701            | 7           | Low                |

Source: Produced by the author, based on the SPSS results.

Table 11. Multicollinearity and autocorrelation test

|                              | Tolerance | VIF   | Durbin Watson |
|------------------------------|-----------|-------|---------------|
| Remove waste                 | ,459      | 2,177 | 2,027         |
| Total productive maintenance | ,356      | 2,809 |               |
| Quick set up                 | ,578      | 1,730 |               |

Source: Produced by the author, based on the SPSS results.

Table 12. Model summary

| Modèle | R    | R square | Adjusted R square | std Error of the estimate |
|--------|------|----------|-------------------|---------------------------|
| 1      | ,858 | ,737     | ,732              | ,64179                    |

Source: Produced by the authors, based on the SPSS results.

Table 13. ANOVA

| Model |            | Sum of Squares | Df  | Mean Square | F       | Sig.  |
|-------|------------|----------------|-----|-------------|---------|-------|
| 1     | Regression | 168,466        | 3   | 56,155      | 136,332 | 0,001 |
|       | Residual   | 60,137         | 146 | ,412        |         |       |
|       | Total      | 228,604        | 149 |             |         |       |

Source: Produced by the author, based on the SPSS results.

Table 14. Coefficients

| Model |                              | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig.  |
|-------|------------------------------|-----------------------------|------------|---------------------------|--------|-------|
|       |                              | B                           | Std. Error | Beta                      |        |       |
| 1     | (Constant)                   | 5,177                       | ,567       |                           | 9,124  | 0,001 |
|       | Remove waste                 | ,681                        | ,171       | ,249                      | 3,975  | 0,001 |
|       | Total productive maintenance | 2,424                       | ,195       | ,882                      | 12,403 | 0,001 |
|       | Quick set up                 | 2,800                       | ,166       | ,942                      | 16,868 | 0,001 |

Source: Produced by the author based on the SPSS results.

### Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

RO'AA A. M. ALRABABAH was responsible for the section of abstract, introduction, problem formulation, literature review, model & Questionnaire design.

Fadi H.Al-Qudah carried out data collection and Questionnaire distribution.

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ASSIA BENAHMED was responsible for the statistics, findings, and discussion, Conclusion.

Amin Khalifeh was responsible for the recommendations and abstract sections.

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