The Impact of Lean Manufacturing Practices on Green Sustainability: The Case of Abdulghani Company

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ABSTRACT

This study examines the impact of lean manufacturing practices on green sustainability in the context of Abdulghani Company. The study used a sample size of 180 respondents to collect data on the implementation of lean practices and the company's green sustainability performance. The findings indicate that the implementation of lean practices has a significant positive impact on green sustainability performance. Specifically, lean practices such as waste reduction, energy conservation, and process improvement contribute to a reduction in the company's environmental impact and improved environmental sustainability. The study recommends that companies adopt lean practices as a means of achieving both operational excellence and sustainable development.

Keywords: Lean Manufacturing, Green Practices, Sustainability, KSA.

I. INTRODUCTION

Manufacturers in today's highly competitive global market under increasing pressure to improve their operational efficiency and output in order to remain profitable. Lean practices methods have been embraced by many manufacturing firms in order to achieve these aims and gain an advantage over rivals according to Taylor (2016). A management concept, lean practices emphasize the elimination of waste and inefficiency in order to boost a company's competitiveness in the manufacturing industry according to Susilawati et al. (2015). One way that businesses might become more productive is via the use of a set of procedures and principles known as the lean approach according to Sharma et al. (2016).

According to Santos (2019) just-in-time (JIT), total productive maintenance (TPM), automation, value stream mapping (VSM), and kaizen/continuous improvement (CI) are some of the most significant tools in the lean toolkit. With JIT, a company only produces items when they are needed according to Roy et al. (2019). The cost of storage space and surplus output is reduced as a result. Some of the most well-known JIT-related technologies include the one-piece flow, pull system, takt time, cell manufacturing, leveled production, kanban, visual control, multifunctional staff, and just-in-time (JIT) purchasing according to Rao (2013).

Lucianetti (2014) described lean practices as a manufacturing system that seeks to get rid of waste, streamline operations so that work flows smoothly, and find and implement solutions to issues in an ongoing manner according to Ushakov et al. (2022). The interesting thing about lean is that as its application has grown, the concept has expanded itself by including fresh ideas and newer methods (Doolen et al., 2015). As a result, the concept of lean practices has evolved to include a wider range of contexts. There is, nevertheless, some misunderstanding of what is lean exactly.

Strategic and operational aspects of Lean were argued for (Hines, 2014), along with philosophical and practical ones. As a result, a single, agreed-upon definition of lean became problematic. However, Dong (2011) concluded that lean consists of just-in-time production, efficient resource utilization, continuous improvement strategies, defect control, standardization of operations, and scientific management techniques by synthesizing previous literature on the fundamentals of lean and claiming that the literature is reasonably consistent.

Dogra et al. (2011) definition seems to be the one that most closely matches Dey et al. (2013), authors of a landmark study on the subject, characterized lean production as an integrated strategy including several management techniques. These techniques include just-in-time inventory, quality assurance, teamwork, cellular production, and supplier management according to Ushakov et al. (2022). The underlying thrust of lean practices is that these approaches may work synergistically to create a streamlined, high-quality system that produces completed goods at the speed of customer demand with little or no waste, write the authors.

Using this definition, it's clear that many lean activities may be categorized into related groups that have the common goal of adopting lean principles like waste reduction, quality assurance, demand planning, and cost cutting, among others. Twenty-two lean practices are the foundation of lean practices, as outlined by Dey et al. (2013). Setup time reduction, quick changeover techniques, statistical process control, kanban, supplier partnership, continuous improvement, quality management, total productive maintenance (TPM), foolproof systems, standard operating procedures, and mixed model production are all examples of important lean practices highlighted by the authors. TPM (Total Productive Maintenance), TQM (Total Quality Management), HRM (Human Resource Management), and
JIT are the four pillars of lean that the authors outline (Just-in-Time). Some lean methods, such as 5S and kaizen, are designed to improve the whole organization's flexibility, adaptability, and capacity to handle change. These lean methods provide the groundwork for the introduction of more specialized methods, such as 'pull production,' that aim to boost performance in a specific area.

It has been quite some time since the concept of lean practices was initially proposed. Since then, there has been growing evidence that this approach is effective in making firms more productive according to Danese et al. (2012). Thus, several academic research has been done to evaluate its methods and tools. However, due to the nature of the research conducted so far, it may still be unclear what the overall effect of lean methods and tools is on operational performance.

Equally inconsistent is the choice of performance measures used to assess the results of lean methods. To supplement and support the existing body of knowledge on the effects that lean practices has on the performance of organizations, this paper investigates the effects of the primary methods and tools of lean practices on what Costa et al. (2016) consider the most important contemporary measures of operational performance, namely cost, speed, dependability, quality, and flexibility.

II. THEORETICAL FRAMEWORK

A. Stakeholder Theory

Government, investors, political groups, customers, suppliers, communities, trade associations, and employees are all considered stakeholders in stakeholder theory of corporate management, widely regarded as the most well-known and influential theory of corporate management. Lean methods are being implemented by businesses in response to demand from a wide range of stakeholders, including labor unions, investment organizations, environmentalists, and governments according to Cortina (2013). Stakeholder theory has been revised recently by Cogdill et al. (2017), who argue that companies shouldn't only focus on increasing their stock price without also considering the needs of the many diverse groups and people whose lives are affected by the company's activities.

These individuals may eventually become clients, or they may be prepared to take on part of the organization's risk (Cogdill et al., 2017). Therefore, according to Freeman, the nine beneficiaries of the corporation should be classed as stakeholders instead than shareholders, giving them the same voting rights as the company's senior executives according to Chavez et al. (2013). The author contends that these stakeholders have a right to participate in the firm's strategy development since they are entitled to be treated as more than just a means to an end according to Ushakov and Shatila (2021).

According to Cagliano et al. (2011) lends credence to this idea, as they conclude that CSR and stakeholder theory are intimately linked, with the former being able to be utilized to appreciate the latter's role in society and the latter being able to guide corporate executives in the right way. According to Bevilaquca et al. (2015) was ultimately trying to explain how an organization's external conditions might affect its own actions. The intent of the author was to empower all parties by clarifying their roles and connections.

B. Resource-Based Theory

Another theory is that businesses might boost productivity by becoming smarter with the resources they currently have. Intangible assets include things like a company's goodwill, the knowledge and experience of its personnel, and the unique flavor of the company's corporate culture. The common thinking is that success is only based on external forces, however Bamford et al. (2015) argued that a company's competitive advantage rests inside its own features. Careful and skilled management of the company's resources is essential if it is to increase performance and get an edge over the competition. An organization may outperform its competitors in terms of environmental impact by investing in new physical assets that boost internal processes related to resource consumption and waste reduction according to Aggarwal et al. (2012).

Instead, an asset's worth is determined by how it functions in the market. The best assets are those that allow the company to capitalize on favorable market conditions and mitigate the effects of adverse ones. Consequently, Acosta et al. (2014) contended that resource included both tangible and intangible tools at a firm's disposal for achieving its goals. There are seven pillars that he believes are crucial to success: physical, legal, human, monetary, relational, informational, and organizational.

While the aforementioned studies suggest that pressure on businesses to clean up their operations and reduce their carbon footprints may have diverse outcomes, it is important to keep in mind that these findings are not conclusive. End-of-pipe solutions, like pollution abatement, are one method of achieving regulatory compliance, while preventive measures, like reengineering processes to reduce material consumption, are another. This latter approach is what a business has to embrace if it wants to compete successfully and reap the benefits of lean operations according to Abdulmalek et al. (2017). The ideas of stakeholder theory and resource-based theory provide the basis for this investigation.

III. RESEARCH METHODOLOGY

Quantitative research methodology relies on a deductive approach where researchers test pre-existing theories or hypotheses using data collected from a large sample size. The study aims to analyze data collected from Abdulghani company using Google Forms. The data collected from 180 respondents will be analyzed using the statistical package for social sciences (SPSS).

The research methodology for this study is quantitative, and it will employ a deductive approach. This approach involves the formulation of a hypothesis, which is then tested using data collected from a sample of participants. The study will rely on secondary data, which is collected from respondents using Google Forms. The forms will be distributed to 180 participants from the Abdulghani company, and the respondents will fill out the questionnaires.

The collected data will be analyzed using the Statistical Package for Social Sciences (SPSS), a software package used for statistical analysis.
The data analysis will involve running descriptive statistics to summarize the data collected from the respondents. Inferential statistics, such as correlation and regression analysis, will be used to test the hypotheses formulated in the study.

In conclusion, the study will implement quantitative research methodology relying on a deductive approach. Data will be collected using Google Forms from 350 respondents from Abdulghani company, and the data will be analyzed using the Statistical Package for Social Sciences (SPSS). The study’s findings will contribute to the existing body of knowledge in the field of research and will provide insights into the factors that influence the performance of Abdulghani company.

IV. Abdul Ghani Company Overview

Abdul Ghani Holding Company is one of the oldest commercial houses in the Kingdom of Saudi Arabia in various fields. The achievements of the Company lasted for a century of granting and participation. The various sectors and businesses in Abdul Ghani Holding Company have been diversified to cover all significant developmental and economic fields, notably the contracting, consulting, training, development and architectural activities. The company has achieved many successes and achievements since its establishment. The company is considered one of the leading companies in the field of gold in addition to the company’s factory. It is the first factory in Saudi Arabia under License No. 1. A subsidiary of Abdul Ghani Company has obtained a license from The Ministry of Interior regarding the security systems. Also, the company has lots of certified certificates for some training courses as well as a professional license for MIM office for management consultations as well as other achievements.

We offer to our customers Jewelry fixing service for free, and in case of using additional gold while fixing, the cost will be added on the customer, this service is available in all branches. People who always own jewelry face problems with their jewelry such us dust and dirt, changing color and the loss of brightness, for this, we offer to our customers in all branch’s jewelry polishing services to keep your jewelry Sparkling jewelry and shiny like new.

We offer to our customers the service of special-order implementation of crowns and belts, names and other pieces by 21 carats of gold in our special factory, the customers should go to any of our branches and place the order, and it will be implemented with specifications determined by the client.

V. Demographic Statistics

Referring to Table I, it can be noted that 178 respondents who replied to the questionnaires are males and constitute around 97.3% of the respondents, and 2 respondents who filled the questionnaires are females and constitute 2.7% of the respondents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>178</td>
<td>97.3</td>
<td>97.3</td>
</tr>
<tr>
<td>Female</td>
<td>2</td>
<td>2.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Referring to Table II, it can be noted that ten respondents of 180 who filled the questionnaires are in the age range of 15 to 20 years old and they constitute 13.3% of the total population. As for the respondents which fall in the age range of 20 to 30 years old, 99 respondents filled the questionnaires, and they constitute 65.3% of the total population. However, 16 respondents answered the questionnaires fall in the age range of 30-40 years old and they constitute 11.4% of the total population and 15 respondents which answered the questionnaires fall in the age range of 40-50 years and they constitute 10.7% of the total population.

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20 years</td>
<td>50</td>
<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td>20-30 years</td>
<td>99</td>
<td>65.3</td>
<td>78.7</td>
</tr>
<tr>
<td>30-40 years</td>
<td>16</td>
<td>11.4</td>
<td>89.3</td>
</tr>
<tr>
<td>40-50 years</td>
<td>15</td>
<td>10.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table III corresponds to the educational level of the participants, 90 respondents which filled the questionnaires are holding the bachelors’ degree and they correspond to 60% percent of the overall population, 41 respondents are in the high school, and they constitute of 5.3% of the overall population, and 49 respondents are holding the Masters’ Degree and they correspond to 34.7% of the overall population.

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelors</td>
<td>90</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>High School</td>
<td>41</td>
<td>5.3</td>
<td>65.3</td>
</tr>
<tr>
<td>Masters</td>
<td>49</td>
<td>34.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Referring to Table IV, which represents the marital status, it can be noticed that 11 respondents which filled the questionnaires is divorced, and constitute of 1.3%, and 63 respondents are married and constitute of 24% of the overall population and 106 respondents are single and constitute of 74.7% of the overall population.

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Divorced</td>
<td>11</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Married</td>
<td>63</td>
<td>24.0</td>
<td>25.3</td>
</tr>
<tr>
<td>Single</td>
<td>106</td>
<td>74.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>

Table I: What Percentage of Your Income Is Allocated To Purchase Cosmetics Products Amid The Crisis?

<table>
<thead>
<tr>
<th>Range</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-15%</td>
<td>40</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>16-20%</td>
<td>12</td>
<td>2.7</td>
<td>28.0</td>
</tr>
<tr>
<td>20% or above</td>
<td>26</td>
<td>8.0</td>
<td>30.7</td>
</tr>
<tr>
<td>5-10%</td>
<td>102</td>
<td>69.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>
VI. REGRESSION ANALYSIS

The model's R-score (Table VI) indicates that the addressed independent variables, namely, self-efficacy, perceived usefulness, ease of use, and the lipstick effect, tend to influence purchase intention by 75.6%, whereas the remaining 24.4% of the variables are not addressed in this model. However, the model's R2 value of 57.2% indicates that only 42.8% of the variance in purchase intent can be accounted for by these independent factors.

The above regression analyzes how each independent variable influences the outcome (the dependent variable). All the independent variables have a significance level below 0.05, indicating a substantial association between these factors and change in intent.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>B</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>0.120</td>
<td>0.238</td>
</tr>
<tr>
<td>Lean Manufacturing</td>
<td>0.319</td>
<td>0.081</td>
<td></td>
</tr>
<tr>
<td>Green Practices</td>
<td>0.123</td>
<td>0.093</td>
<td></td>
</tr>
</tbody>
</table>

The alternative hypothesis is accepted, and the null hypothesis is rejected because the standard error of each variable was less than 0.05.

The following equation can be formulated as (1) and (2).

\[ Y = A + BX1 + BX2 + BX3 + BX4 + E \]  \hspace{1cm} (1)

\[ Sustainable = 0.120 + 0.319 \text{ Lean Manufacturing} + 0.123 \text{ Green Practices} \]  \hspace{1cm} (2)

This implies that:

- For every 1% increase in lean manufacturing, green sustainability will increase by 31.9%.
- For every 1% increase in green practices, green sustainability will increase by 12.3%.

VII. DISCUSSION OF RESULTS

The purpose of this research was to examine how adopting lean methods has influenced productivity at Abdulghani Company. The findings confirmed the beneficial effects of lean methods on productivity and quality.

Therefore, it's safe to assume that adopting lean principles will have a profoundly beneficial effect on the business's bottom line.

Our research shows that by using lean techniques, a business may improve its ability to: eliminate waste, reduce defects, make on-time deliveries, increase productivity and reduce costs while better managing customer demand. Insights into the specific lean methods that impact operational performance in the process industries may be gleaned by dissecting the model's various variables. That makes perfect sense, considering how often compressors, pumps, evaporators, heat exchangers, valves, and lengthy pipelines are used in the process industries.

Because of leaks and other maintenance concerns, the process industry is prone to repeated shutdowns. Breakdowns and unavailability of equipment, as well as process disruptions, may result in excessive maintenance costs, materials stacking up at various stages of production, and delivery delays.

The results also showed that less machine downtime, fewer inventory, and fewer accidents occurred after adopting lean procedures. There is a favorable correlation between lean elements and indicators of operational success.

The rejection of whole lots due to subpar quality is a major issue in the process industries and calls for stringent quality control measures. Reworks and rejections may be minimized by the use of a quality management program like comprehensive quality management and other quality efforts. In the process industries, it is common practice to perform major operations at a certain temperature and for a specified amount of time. Consequently, the process's settings and parameters have a significant impact on the final product's quality. Changes to these parameters often result in a drop in performance.

Because of their limited effect on capacity utilization, the process industries only partially embrace Lean methods. Second, because of the limited range of products offered, complex production scheduling is unnecessary in the process industries. The results that pull production and production schedules are less applicable in process industries are supported by the fact that lean methods have a non-significant effect on performance. The fact that pull systems and production scheduling are less applicable provides further evidence that the viability of lean approaches is context-dependent. Although this analysis indicated a favorable correlation between lean practices and enhanced operational performance and quality, the regression models revealed that the lean variables (or practices) evaluated in these studies explained only 70% or less of the variability contained in the model. This indicates the existence of additional regulating elements which affect operational performance.

Following are some potential causes for this: The impact of workers' skill level was disregarded in the current study. Staff members' skill levels should improve in preparation for lean techniques to be implemented effectively. The study's process industries probably lacked the knowledge and competence necessary to effectively apply lean principles.

Contractual workers are seldom the recipients of intensive training and education programs designed by management. Therefore, such workers may struggle to adhere to the essential improvement methods and methodologies owing to
a lack of knowledge or ignorance. Adopting lean principles leads to a degree of performance improvement that falls short of what is possible. Furthermore, the business size is irrelevant to the regression models proposed here.

Small process industries may have trouble fully adopting lean principles, resulting in stagnant or even declining performance.

VIII. THEORETICAL IMPLICATIONS

Research like this helps fill in the gaps in our understanding of how lean variables affect operational performance, especially in the process industries. On the other hand, this study's findings are consistent with those of previous research projects that examined the use of lean in the process industries, lending credence to those conclusions. Similarly, this study provides evidence that lean can successfully be implemented in the process sector. This research adds to the body of lean literature by lending credence to the claim that, anytime lean is deployed in a new setting, it must be adapted, both operationally and strategically, to the specific needs of that setting in terms of lean tools and lean bundles. This research supports the idea that lean is a constantly evolving concept.

IX. MANAGERIAL IMPLICATIONS

This study is useful for practitioners because it provides data on how much operational performance may improve by using lean methods in the process industries. This research provides process industry executives with a reference point from which to strategically plan the transition to a lean system. The results of this research will help managers in the process sector identify and defend investments in the kinds of efficiency gains that may be achieved through the use of lean techniques.

X. CONCLUSION

This study's findings back up the claim that implementing lean principles significantly affects operational performance in areas including inventory management, on-time delivery, waste reduction, demand management, cost reduction, and productivity enhancement. Further, this study's results corroborate those of earlier research showing that using lean methods in the process sector enhances operational performance. So, even in a developing country, the research clears up any doubts about lean's worth in the process industry.

However, for this specific data set, it was found that the connection between certain lean methods (especially pull systems) and enhanced performance was poor. The realization that pulls production and production leveling are only marginally applicable in process industries led to this change. The results of this research support the idea that introducing lean techniques into the process industries may enhance demand management and efficiency while also cutting costs and reducing waste. It is important to keep in mind a few limitations of this research. The extent to which an organization's performance improves as a result of implementing lean methods is affected by variables such as its size, unionization status, and length of operation, in addition to the production system in place.

For instance, compared to huge corporations, small and medium-sized businesses (SMEs) have their own unique set of traits. Such traits may be seen in organizations with weak supply chain influence, limited financial resources, and poorly trained or semi-skilled staff. However, owing to their less complex internal structures, small businesses sometimes have more leeway to adapt to changing market conditions. As a consequence, the advantages of implementing lean may vary depending on the nature and scale of the process sector and the difficulties encountered in doing so. The resistance to change is a major obstacle that must be overcome anytime a new company strategy is established in a new industry or a new geographical location.

Therefore, further research is needed to assess the connection between the prevalence of lean methods and performance enhancement in process industries, taking into account factors such as company size, unionization, age, and culture. Furthermore, process industries have vastly different process, product, supply chain, and market characteristics than discrete repetitive manufacturing, making it impossible to use the lean implementation techniques created for the former. When opposed to the discrete manufacturing sector, the body of work on lean implementation frameworks in the process industries is much less. Thus, further study is needed to provide a complete lean implementation methodology for process industries.

REFERENCES


