

The Impact of Six Sigma Adoption on Performance of Jordanian's Pharmaceutical Firms

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Key words: Six sigma, performance, pharmaceutical, significant, standard deviation

Abstract: This study aims to show the impact of applying six sigma methodologies on performance of pharmaceutical firms in Jordan. For the purpose of gathering, the data a well-structured questionnaire has been developed, the population includes all workers and service recipients of pharmaceutical firms while the sample considered those who are directly dealt with or related to the total quality management which consisted of senior management and departments related to the overall quality, unit managers and heads of departments. A correlational descriptive analytical method was used for data analysis and hypotheses testing. A number of statistical tools and methods were used such as the arithmetic mean, standard deviation and canonical analysis. The results reached showed the existence of the effect which is statistically significant at the level of significance ($0.05 \alpha \leq$ standards for six sigma; continuous improvement, customer focus, prevention, commitment and support of senior management) on performance. Therefore, it has been concluded that the effect six sigma on the firm's performance is an important topic and needs to be studied deeper, especially in the present time, due to its impact on the reality and the future of the surveyed firms. The study recommends that its highly needed to always gain the support of senior management to adopt six sigma style and improved service that satisfies customer's needs and desires.

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INTRODUCTION

The philosophy of quality management aimed at developing inputs, processes and outputs and continuous improvement which is the most important pillars of total quality management is the core concept of six sigma and in the light of the changing business environment. Many firms are seeking to seize the opportunities to develop its business and operations by adopting the six-sigma methodologies. One of the most important ways that deal

with discovery flaws and mistakes as the increased competition between service organizations locally and internationally have been required offer the best services to meet the needs and customer satisfaction and led development of the great in the product sector and for the great changes and changing consumer tastes dramatically increase the intensity of competition is the quality a weapons competitiveness task that enable organizations to improve the services provided to customers, so, the researcher to study in the application of the selected

sample of pharmaceutical firms in Jordan in order to determine the impact of six sigma methodology on the performance and the development of the necessary recommendations.

Problem statement: The problem of the current study stems from the following questions:

- Is there a relationship between six sigma (Commitment and support of senior management, continuous improvement, customer focus) and Performance in pharmaceutical firms in Jordan?
- Is there a trace of six sigma (Commitment and support of senior management, continuous improvement, customer focus) and performance in pharmaceutical firms in Jordan?

Importance of study: This study stems from the following scientific and practical consideration:

- Highlight the importance of six sigma in pharmaceutical firms in Jordan and their importance in achieving high levels of performance, raising the level of these firms and contributing to the achievement of the objectives in the long run
- Contribute to the developmental work of pharmaceutical firms as well as maintain the continuity for public good
- This study contributes to opening up other research areas on the subject of six sigma and spurring interest in this kind in the pharmaceutical firms in order to accomplish the strategic objectives of these firms

Objectives of study: The aim of this study is to learn of the impact of six sigma on performance of pharmaceutical firms in Jordan. The independent variable is six sigma, whereas the dependent variable is performance of the pharmaceutical firms.

The study also aims to identify the impact of six sigma (Commitment and support of senior management, continuous improvement, customer focus) on performance in pharmaceutical firms in Jordan.

Study variables: Performance is defines the level of achievement of the organization for its objectives in the diagram^[1]. Market share according to Farris, etc., the percentage of the total market or part of the market being serviced or the total sales of the company divided by the whole sales of the group.

Profitability refers to the level of profits achieved by the organization compared to competitors^[2], profitability is a measurement of return in the form of profits received (shareholders for their investments in the organization^[3]. Sales volume equals the quantity of items a business sells during a given period.

Study hypothesis H₀₁: There is a statistically significant effect of six sigma (Commitment and support of senior management, continuous improvement, customer focus) performance in pharmaceutical firms in Jordan, e.g., (profitability, sales volume, market share) at a level of significance of 0.05. This give rise to the following sub-hypothesis:

- H₀₁₋₁: there is a statistically significant effect of Commitment and support of senior management Performance in pharmaceutical firms in Jordan at a level of significance of 0.05
- H₀₁₋₂: there is a statistically significant effect of continuous improvement Performance in pharmaceutical firms in Jordan at a level of significance of 0.05
- H₀₁₋₃: there is a statistically significant effect of customer focus performance in pharmaceutical firms in Jordan at a level of significance of 0.05 (Fig. 1)

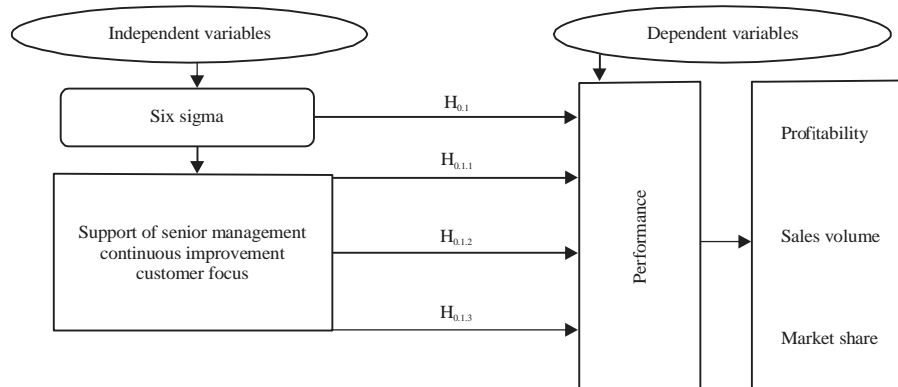


Fig. 1: Performance in pharmaceutical firms in Jordan

Research model

Literature review of six sigma

Background: Six sigma concept begins in the 80's where Motorola Company discovered the normal quality levels. At that time, the company did not seal the requirements of its customers neither their expectations. Therefore, the company has experienced customer's loss which was caused by reliance on Three-sigma application. This application reflects an increase in the cost of products for the high cost of reform^[4]. Six sigma methodology aims to improve operations in the firms by reducing the rates of errors leading to raise the level of customer satisfaction and reduce costs. This study would guide and enable the pharmaceutical firms in Jordan to improve significantly with respect to the basic structure and their operations and through the values and continuous monitoring the activities of daily operations, so as to reduce waste and the consumption of resources and to meet the customer's needs. The successful implementation of six sigma methodology requirements^[5]:

- Customer focus
- Support and the support of the top management
- Personnel commitment and conviction methodology six sigma methodology for continuous improvement
- An effective measurement system
- Obstacles that are related to the application of six sigma methodologies
- Default data on improvement projects
- Provide changing customer needs and expectations
- Lack of skills needed on the part of some employees in improvement projects^[6]

MATERIALS AND METHODS

Previous studies: Erturk *et al.*^[7] the main aim of the study is to investigate the main structure of the six sigma approach and its characteristics and to analyze the effects of six sigma approach on the firm's performance indicators by considering a firm benefiting efficiently from six sigma approach and operating in the white goods sector in Turkey. Almasarweh and Rawashdeh^[8] the study tend to show the effect of using six-sigma methodology on the quality of health services in Prince Hashem Hospital, this study concludes that six sigma and quality of health services of the important topic and sensitive, chiefly in the present time, due to its impact on the reality and the future of the surveyed organizations. Dizgah *et al.*^[9] human capital Characteristics and Organizational performance, its aim was to inspect the relationship between human capital character and organizational performance in banks operating in Guilan Province. The study sample consisted of (22) government banks. The study found a statistically significant relationship at (0.05) level between human capital and

organizational performance. Chin and Sofian^[10], the Impact of human capital and total quality management on corporate performance: this study was to confirm the impact of human capital and TQM on corporate performance. Almasarweh^[5] the impact of human capital on competitive performance: an empirical study on Jordanian Pharmaceutical Companies, the study sample consisted of Jordanian human medicines manufacturing companies listed in the Jordanian Association of Pharmaceutical Manufacturer's report of manufacturing companies for 2015. This amounted to 15 companies. The study suggested that attention should be given to human capital in the companies which will lead to an improvement in the level of the company performance such as an increase of its market share and maximizing of its strength. Nahia and Al-Din^[11] over the use of six sigma methodology to achieve internal audit quality status of the Palestinian universities in the Gaza Strip studying. The study aimed at showing the extent of the use of six sigma standards in achieving internal audit in the Palestinian universities in the Gaza Strip quality. The study concludes that six sigma standards to the Palestinian universities in the Gaza Strip are available significantly and are committed to Palestinian universities by applying six sigma standards with no significant correlation statistically between the use of six sigma standards and the achievement of audit quality at the level of significance ($\alpha \leq 0.05$). Asfour^[12] "Application of Lean Six Sigma to Optimize Admission Waiting Time at AL-Mowasah Hospital", it aims at applying six sigma to improve the waiting time in sympathy hospital and a report to what extent is committed to apply the six sigma standards and to identify the level of patient satisfaction with the services provided and the impact of six sigma principles on patient satisfaction in the hospital and the most important results showing a trace of the use of the principles of six sigma in patient satisfaction.

RESULTS AND DISCUSSION

Research design and analysis

Study approach: The modern study can be regard as an exploratory study. It is based on the descriptive analytical method where the questionnaire will be used to collect data and information about the support variables of the study section. It is the descriptive analytical method that is most suitable to realize the objectives of the current study.

Stability study tool: The stability or the internal consistency of the instrument used in this study to evaluate response to paragraph was assured by means of Cronbach equation alpha (Cronbach alpha, Table 1). The outcome is acceptable statistically if the value is

>0.70^[13]. In addition, the results explain that the coefficient value stability is acceptable. As Table 1 shows, the alpha Cronbach indicators on the suitability of the above study tool is generally high by a factor of stability and thus achieves the purposes of the study.

The results of the special six sigma: The arithmetic mean is calculated and the standard deviation and arrangement of the answers of respondents to the study vertebrae that measure the six sigma tools in pharmaceutical firms in Jordan the results were as follows in Table 2.

Achieved variable customer focus the top center of my account and was (2.85) and standard deviation (1.032) which indicates that the customer focus in the firms is high from the viewpoint of the sample level has made the commitment and support of senior management variable central mathematically of (2.46) and standard deviation of (0.980).

The results of the special quality of pharmaceutical firms in Jordan. The arithmetic mean is calculated and the standard deviation and arrangement of the answers of respondents to the study vertebrae that measure the Performance in pharmaceutical firms in Jordan tool the results were as follows.

Table 3 indicates that the performance at pharmaceutical firms in Jordan, so from the standpoint of the respondents as shown by the table that the

Table 1: Cronbach alpha

| n | Dimension | Questions | (α) |
|-----|---|-----------|------|
| 1 | Six sigma | 15 | 0.85 |
| 1-1 | Commitment and support of senior management | 5 | 0.83 |
| 2-1 | continuous improvement | 5 | 0.78 |
| 3-1 | Customer focus | 5 | 0.86 |
| 2 | Performance Questionnaire | 5 | 0.89 |
| | | 20 | 0.82 |

Table 2: Means and standard deviation of six sigma dimensions

| Six sigma | Mean | SD | Rank |
|---|------|-------|------|
| Commitment and support of senior management | 3.46 | 1.980 | 4 |
| Continuous improvement | 3.69 | 2.121 | 2 |
| Customer focus | 3.85 | 2.032 | 1 |

Table 3: Means and standard deviation of performance dimensions

| Performance | Mean | SD | Rank |
|---------------|------|-----|------|
| Profitability | 3.2 | 2.3 | 3 |
| sales volume | 3.1 | 2.5 | 2 |
| market share | 3.9 | 1.2 | 1 |

Table 4: Pharmaceutical firms in Jordan at a level of significance
Dependent variables; Performance

| R | R ² | df | | | Mean square | | F | B | | | T | | | Sig. |
|---------|----------------|----------|----------|-------|-------------|----------|-------|------------|------------------------|----------------|------------------------|------------------------|----------------|-------|
| | | Regressi | Residual | Total | Regression | Residual | | Regression | Continuous improvement | Customer focus | Commitment and support | Continuous improvement | Customer focus | |
| 0.81, 1 | 0.658 | 4 | 56 | 50 | 2.7 | 0.03 | 170.1 | 0.33 | 0.25 | 0.1 | 3.12 | 3.27 | 0.64 | 0.001 |

effectiveness of each level after the Performance dimensions was a little different, it was the highest yet in terms of the level after safety with a mean of (2.91) and a standard deviation of (1.116) and the level is high and came after a response and a high level of reaching the middle arithmetic (2.89) and standard deviation (1.331) where he was the arithmetic mean of the post-physical aspects of the concrete (2.80) and standard deviation (1.184).

Results and testing of hypothesis

Hypothesis H₀₁: There is a statistically significant effect of six sigma (Commitment and support of senior management, continuous improvement, customer focus) on performance (profitability, sales volume, market share) in pharmaceutical firms in Jordan at a level of significance of 0.05.

Table 4, the results of multiple regression contrast the impact of (Commitment and support of senior management, continuous improvement, Customer Focus) analysis on performance (The dependent variable is the performance).

The results of Table 4 shows the value of the coefficient of determination to be R² = 0.658. This means that the independent variable (Six sigma) explains what percentage of discrepancy (66%) is in the dependent variable (the performance). Because the value of F = 165.23 at the significance level of <0.05, we accept the hypothesis that there is a statistically significant effect (0.05 ≤ α) of six sigma on performance.

Hypothesis H₀₁₋₁: There is no statistically significant effect of commitment and support of senior management on performance in pharmaceutical firms in Jordan at a level of significance of 0.05.

Table 5, the results of simple regression contrasts Commitment and support of senior management performance impact analysis (dependent variable is the performance). The results of Table 5 shows that the value of the coefficient of determination R² = 0.623. This explains the rate (62%) of the discrepancy in the dependent variable (the performance). And because the value of F = 321.61 at a significance level of <0.05, we accept the hypothesis that there is a statistically significant effect (0.05 ≤ α) to learn the performance.

Sub-third hypothesis H₀₁₋₂: Table 6, there is a statistically significant effect of continuous improvement

Table 5: The results of simple regression contrasts

| Dependent variable; Performance | | | | | | | | | | |
|---------------------------------|----------------|------------|----------|-------|-------------|----------|------------|-----|------|-------|
| R | R ² | df | | | Mean square | | F | | | |
| | | Regression | Residual | Total | Regression | Residual | Regression | B | T | Sig. |
| 0.789 | 0.623 | 3 | 57 | 50 | 4.3 | 0.4 | 322.2 | 0.8 | 40.1 | 0.005 |

Table 6: Statistically significant effect of continuous improvement

| Dependent variable; Performance | | | | | | | | | | |
|---------------------------------|----------------|------------|----------|-------|-------------|----------|------------|------|------|-------|
| R | R ² | df | | | Mean square | | F | | | |
| | | Regression | Residual | Total | Regression | Residual | Regression | B | T | Sig. |
| 0.722 | 0.521 | 3 | 57 | 50 | 5.8 | 2.1 | 400.1 | 0.73 | 30.1 | 0.002 |

Table 7: The value of the coefficient of determination

| Dependent variable; Performance | | | | | | | | | | |
|---------------------------------|----------------|------------|----------|-------|-------------|----------|------------|-----|------|-------|
| R | R ² | df | | | Mean square | | F | | | |
| | | Regression | Residual | Total | Regression | Residual | Regression | B | T | Sig. |
| 0.567 | 0.321 | 3 | 57 | 50 | 3.7 | 0.7 | 80 | 0.4 | 21.2 | 0.001 |

on Performance in Jordanian pharmaceutical companies at a level of significance of 0.05. The results of simple regression contrast the impact of continuous improvement on performance analysis (dependent variable is the performance). Results of Table 6 showed the value of the coefficient of determination to be $R^2 = 0.521$. This means that the independent variable continuous improvement explains what percentage of (52%) discrepancy is existent in the dependent variable (the performance). And because the value of $F = 397.3$ at a level significance <0.05 , we accept the hypothesis that there is a statistically significant effect ($0.05 \leq \alpha$) of continuous improvement on the performance.

Sub-third hypothesis $H_{01.3}$: There is a statistically significant effect of customer focus on performance in pharmaceutical firms in Jordan at a level of significance of 0.05. The results of simple regression contrasts the influence of customer focus on the performance analysis (dependent variable is the performance).

Results showed, through Table 7 the value of the coefficient of determination to be $R^2 = 0.321$. This means that the independent variable customer focus explains what percentage of (32%) discrepancy is present in the dependent variable (the performance). And because the value of $F = 79.35$ at a significance level of <0.05 , we accept the hypothesis that there is a statistically significant effect ($0.05 \leq \alpha$) of skill on performance.

CONCLUSION

After the theoretical and empirical study, the study concluded the following results: demonstrated by the theoretical literature that six sigma and performance is an important topic and sensitive to improve firms

performance, especially in the present time, due to its impact on the reality and the future of the surveyed firms.

The results showed that the performance of the first hypothesis which eliminates the effect of the presence of a statistically significant at the level of significance ($0.05 \leq \alpha$ standards for six sigma (continuous improvement, customer focus, commitment and support of senior management) in the performance, so, the first hypothesis is accepted.

The results proved the performance of imposition which requires the existence of a statistically significant effect at the level of significance ($0.05 \leq \alpha$) for the commitment and support of top management on the performance, so, the second hypothesis is accepted.

The results showed the validity of the third hypothesis which requires the existence of a statistically significant effect at the level of significance ($0.05 \leq \alpha$) continuous improvement in the performance, so, this hypothesis is accepted. The results showed the validity of the hypothesis which requires the existence of a statistically significant effect at the level of significance ($0.05 \leq \alpha$) to focus on customers in the performance so it is accepted.

RECOMMENDATIONS

This study has confirmed of the need for support by the senior management in adopting of six sigma methodologies, also to provide a suitable customer care and achieve their satisfaction through identification of needs and expectations of customers and work on the improvement of the continuity of operations in line with the needs and expectations to satisfy their needs and desires. Finally supporting employees of these firms and create all favorable conditions to motivate them and

sharpen their potential for creativity and excellence to achieve better performance. Further research suggestion; in respond to several researcher, a comparison research should be conducted among different sector in developed and developing countries as to extract the best practices such as in using six-sigma methodology on the performance and then implement them appropriately.

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