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## **Assessing and Improving University Performance Using Six Sigma**

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### **Abstract**

The current study aims at improving and enhancing university performance using Six Sigma approach, as it is considered a new approach for upgrading the quality levels of processes and reducing error rates in these processes. Thus, this raises the efficiency of the performance in educational institutions and brings it to an ideal form.

Key words: Six Sigma, university performance

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### **Introduction:**

Assessment of university performance has become a global trend in most universities in both the developed and the developing countries. In Egypt, the need for adopting performance assessment approach is increasing at the present time.

Moreover, the importance of assessing university performance is increasing with the increase of different forms of external monitoring that society exercises upon universities, and with the application of accountability that reflects an economic policy which is concerned with measuring the results of the educational process, as accountability is mainly concerned with defining objectives, responsibilities, selecting inputs, measuring outputs, and ensuring effectiveness. Thus, it comprises policies and objectives providing evidences upon the validity and appropriateness of programs and processes, and finally assuring the quality of outputs.

According to the principles of accountability, universities are responsible for their functions and roles in society and are expected to prove the effectiveness of their work and their ability to evaluate their performance. This is in addition to linking the results of evaluating the performance to funding; what's known as "performance- based funding".

More and more, university performance assessment should be done via the use of the recent performance measurements that proved great success in different sectors and fields. Among these measurements are balanced scorecards and performance prism.

Thus, it can be said that universities in their way to achieve progress in the levels of performance quality have adopted different approaches and quality systems; in their forefront “Total Quality Management” (TQM) approach. But recently as a result of the challenges and fierce competition universities face and the ever-changing needs and desires of stakeholders, Total Quality Management is no longer applicable, and therefore new approaches to Quality Management should be adopted to achieve the highest quality levels; among these approaches is six sigma.

The term Six Sigma has its roots in mathematics and statistics. Six sigma is derived from the statistical term sigma, which stands for standard deviation. Although its roots go back to statistics, specifically to Carl Fredrick Gauss (1777-1855), who is credited for introducing the concept of the normal distribution curve, as well as to Walter Shewhart, who developed the concept of three sigma as a measure of the quality of outputs in 1922, where he indicated the need to intervene and make adjustments when the outputs deviate from the required limits, which were estimated by three sigma, three sigma refers to a process whose quality level is estimated by 99.973% with an error or defect rate of 2.600 per million, and this rate was then acceptable to industrial institutions. The beginnings of applying the idea of Six Sigma go back to 1970 when a Japanese company took over the management of the Motorola factory in the United States where the new management made radical changes in the method of management and work, and these changes helped in improving the quality of products in the factory, with an error rate less than twenty times what was produced before the Japanese company took over the management, and this improvement in performance occurred without any changes in the workforce, or technology, or designs used, and without any increase in the costs of production, but on the contrary, the improvement was accompanied by a significant decrease in costs.

In 1971, Bob Galvin the CEO of the company, has succeeded in five years in improving the performance in the company ten times what it was at the time of taking the position. In 1985 Bill Smith

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submitted a report on internal quality in the company to Galvin, where Smith discovered that there is a relationship between the level of products' quality and the rate of rework as a result of wrong practices during the production process, and from here the challenge began for the company to find practical ways To eliminate defects in products, and indeed Smith was able to reach an approach to solving problems that has consisted of four stages: Measurement - Analysis - Improvement - Adjustment, known as MAIC, and later on these stages became a roadmap for the DMAIC model/approach to achieve Six Sigma level of quality.

In 1987 Galvin launched a long-term quality program called "The Six Sigma Quality Program", where the idea of this program was based on the principle that Six Sigma is the standard to be reached in everything such as products, processes, services, management, etc. Through the introduction of this program, the company was able to win the Malcom Baldrige National Quality Award in 1988, which prompted other large companies such as General Electric, and others to follow the same path.

Six Sigma is considered one of the latest administrative approaches that can help both for profit and non-for-profit organizations achieve the highest levels of quality. It is also considered one of the contemporary developmental approaches that focuses on meeting the needs and requirements of service beneficiaries via identifying different aspects of waste in time, mental, financial, and human efforts and energies and eliminating them. Six sigma is not a system that addresses quality like the ISO or the quality certification system and is not only related to improving the quality of outcomes, but it is also concerned with the organization as an integrated system from the simplest processes in the organization to the most complex ones.

Six Sigma is also an approach that aims at continuous improvement based on identifying the causes of errors and deficiencies in the processes and eliminating them to reach the highest levels of quality and efficiency of outcomes, as it brings performance levels to the lowest error rate of 3.4 errors per million

performance opportunities (DPMO). Defects Per Million Opportunities, or in other words achieving a success rate of 99.9997%, by working to continuously improve the efficiency and effectiveness of all operations carried out by the organization to achieve levels of satisfaction that exceed customer expectations.

Opinions differ about what Six Sigma is, some focus on the statistical methods used in it, while others see it as a quality management system that aims at reaching the degree of perfection in terms of accuracy of adherence to specifications and avoiding errors in operations, which means that in every million operations there are possibilities of error not more than 3,4 operations. Some also see it as a kind of cultural change in organizations, as it focuses on a meaning that is close to perfection in terms of individuals' understanding of their duties and performance of their work, which results in reaching the maximum degree of compatibility with the requirements of the beneficiaries. Some also see it as a methodology aimed at establishing goals and improving the quality of operations in the organization, as it focuses on identifying the needs of customers, and others see it as a flexible system that helps in improving leadership style and performance levels in the organization and focuses on the use of statistical systems to determine the extent of the organization's success in accomplishing a certain work. During a specified period of time

Six Sigma is defined as: "a systematic scientific method aimed at strategic improvement of operations and development of products and services in an organization, by relying on statistical and scientific methods to bring about a real reduction in error rates in operations". It is also defined as: "An approach to continuous improvement that is based on identifying the causes of errors and deficiencies in operations, and working to eliminate them, in order to reach the highest levels of quality and efficiency, and to achieve profit for the organization".

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### Six Sigma principles:

Six Sigma is based on a set of principles that can be summarized as follows:

1- **focus on customers:** In Six Sigma, the focus on the customer becomes the top priority, and Six Sigma has given a broader and more comprehensive concept of customers, as it is no longer limited to the external customers of the organization, but the concept has expanded to include internal customers represented by the employees within the organization, as they are one of the important and vital elements in achieving the best levels of quality in the organization, thus, Six Sigma pays much attention to the satisfaction of internal and external customers, where performance measurement begins with the customer because it is one of the priorities to ensure the continuous success of the organization. That's why Six Sigma enhances the concept of the Voice of Customer (VOC), which emphasizes identifying the needs and expectations of customers and at the same time takes into account the continuous change in these needs and expectations.

2- **Management with data and information:** The idea of managing with data and information is one of the basics that Six Sigma focuses on in the process of solving problems. Six Sigma is a system that begins with defining the criteria and measurements that will be used in performance evaluation, then data is collected and analyzed, which contributes to identifying problems more effectively, and then analyzing These problems are to arrive at making decisions that would solve the problems in a realistic and tangible way in light of sound facts that reduce the risk rate, that is, Six Sigma emphasizes the maximum use of data and information in solving the problems facing the organization, and it seeks to find a system that enables all employees in the organization From collecting, analyzing, and presenting data based on a scientific basis, using a set of statistical and non-statistical tools and means,

thus contributing to solving problems, developing and improving performance in the organization away from randomness, hypotheses, and personal impressions.

**3- Inherence of operations and outputs:** Six Sigma focuses on the fact that operations are the key to success in any organization, and that perfecting operations is a way to build positive competition for the quality of products and services for customers, and then Six Sigma aims at continuously improving all operations that take place within the organization to achieve satisfaction for customers and beneficiaries.

**4- Proactive management:** Taking the initiative means acting prior to the events themselves instead of waiting for them to happen, then interacting and responding to them. Six Sigma includes setting ambitious goals, reviewing these goals over and over, setting clear priorities. Six Sigma focuses on avoiding problems rather on solving problems after their occurrence. Six Sigma includes a set of tools and practices that will bring about a shift from "reaction management" to "proactive management or managing problem handling before they occur." It is the starting point for creativity and effective change.

**5- seeking perfection with the ability to tolerate failure:** in fact, the two ideas complement each other, as no organization can pursue Six Sigma without introducing new ideas or methods that contribute to bringing the product or service to the highest quality levels. At the same time, these new ideas and methods carry some risks, and therefore the organization must be ready to accept the results and use crisis management to overcome some of the negatives and risks that can result from this.

### **Six Sigma Team**

The application of Six Sigma requires the formation of a work team that performs many responsibilities and activities. This

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team ranks in terms of experience and knowledge according to a system known as Belts, and each belt has a specific color that expresses the extent of the experience of the belt holder. There is the Master Black Belt, the Black Belt, and The Green Belt. the individual obtains one of these belts after passing specific training and testing for the color of the belt, in addition to implementing a number of Six Sigma projects starting with the Green Belt.

1. **Champions:** The champion is chosen from the top management of the institution, and he undertakes the implementation of the Six Sigma project and leads the process of change throughout the institution in an integrated manner by supporting the Six Sigma team by providing the necessary resources for the project.

2. **The master black belt** is known as the "professional" level, which is a higher level than the black belt, and they are appointed by the champions.

3. **Black Belt Holders:** The black belt holder is more experienced than the green belt level, he is considered the leader of Six Sigma projects, and he has the ability to manage programs and projects. Those in this level have the knowledge and skills necessary to use Six Sigma and its tools. The black belt focuses on practical knowledge of statistics and statistical analysis. Obtaining a black belt requires the implementation of several projects almost individually. Usually, the black belt holder is chosen from the middle management and has an experience of not less than two years in project management. He prepares the team to start the project and supervises and trains the Green Belt personnel if needed. He is also responsible identifying the required data and setting the time frame for the implementation of the project.

4. **Green belt holders:** The green belt holder helps and supports the black belt holders, and can also lead some small projects, green belt holder can implement Six Sigma projects under the leadership of the black belt. the green belt is the first step on the path to full understanding of Six Sigma. Individuals at the green belt level have basic knowledge of the Six Sigma approach, and they can lead the process of quality improvement, and they can use basic statistical



tools as well as they can deal with specialized programs for the application of Six Sigma.

### **Stages of applying Six Sigma**

There are two basic models for the application of Six Sigma in organizations. The first model, which is the most common, is known as DMAIC. It symbolizes five basic stages of the application: (Define - Measure - Analyze - Improve - Control). This model is used when the organization is in a need for a process of improvement and development in its services or products to comply with customer requirements. The second model is known as DMADV and symbolizes five basic stages of the application: Define, Measure, Analyze, Design, and Verify. This model is used when the organization needs to design a new process, product or service that do not exist in the organization.

1. **Define stage:** This stage focuses on defining the goals of improvement efforts and identifying the processes that need improvement, based on customer needs and expectations, and expressing them in the form of measurable goals. The objective of this stage is to verify that the process/problem that is selected for the improvement is within the organization's priorities and that it has the support from the organization's management. The define stage begins with defining the problem and ends with a clear understanding of the scope and limits of this problem.

2. **Measurement stage:** This stage aims at measuring the current level of performance, by collecting basic data and information about the process that was identified in the previous stage. This information is used to give a clearer picture of what is specifically taking place in the process, as well as a deeper understanding of Customers' expectations, where the problem lies. the Measurement stage begins with collecting the necessary data and converting all dimensions of the problem into a quantitative form that can be measured, for example the number of times during which the process

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failed to achieve the CTQ factors that customers demand. Here, the work team must remember that it is making an attempt to improve the efficiency and effectiveness of the process, where effectiveness is related to output measurements that are important to customers, while efficiency measurements refer to what is done within the process, whether it is related to time, cost, or value achieved from the starting point and end point of the Process Map, where the focus is on measuring outputs, outcomes, processes, and inputs.

3. **Analyze stage:** This stage aims at reaching a perception about the real reasons that led to the occurrence of errors or defects, wherein the data is analyzed and the process itself analyzed, and then the team is able to identify the root causes that led to the current Sigma level of performance, and stood behind the shortcomings and deviations from the standards, as well as to identify the methods through which it is possible to narrow or eliminate the gap between the current performance of the process and the expected or desired performance, through the work of statistical analysis to study the variables that affect the quality of the outputs, then a plan is developed for the priorities of improvement in the future.

4. **Improvement phase:** This stage deals with how to intervene to reduce the levels of defects (deviations), and it may require several rounds of improvement processes that use planning and management tools to develop creative alternatives for development.

5. **Control stage:** At this stage, the control method is determined and applied to the new process. After the desired improvements are made, a system is developed to maintain them and prevent the problem from recurring, and to maintain the introduction of the new system into the institutional context by modifying policies, procedures, and management systems. In general, this involves two main steps: defining the technical method of control and developing a plan for response.

Based on what has previously been said, the current study aims at exploring the benefits of the use of Six Sigma in improving university performance and in enhancing the efficiency of the whole educational system.

**Statement of the Problem:**

The current study is an attempt to improve and enhance university performance through the use of Six Sigma approach, as it is considered a new approach for upgrading the quality levels of processes and reducing error rates in these processes. Thus, this raises the efficiency of the performance in educational institutions and brings it to an ideal form. Hence, this puts forward a major question under which other sub questions can be posed:

The major question is:

**What are the orientations of The Philosophy of Assessing University Performance? And how can this university performance be assessed and enhanced using six sigma approach in the Light of Quality and Accreditation Requirements?**

The sub questions of the study are: -

1. What are the orientations of The Philosophy of Assessing University Performance in the Light of Quality and Accreditation Requirements?
2. What are the policies and practices of performance assessment systems and experiences in some universities worldwide?
3. What are the international approaches and measures of assessing university performance?
4. What are the distinctive features of six sigma approach as an approach for assessing and improving university performance?
5. Practically, how can six sigma be applied to assess students' academic performance in universities?
6. Being one of the approaches for assessing and improving institutional performance, what is the proposed perception

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for transforming universities into six sigma organizations?

### **Research Objectives:**

- 1- Identifying the distinctive features of The Philosophy of Assessing University Performance in the Light of Quality and Accreditation Requirements.
- 2- Identifying the policies and practices of performance assessment systems and experiences in some universities worldwide.
- 3- Identifying the international approaches and measures of assessing university performance.
- 4- Identifying the distinctive features of six sigma approach as an approach for assessing and improving university performance.
- 5- Applying six sigma approach to assess students' academic performance in universities.
- 6- Proposing a perception for transforming universities into six sigma organizations.

### **Methodology:**

In the light of the nature of the research problem, the current study adopted the DMAIC methodology of Six Sigma, this is in addition the descriptive method of research.

### **Findings:**

1. The study presented an applied model for the use of Six Sigma to evaluate the academic performance of students in universities, this was via conducting a Six Sigma project entitled "Improving the success rates of students of the French language teacher preparation program at the Faculty of Education - Ain Shams University using Six Sigma" using the DMAIC methodology of Six Sigma.
2. The study ended up with a proposed vision for transforming universities into Six Sigma Organizations.

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