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# Integrating Six Sigma with Quality Management Systems for The Development and Continuous Improvement of Higher Education Institutions

Pavel Adina-Petruța<sup>a\*</sup>, Sârbu Roxana<sup>b</sup>

<sup>a</sup>*Bucharest University of Economic Studies, The Institute for Doctoral Studies, Bucharest, Romania*

<sup>b</sup>*Bucharest University of Economic Studies, Bucharest, Romania*

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## Abstract

Competitiveness, innovation and performance are the key words that best define the goals of the present business environment. Under the given circumstances concepts such as quality and continuous improvement become important actors in achieving these goals. Regarded as a whole, higher education plays various roles such as: training the students and preparing them for the economic environment by involving them in the teaching-learning and research processes and offering the example of a system whose outcomes meet the organizational goals by implementing Six Sigma. The paper focuses on the way Six Sigma is applied to higher education and on integrating Six Sigma with one of the quality management systems, namely the model ISO 9000, for the development and continuous improvement of universities. A synergetic approach created by analyzing and simultaneously using the benefits of Six Sigma and ISO 9000 plays an important role in the development and success of a higher education institution.

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## 1. An overview on Six Sigma

The Six Sigma methodology is one of the most popular business practices used today. Employees of the Motorola Corporation, which manufactures wireless infrastructure technology, are credited as the first to create and implement this methodology in the mid- 1980s. Many other quality control methods have come and gone, but Six Sigma remains as the most popular method currently in use. The Motorola Corporation has reported saving upwards of 16 billion dollars by using these concepts over the years. Many other companies have adopted this methodology

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\* Corresponding Pavel Adina-Petruța Tel.: +40-723-554287  
*E-mail address:* [adyna\\_pavel@yahoo.com](mailto:adyna_pavel@yahoo.com)

as more than just a quality control system, but also as a total business plan. It has been praised by major leaders of industry such as the Chief Executive Officers of General Electric and The Honeywell Corporation. Even though the history of the Six Sigma Methodology spans only a few decades, it is now considered a vital part of quality development and efficiency in the top corporations of the world today.

Six Sigma allows a multidimensional approach, as it could be viewed as “a metric, a philosophy or a methodology for quality improvement” (Mitra, A., 2004). Six Sigma emphasizes on three levels: a metric, a methodology, and management systems (Andersson et al., 2006; Arnheiter, Maleyeff, 2005; Linderman et al., 2002, McCarty et al., 2006). Six Sigma could be defined as a metric not only at top management level, but at other levels, as well as, such as the level of the operating personnel (Mitra, A., 2004). As a quality management methodology Six Sigma uses different theories and tools to improve upon the processes of a certain business. Simply put, this results in near perfect products and services that meet and/or exceed the expectations of customers or end users, while simultaneously reducing the amount of time, money, and resources put in. In other words, with less input, a greater output will be realized.

The second way to define “Six Sigma” is the statistical way – metric system. “Sigma” ( $\sigma$ ) is a Greek letter used to represent the statistical term ‘standard deviation’ which measures the deviations from average in a particular business process. With more “deviation” from normal, come defective products and services that do not fulfill customer needs and wants. These “defects” end up being returned or requiring resolution, which costs businesses increased time, money and resources in the long run. A 6 Sigma business process “produces only 3.4 defects per million opportunities” (Goffnet, S. P., 2004) with other words the concept is used for processes that, virtually, perfectly meet the customers’ requirements and needs. Thus 0.00034% of products produced in a Six Sigma Process are defective. A ‘5 sigma’ process produces 233 defects per million opportunities - DPMO (0.023% defective), a ‘4 sigma’ process produces 6,210 DPMO (0.62% defective), a ‘3 sigma’ process produces 66,807 DPMO (6.7% defective) and a ‘2 sigma’ process produces 308,538 DPMO (31% defective).

As a management system, it is reported to:

- Ensure improvements are sustained
- Bring production teams together to maximize their efforts
- Bring business strategies in line with improvement efforts
- Accelerate results

At the mid-management level Six Sigma is used by project leaders as a methodology to achieve quality improvement by reducing the defects in products, services and processes (Mitra, A., 2004). Whereas for products and services the DMAIC (define-measure-analyze-improve-control) approach is being used, for products and processes another approach is popular in the literature, namely DMADV (design-measure-analyze-design-verify) (Pfeifer, T. et. al., 2004).

The first goal of the Six Sigma Methodology is to discover all of the problems within an organization that may or may not be apparent. This is done through much research and data collection. The next step is then to take appropriate action to reduce the number of errors and reworks which are known to cost time, opportunities, money and clients. In this way, the Six Sigma process translates knowledge and awareness into an open opportunity for expanding business.

Often times, more than one problem is found through Six Sigma implementation. In this case, there are tools used within the methodology that make it easier to choose which project is the most important to tackle first. All improvements are done with the ultimate goal of increasing the quality of the business output. There are three key holders of quality; they include the customer, the employee and the process. Customers define the quality of a product or service, as they are the key decision makers. In other words, if your product or service is not up to par, the customer will not buy it. If you have no customers, you will never be successful in your venture. One of the key places to start collecting data is the customers. You cannot produce what they want and need if you are not directly asking them what they want and need. Universally, customers expect reliability, competitive prices, performance, efficient delivery of goods and services, etc.

The most important part of the entire process, is uncovering the gaps or defects in a business process. There are many Six Sigma tools within the methodology that help the Six Sigma professionals in charge improve the most critical processes first. One of the most important things to note about the Six Sigma process is that it does not rely on quick-fix programs to temporarily mask a business problem. It is a systematic methodology of hard work that is fused with a disciplined, factual, data-based and statistical problem-solving method. Therefore, it affects almost all

aspects and levels of a company or institution, which can create panic among employees if it is not thoroughly explained, through a process called change management.

Though the actual working definition of the term, Six Sigma, now differs from company to company and from country to country, the idea behind it is simple. The goal is to turn production into a process that uses statistics, solutions, and data to solve problems instead of using the trial and error method. By first gathering data and statistics, any process can be made more cost effective, efficient, less time consuming and, simply put, all around 'smarter' than before. The amount of guesswork and product testing can be cut to a fraction, saving time and money.

The following are some of the common processes in the educational institutions which can be significantly improved by applying the Six Sigma methodology: academic achievement, the process of college admission, teaching and academic programs, study program and process, institutional effectiveness, student learning performance, evaluation of the instructional delivery, the accreditation process.

## 2. An overview of ISO 9000

ISO 9000 is a well-established international standard for quality management systems for all kinds of companies in nearly every industry. Developed by Technical Committee 176 of the International Organization for Standardization (ISO), it has evolved – based on input from companies and institutions – from a theoretical set of requirements in 1987 to a practical and process-oriented approach to assess the framework for quality management in 2000. The ISO 9000 family of standards is one of the most well-known models belonging to the quality management systems. The revised ISO 9000:2005 and ISO 9001:2008 relies on eight principles: customer focus, leadership, involvement of people, process approach – Figure no.1, system approach to management, continuous improvement, factual approach to decision making, mutually beneficial supplier relationships.

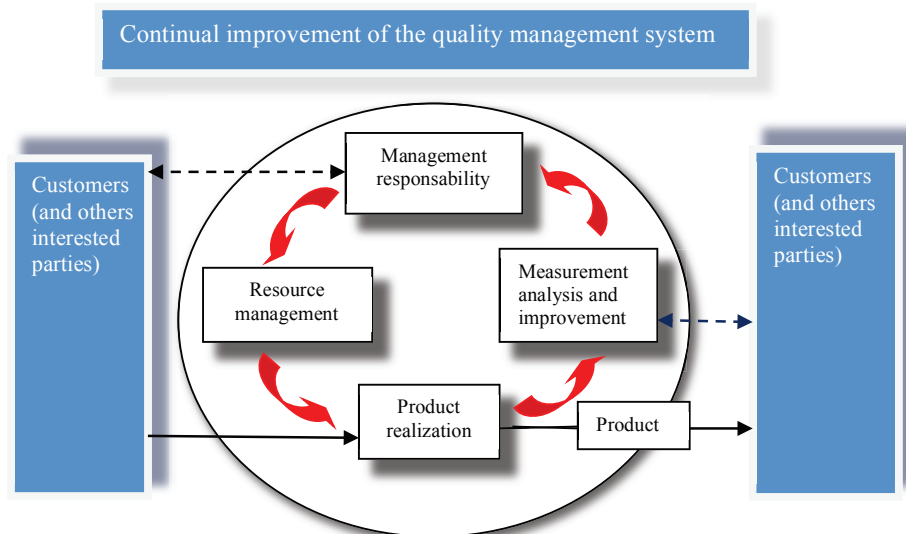


Figure no. 1. – The ISO 9000 process approach

Source: International Organization for Standardization, 2011. *The ISO 9000 family – core standards*

Further on it is presented how these principles can be applied within a higher education institution.

**Customer focus.** It is very important that any higher education institution identifies its customers and stakeholders (students, professors, parents, employees, etc.)- in order to understand their needs and expectations. Following these steps the higher education institution aims at best fulfilling their needs and satisfying their requirements. The similarity with Six Sigma relies on the consideration of this principle, customer orientation, as a prerequisite of the success of an organization (Pfeifer, T. et. al., 2004).

**Involvement of people.** This principle brings people's active participation at various activities forward, positive attitudes regarding their creative role and responsible attitudes towards solution finding. The involvement of people

in different activities and processes in a higher education institution should be increased as knowledge creation, dissemination and utilization are very important.

*Leadership.* According to this principle, a higher education institution has to establish the direction it is moving to, mission, vision and goals to be attained. On the other hand it is responsible for the environment people are working in, for offering them the opportunity to develop (Sandru, I., 2007). From the point of view of creating an internal environment sensitive to people's needs a further similarity with Six Sigma can be emphasized (Pfeifer, T. et. al., 2004).

*Process approach.* The quality management system is process based according to the revised version of ISO 9000. Process components that are to be taken into account are the inputs and outputs of the teaching-learning, respectively research processes. A clear evaluation of the risks and effects of the performed processes upon the various stakeholders is to be made (Olaru, M. et al., 2006). Higher education is viewed as a network of processes, where the existence of resources and their efficient use play an important role in achieving quality outcomes and quality educational services. Within ISO 9000, the Deming cycle or PDCA (plan-do-check-act) methodology, can be applied to all processes, whereas Six Sigma uses a different methodology called SIPOC (supplier-input-process-output customer) (Pfeifer, T. et. al., 2004).

*System approach to management.* Higher education can be seen as a system of integrated processes that interact and communicate with each other under the supervision and control of the top management and of the other responsible parts. The management structures are able to better enhance and improve the quality of the educational processes as well as outcomes.

*Continuous improvement.* Within higher education institutions this principle is achieved by measuring the quality of processes and outcomes. It is necessary to introduce and use quantitative and qualitative indicators, and by comparing it to stakeholders' satisfaction. To continuously improve both research and educational products and services one should increase the efficiency and effectiveness of the quality of the university processes, and permanently evaluate the process outcomes and criteria used to analyze the results (Olaru, M. et al., 2006). Another possible way of evaluation is by conducting audits and/or benchmarking processes

*Factual approach to decision making.* A factual approach is possible when data is available and reliable. A higher education institution should develop a system specially designed for collecting and assessing the necessary data. To make appropriate and sound decisions the data and the information should be clear and accessible and should be first analyzed (Olaru, M. et al., 2006). The factual approach in decision making is vital within Six Sigma, as all decisions are based on data rather than on simple assumptions (Antony, F., 2004).

*Mutually beneficial supplier relationships.* Lasting relationships with suppliers can be achieved and consolidated when both parts are committed to quality based activities and outcomes.

One of the strengths of ISO 9000 has always been those requirements that make an organization assess itself, which starts with internal audits once or twice a year and goes on to annual external third party audits performed by accredited certifying bodies. These requirements keep the ISO 9000 quality management system alive and up-to-date, avoiding the idea that ISO certification is a one-time event, a project just to reach the certification and to show the paperwork.

### **3. Bringing the two concepts together for the development and improvement of higher education institutions**

The benefits of Six Sigma and ISO 9000 create a synergetic approach that plays an important role in the development and success of higher education institutions. A prerequisite for the success of this synergetic approach is the congruence of the project goals of Six Sigma with the process goals of ISO 9000 (Pfeifer, T. et. al., 2004). A certain goal correlation has to be identified between the two models. With complex projects this prerequisite is difficult to meet. While Six Sigma is orientated towards those projects that offer financial success through customer focus, ISO 9000 is related to those projects that aim at improving the existing processes and activities, targeting the same goal, namely customer satisfaction. These two approaches are compatible and complementary, and are used, for instance, within research processes or partnerships. In addition to ISO 9000, Six Sigma emphasizes a statistical thinking, making use of statistical methods to evaluate the academic processes and outcomes and to improve them by reducing defects and failures.

The planning of a Six Sigma project and the recruitment of employees to participate are closely related to the processes already identified and analyzed within the ISO 9000 documentation (Pfeifer, T. et. al., 2004). The different management levels existing in a quality management system (Senate presidents, rectors, deputy rectors,

deans, chairs, etc) such as ISO 9000, coincide with the structures identified by Six Sigma: green belts – representing the practitioners, black belts – representing the experts responsible with the problem solving, master black belts - supporting the personnel involved in the project, and champions or leaders (senior management) –responsible with the project supervision and control and providing the necessary resources.

As many higher education institutions struggle to tackle the issue generated by the so called “funding gap” (Winckler, G., 2006), Six Sigma projects within such institutions could offer an answer to this matter by generating monetary benefits and possible financing resources through a continuous focus on customers’ needs and expectations.

There are many practitioners who believe that Six Sigma and ISO 9000 can be complimentary, although there are many who feel that both are unnecessary. A full-fledged Six Sigma program would impact quite a few organizational processes, which would require the ISO 9000 system to keep pace with the changes. The bridge between the two is a good control plan. Combining the two approaches is made possible due to a few main similarities (compare to Antony, F., 2004): both process based aspects imply the existence of dysfunctionalities and disturbances that occur during the various processes and activities and the preoccupations and intense measures undertaken to improve the quality of services and products by eliminating the causes that lie at the their bottom.

Just like ISO 9000, Six Sigma focuses on quality improvement by reducing the defects and flaws in the processes of delivering educational services. Permanent efforts are being made to increase customer satisfaction by decreasing the number of failures that lead to clients’ dissatisfaction. The success of the synergetic approach of Six Sigma relies on the development, such as ISO 9000, of a well-structured documentation, explicit procedures, clear defined tasks, activities, indicators and achievable goals.

## Conclusions

Higher education institutions should more often consider and refer to Six Sigma as a success strategy in maintaining academic quality at high standards, improving it continuously and reaching a higher level of performance. Six Sigma and quality management systems are popular today among hospitals, toy makers, clothing retailers, financial services, banks, education services and universities and the military as a method to improve their performance. If there is a process involved, it can be streamlined with Six Sigma or a quality management system with both.

The University of tomorrow will certainly be serving in the information society, this irrefutable fact has important implications for the strategies each institution should adopt due to the significant impact the information society will have on higher education in general and on each University in particular. It is important that each University take full cognizance of the changes in the information society and face one of the most complex of all campus planning operations pertaining to acquisition, distribution and management of computing and related technologies. Hence each institution must make its plans and develop its strategies to be proactive with respect to the environment context and must not lag behind society in general and other educational institutions in particular.

The complex character of Six Sigma is defined by the existence of a customer orientation, a management infrastructure (the different levels of belts), a process based perspective, a system approach and quality improvement. This proves its compatibility with ISO 9000, a quality management system and integrating Six Sigma in the quality culture of any higher education institution could be a success..

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