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## What Six Sigma Can Learn from the Systems: ISO 9000

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### **Abstract:**

*Over the decades, companies have evolved various quality checks to minimize defects in productivity. There have been many good and not so good quality techniques; however one technique, which has stood out, is the Six Sigma approach. This approach has enjoyed tremendous corporate attention, the kind, which no other approach can quite claim for itself.*

*Six Sigma, despite of far flung success and wide spread applications, has some limitations like any contemporary new improvement methodology, both in Theory and Practice as well as tools and methods available to achieve the Six Sigma performance. One such weakness is that, that Six Sigma does not take a system view. A subject which can help this weakness is the systems (QMS) itself.*

*This paper takes a brief look at the ISO 9000. It compares Six Sigma with the ISO 9000 quality system, attempts an integration and identifies some areas where Six Sigma can learn from the systems to ensure long-term success in the industry*

**Keywords:** Six Sigma, ISO 9000, DMAIC.

### **1. Background**

Organizations across the world are on the lookout for methods and measures that could enhance the quality of organizational climate prevailing within them. Popular initiatives such as TQM and Six Sigma are chosen and practiced by organizations to achieve this end and these programs often tend to be successful in inducing favorable changes in the internal environment of organizations mainly because of the human interventions involved in their implementation process, Kunnanatt (2007). Six Sigma could end up being remembered as just another passing management fad if it does not deliver on the promise that it can transform the industry the way Jack Welch says it has transformed General Electric, Munro (2000).

Over the years, companies have evolved various quality checks to minimize defects in productivity. There have been many a good and not so good quality techniques; however, one technique, which has stood out, is the Six Sigma approach.

The history of Six Sigma is a well-documented one and hence we note only briefly here. It can be traced to the American electronic giant, Motorola where a goal of improving all products - goods as well as services was established. To set a clear measure on the improvement work, the program called Six Sigma was launched in 1987, Klefsjo, Wiklund and Edgeman (2001). As a result of winning the Baldrige Award in 1988, Motorola was compelled to share its quality practices with others. The company's approach to continuous improvement was based on a comparison of process performance and product specification, and aggressive efforts to drive down defects, Folaron (2003). Motorola changed the language of quality in America by beginning to measure defects out of opportunities or parts per million (and even billion), instead of parts per hundred, Raisch, Anderson, Krogman and Krueger (2001).

Six Sigma is a quality movement, a methodology, and a measurement. As a methodology, it is used to evaluate the capability of a process to perform defect-free, where a defect is defined as anything that results in customer dissatisfaction. Six Sigma is customer focused and has the potential to achieve exponential quality improvement through the reduction of variation in system processes, Black and Revere (2006). Six-sigma's target is to achieve less than 3.4 defects or errors per million opportunities. We can sum up Six Sigma as a defect reduction effort, a variation reduction mechanism, customer satisfaction, a profit enhancing device, a loss control method, a data driven metric and ultimately a management philosophy.

Six Sigma, like any new Quality improvement methodology, has some limitations. One such weakness is that, that Six Sigma does not take a system view. It takes only a project view and not a holistic comprehensive view of the entire organization. A subject which can help this weakness is the systems (QMS) itself.

This paper takes a brief look at the ISO 9000. It compares Six Sigma with the ISO 9000 quality system, attempts integration and identifies some areas where Six Sigma can learn from the systems to ensure long-term success in the industry.

### **2. History of ISO 9000**

The ISO 9001 quality management systems standard is widely accepted around the world. Motivation for the introduction of this standard differs considerably and is most often connected with demands, requested by customers in supply chains. The ISO 9000 series of quality management and quality assurance standards are published by the International Organization for Standardization

(ISO), which is based in Geneva. The standards were published in 1987 and based on the earlier British Standard 5750, with input from other countries such as Canada. The five standards in the series (ISO 9000-ISO 9004) provide a framework for quality system development in nearly all types of industry, Yung (1997). Different perspectives on the management of quality in organisations are well summarized in the literature. Despite the remarkable growth of attention to this topic in the recent time, the literature reveals that total quality remains an ambiguous concept and the most important and yet least understood subject for managers. This may explain why managers, across different organisational contexts, regard the management of quality as one of the most critical and challenging issues confronting them. Although BS 5750 quality standard has been superseded by ISO 9001/2/3, for practical purposes, ISO 9000 is used for further references, Nwankwo (2000).

The reason for the acquisition of the standard must be supported by top management and consequently by all employees. Once the system is established, a company must inform its customers and clearly indicate all the benefits for customers. On the other hand, motives such as the necessity to simplify and standardize a set of processes, the rationalization of company growth or profits improvement, productivity improvement, are related to internal aspects. Organizations expect to be rewarded by their customer as a consequence of the certification, Piskar and Dolinsek (2006).

### 2.1. The ISO 9000 Quality System

Since the European Community has begun to eliminate internal trade barriers by harmonizing the standardization process, ISO 9000 has become a trademark for manufacturers to demonstrate their “good quality system” to their international purchasers. Many companies, originally unconcerned about quality, have started to establish their own quality systems in compliance with ISO 9000 requirements, in order to survive and remain competitive in their market. Consequently, the ISO 9000 quality system has created a quality oriented climate around the world, and people have become more quality conscious and aware. As yet, there seems to be no other quality methodology or philosophy that has same influence on the world market, Yung (1997).

ISO 9000 is the most widely-adopted quality assurance scheme. It is a first level formal system for the improvement of quality control. The label first level has been attached to this system because it is perhaps more to do with achieving conformance to pre-determined standards than it is to do with instilling the philosophy of excellence associated with a customer responsive management or customer value delivery orientation throughout an organization, Nwankwo (2000). The quality management system standards of the revised ISO 9000:2000 series were based on eight quality management principles which the ISO claimed could be used by senior management as a framework to guide their organizations towards improved performance. The revised standards are also more compatible with national quality award criteria (ISO, 2001). It is not difficult to see that these principles exhibit many similarities with the principles of TQM, Sun et al (2004).

ISO 9001 specifies requirements for a quality management system that can be used for internal application by organizations, or for certification, or for contractual purposes. It focuses on the effectiveness of the quality management system in meeting customer requirements.

### 2.2. The New Version: ISO 9001:2008

ISO 9001:2008, *Quality management system* –, is the fourth edition of the standard first published in 1987 and which has become the global benchmark for providing assurance about the ability to satisfy quality requirements and to enhance customer satisfaction in supplier-customer relationships. ISO 9001:2008 contains no new requirements compared to the 2000 edition, which it replaces. It provides clarifications to the existing requirements of ISO 9001:2000 based on eight years’ experience of implementing the standard worldwide and introduces changes intended to improve consistency with the environmental management system standard, ISO 14001:2004. (www.iso.org). Recently the ISO9000:2008 is superseded to ISO 9000:2015.

## 3. Comparison between ISO 9000 and Six Sigma

The similarities, dissimilarities between both the approaches elaborate discussions and the areas of ISO that can help Six Sigma are shown in the Table. 1. Some of the points raised by Yung (1997), Pfeifer et al (2004), Sun et al (2004) are also included. We can see that there many areas like Objective, Philosophy, Policy, Customer focus, Strategy, Management, Leadership and Training there is congruence between both the philosophies. In Organization and Involvement of people, Six Sigma differs in the sense that its operators are special class who are specifically trained. TQM and ISO 9000 emphasize that all employees should be trained and involved. Six Sigma in turn should train everyone and each one should at least be a greenbelt. In areas like Quality system, Project management and Methods, Continual improvement, Process and System approach to management, Contract review and design control, Documentation and Document control, Corrective action Six Sigma has considerable to learn from the Systems.

Principle	Quality Management Systems/ ISO	Six Sigma	Areas in which ISO can help Six Sigma
Objective	Customer satisfaction through high quality products	Monetary benefit through customer satisfaction	
Philosophy	ISO 9000 assessment documents are only used for external quality assurance purposes. It is used to fulfill customer requirements only	Six Sigma's is deeper and broader. Six Sigma concerns both, the internal organization and customer satisfaction, or even going beyond customer satisfaction.	
Policy	ISO 9000 has less control over company policy, provided that the quality policy is relevant to the company's and organizational goals.	Six Sigma provides better guidelines on company policy, because it is a strategic initiative.	
Customer focus	Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.	In the Six Sigma approach the customer focus is also considered as a prerequisite for organization's success.	
Strategy	Arranging business processes according to requirements of standards	High quality level/low failure rates in all business processes	
Management	Listing of management responsibilities. ISO contains directions for management, requiring management to be responsible for implementing and maintaining the quality plan.	In Six Sigma, management must ensure that the improvement program is made a core part of the strategy for cost saving and profit growth. Management must commit itself as owner and sponsor of the improvement program.	
Leadership	Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.	For this purpose, the Six Sigma infrastructure can be applied. Six Sigma Champion, Master Blackbelt, Blackbelt, Greenbelt is the structure followed.	
Organization and Involvement of people	Process owner; management representative is (responsible for QMS). People at all levels are involved and contribute for the organization's benefit.	Process owner (green belts); project officer (black belts). Six Sigma Champion, Master Blackbelt, Blackbelt, Greenbelt are the people involved. By contrast, Six Sigma emphasizes teamwork.	
Training	Required, but not specified. ISO requires that training is planned and provided to personnel. The goal is to ensure that personnel have the skills and abilities needed to perform work tasks related.	In Six Sigma, there is a more a vigorous training program, but the difference to ISO is that the training described in Six Sigma is concerned with improving knowledge about Six Sigma.	All employees should be trained be at least to be a green belt
Project management and Methods	PDCA (model for continuous improvement.)	DMAIC/DMADV (continuous improvement approach)	
Continual improvement	Continual improvement of the organization's overall performance should be a permanent objective of the organization.	The improvement in process capability, the overall customer satisfaction in itself is a result of continuous improvement.	
Process approach	A systematic process definition is not defined in the standards, therefore approaches of process oriented quality management describe detailed proceedings. Model of a process-based QMS.	Six Sigma also offers such a process definition approach called SIPOC (supplier-input-process-output-customer). In the scope of Six Sigma projects single process steps have to be systematically analyzed and improved.	A desired result is achieved more efficiently when activities and related resources are managed as a process. Quality management systems permit an entire and coherent overview of the interaction of processes within an organization. This Six Sigma has to learn

System approach to management	Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives.	Six Sigma does not have systems approach, but the whole DMAIC itself is systematic and rigorous approach.	This is an area Six Sigma can learn from ISO, which makes each phase of DMAIC stronger
	The ISO 9000 quality system lays down comprehensive guidelines on controlling a quality system;	Six Sigma stresses the more human factors. Six Sigma may result in greater quality achievement than ISO 9000 because it is a path to endless improvement	
Contract review and design control	ISO requires that contracts be reviewed to determine whether the requirements are adequately defined, agree with the bid, and can be implemented. In ISO, there are also requirements on the establishment of procedures to control and verify the design, including activity planning, input and output identification etc.	Six Sigma does not say anything on performing reviews, but in DMADV philosophy the very V is verifying.	This is an area Six Sigma can learn from ISO, which makes the control phase of DMAIC stronger.
Documentation	Listing of requirements	No specification	The lack of any document and document control guidelines is a weak point in Six Sigma and this is another area Six Sigma can learn from ISO
Document control	ISO requires control on the distribution and modification of documents.	Document control is no explicit requirement in the Six Sigma model, except for the various diagrams and plots generated by the 7QC tools.	
Corrective action	ISO requires causes of a nonconforming product to be identified and that potential causes are eliminated.	Corrective action is a core part of Six Sigma. The goal is to reduce variation in the product as well as the process, and thus its causes must be addressed.	The 7QC tools are part of the framework for addressing and eliminating the causes.
Quality system	ISO requires the organization to implement an extensive Quality Management System (QMS), which must contain a quality policy and quality objectives, as well as a quality manual and documented procedures.	Six Sigma does not provide such rigorous guidelines, but that does not mean it falls short of neither ISO.	In ISO, the QMS describe activities to be performed for achieving high quality. Six Sigma provides a set of tools to use for achieving better control of variables that cause variation in processes.
Statistical techniques	ISO suggests that statistical techniques should be used if applicable, to verify the acceptability of process capability and product characteristics.	The heart of Six Sigma is the statistical techniques. Six Sigma utilizes a far more advanced framework including the DOEs.	
Concluding remarks	ISO, similarly, contains rigorous guidelines for both which activities that must be performed and how these should be performed.	Six Sigma describes to some extent which activities should be performed, but does not provide strict guidelines for the implementation of these activities. It has controls after Improve.	

Table 1: Similarities and dissimilarities between ISO 9000 and Six Sigma

#### 4. Integration of ISO and Six Sigma

There has been many an author who tried to integrate ISO 9000 with TQM and they were reasonably successful. According to Sun et al (2004), to incorporate the two approaches, a full understanding of the aims, functions and limitations of each is a necessity. Previous debate or criticism concerning ISO 9000 as well as TQM models may be due to misunderstandings of the two frameworks. ISO 9000 standards aim to assist companies establish a quality system that maintains the quality level. Asking too much from ISO 9000 is therefore not realistic. However, the use of ISO 9000 standards only is not enough, which is why companies are encouraged to go further and additionally adopt TQM. Similarly, many authors also tried the integration of TQM with Six Sigma, including this author. Hence integrating ISO with Six Sigma is a logical deduction, it should not be very difficult for us, now, to integrate ISO 9000 with Six Sigma.

By far the most popular and world-wide known standards of QMS are the standards of the ISO 9000 family QMS belong to the most disseminated approaches. For the implementation of such systems it is necessary to identify the business processes at the beginning. Six Sigma also requires the creation of a process model previous to the beginning of a project and provides for this purpose an approach called SIPOC (supplier-input- process-output-customer). This model is used to visualize and optimize processes, Pfeifer et al (2004).

Thus the main challenges of Six Sigma will be supported and the acceptance and benefits of QMS will increase. The integrated approaches support an implementation with limited efforts in enterprises. A proposed Integration model with an in built commonalities of philosophies is presented in Figure 1.

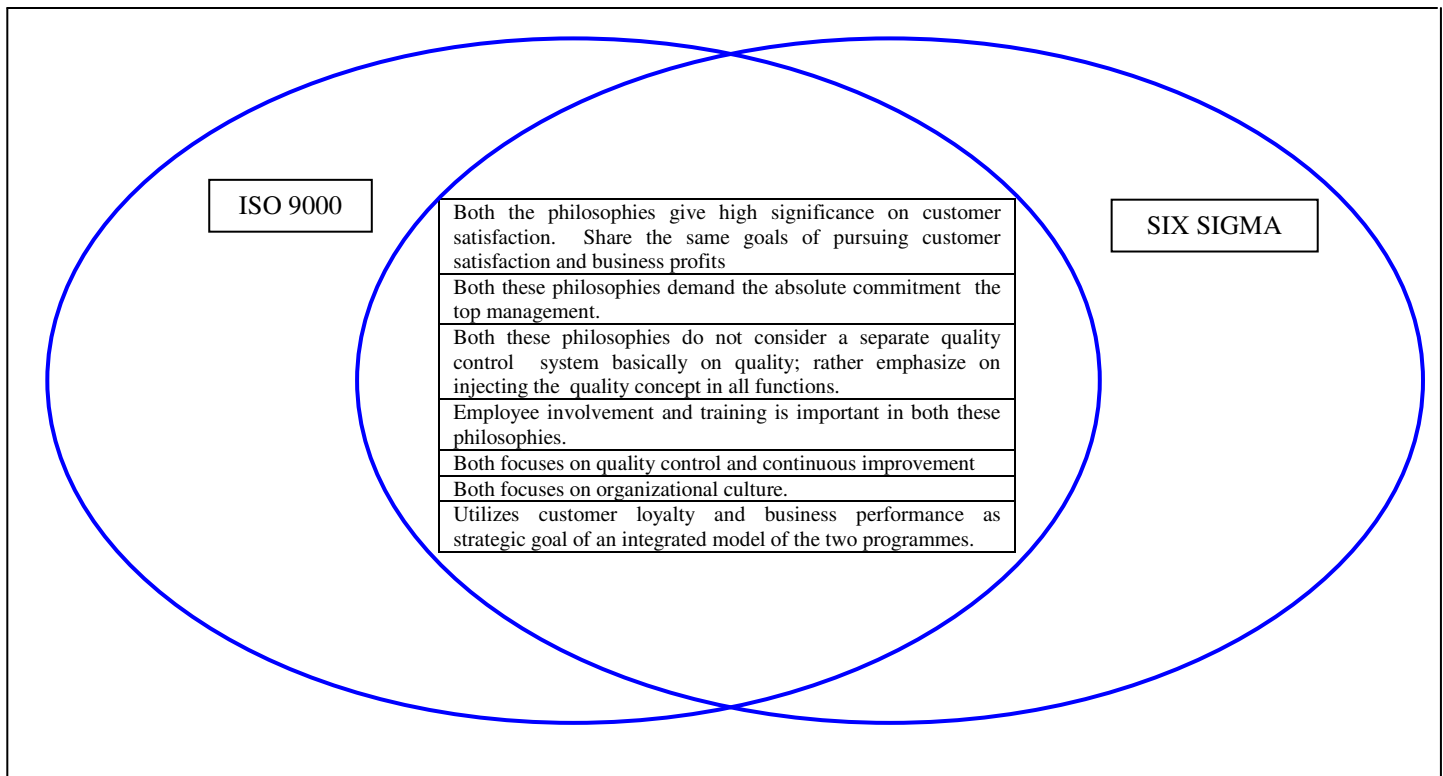


Figure 1: Integration model of ISO 9000 and Six Sigma

Advantages of the systematic integration of both approaches are:

- an effective proceeding to identify the most relevant improvement areas;
- the assurance of conform project and process objectives and thus the sustainability of Six Sigma projects;
- choice of the most capable project participants and minimization of the qualification effort;
- the fulfilment of all organizational requirements for running projects using standard procedures and measures; and. increased availability of project experiences through well-structured documentation facilities, Pfeifer et al (2004).

##### 5. What Six Sigma Can Learn from ISO 9000?

ISO 9000 yields visible and concrete benefits to organizations in the form of sustained product quality, enhanced market image, increased customer satisfaction, and long-term profitability, Kunnanatt (2007). To quote ISO.org, The ISO 9000 standards give organizations an opportunity to increase value to their activities and to improve their performance continually, by focusing on their major processes. The standards place great emphasis on making quality management systems closer to the processes of organizations and on continual improvement. As a result, they direct users to the achievement of business results, including the satisfaction of customers and other interested parties. The management of an organization should be able to view the adoption of the quality management system standards as a profitable business investment, not just as a required certification issue. Among the perceived benefits of using the standards are: Nwankwo (2000), Pfeifer et al (2004), ISO.org

- The connection of quality management systems to organizational processes
- The encouragement of a natural progression towards improved organizational performance, via:
  - the use of the Quality Management Principles
  - the adoption of a process and systems approach
  - emphasis of the role of top management
  - requirements for the establishment of measurable objectives at relevant functions and levels
  - being orientated toward "continual improvement" and "customer satisfaction", including the monitoring of information on "customer satisfaction" as a measure of system performance.
  - measurement of the quality management system, processes, and product consideration of statutory and regulatory requirements.
  - marketing advantages of ISO 9000 certification; better documentation system; quality awareness among internal staff; efficiency improvements/cost reductions.

- ISO 9000 registration communicates to customers and potential customers that the company meets the quality assurance criteria laid down in the British Standards.
- This acts to maintain existing customers, attract new ones, and, at a more general level, market a positive image of the company.
- the process involves the undertaking of a "health check" of the company and this should lead to the uncovering of wasteful, duplicate or otherwise inefficient practices and, hence, the unleashing of cost and time saving.
- it helps those personnel in the production and maintenance of the quality system to gain a better understanding of how the company, through its inter-related parts, works and about how they might improve the system.

ISO 9001:2008 aims at guaranteeing the effectiveness (but not necessarily the efficiency) of the organization. For example: Customers and users will benefit by receiving the products that are:

- Conforming to the requirements
- Dependable and reliable
- Available when needed
- Maintainable

Kunnanatt (2007) adds, Adoption of ISO certification yields a variety of advantages to the organizations in terms of technology, quality, speed of supply, reliability of the products, delivery of services and after-sales services, and savings in costs.

With the above cited advantages and the benefits, we now look what ISO system documentation can help Six Sigma.

- In the "Define" phase of Six Sigma projects it has to be aspired, that project and process concur in objectives as much as possible. However, this is difficult to reach in large projects, because of complex interactions between involved processes. After identifying the involved processes using process maps, the process objectives described in QMS can be compared with the planned Six Sigma project objectives. Thus the impact of modifications in interrelated processes, can be visible, Pfeifer et al (2004).
- System approach to management- Identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives. Quality management systems facilitate the systematic analysis and the graphical representation of processes and thus the distinctness of organisational structures. But processes are frequently only described without looking for optimization potentials. Besides, the processes are described statically, while they should adjust to changing conditions in practice.
- The process of ISO implementation covers all elements in the systems of an organization. The operating procedures and processes of the organization right from product design till after sales service have to be standardized on adopting the quality system. The certification process clearly specifies the development of systems, procedures, and work instructions for the organization. This can be applied and implemented for all the Six Sigma projects.
- Contract review and design control- ISO requires that contracts be reviewed to determine whether the requirements are adequately defined, agree with the bid, and can be implemented. In ISO, there are also requirements on the establishment of procedures to control and verify the design, including activity planning, input and output identification etc. This is an area Six Sigma can learn from ISO, which makes the control phase of DMAIC stronger
- Document control -ISO requires control on the distribution and modification of documents. Document control is no explicit requirement in the Six Sigma model, except for the various diagrams and plots generated by the QC tools. This lack of any document guidelines a weak point in comparison to ISO, and this is another area Six Sigma can learn from ISO. Documents and appropriate check sheets at various phases of Six Sigma projects can be of immense help.
- Continual improvement - Continual improvement of the organization's overall performance should be a permanent objective of the organization. From a level of 3sigma to 6 sigma the progress has to be the fastest.

## 6. Conclusions

Finally, the ISO 9001: 2000 certification is just the first step in the quality ladder, Zaramdini (2007). A procedure can be wrong, but an ISO standard will merely tell you that you are conforming to it. It does not encourage you to change what you are doing in order to make improvements. One of the principles of Six Sigma is continuous improvement. In Six Sigma, it is suggested that all work is a process and the problem-solving process is a continuous cycle of opening one's mind to a wide range of possible solutions. This unison makes the combination lethal. Thus, an organization can continue improving its quality with Six Sigma with the supported of ISO.

In comparison with traditional approaches of quality management, Six Sigma is the most effective concept because of the interrelation between its strategy, organisational structures, procedures, tools and methods. Because of different maturity and objectives of organisations, the concept has to be adapted to the individual call for action. Main challenges for a successful implementation of Six Sigma are the smart integration in existing management systems and an efficient qualification program, Pfeifer et al (2004).

With the incorporation of above suggested components of ISO into the core of DMAIC, the repertoire of a blackbelt can be strengthened.

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