# Six Sigma Application for Library Services

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## ABSTRACT

Six sigma is now increasingly being applied to a wide range of processes ranging from manufacturing to services and variegated transactional processes. A fundamental objective of six sigma is to achieve customer satisfaction. Doing things right and keeping them consistent are the ideas behind six sigma. Success of six sigma in manufacturing is well published. But the same cannot be said about its implementation in services. Applying six sigma to services is still limited.  This paper provides a review and a pilot study on six sigma application for library services with emphasis on necessary critical success factors and key performance indicators for a project to be successful.

## 1.  INTRODUCTION

While quality management tools have existed for a long time, their use is still not widely implemented in services sector. The emergence of six sigma has renewed interest in the scientific management of service industries.

The basic elements of six sigma are really not new. Statistical process control, histogram, run chart, failure mode and effect  analysis, cause and effect diagram, and other tools have been in use for some time. Six sigma offers a framework that unites these basic quality tools with high-level management support.

Since the introduction of six sigma in the 1980s, there have been many success stories from companies like Motorola, General Electric, and  Allied Signal. The majority of these stories are from the manufacturing sector. The service sector, barring the healthcare and banking industries, are lagging behind in applying and reaping the benefits of six sigma.

## 2. WHAT IS SIX SIGMA?

Sigma (σ), a Greek alphabet, is used in mathematics and statistics to define standard deviation. The sigma scale of measurement is perfectly correlated to such characteristics as defects-per-unit, parts-per-million defects, and the probability of a failure. Six is the number of sigma measured in a process, when the variation around the target is such that only 3.4 outputs out of one million are defective. Coronado and Antony[1] has pointed that six sigma methodologies have recently gained wide popularity because six sigma has proved to be successful not only at improving quality but also at large cost savings along with these improvements. So, an organisation needs to adopt smarter six sigma solutions that are linked to bottom line benefits. Kumar[2] stated that six sigma is a statistical measurement, which provides the opportunity and discipline to eliminate mistakes, improve morale, and save money. Doing things rightly and keeping them consistent are the basic ideas behind six sigma. A fundamental objective of six sigma is to achieve customer satisfaction and continuous improvement in processes.

According to Harry[3], CEO of Six Sigma Academy, Phoenix, USA:

✂ Six sigma is a well-structured, disciplined, data-driven methodology for eliminating defects, waste, or quality control problems of all kinds in manufacturing, service delivery, management, and other business activities

✂ It is a business strategy that allows companies to drastically improve their performance by designing and monitoring everyday business activities in ways that minimise waste and resources while increasing customer satisfaction.

According to O'Neill and Duvall[4], six sigma is a disciplined quality improvement methodology that focuses on moving every process that touches the customers' every product and service towards near-perfect quality. It is a measure of the company's quality. Maleyeff and Krayenvenger[5] noted that six sigma implies three things: statistical measurement, management strategy, and quality culture. It is a measure of how well a process is performing through statistical measuring of quality level. It is a new management strategy under leadership of the top management responsible for quality innovation and total customer satisfaction. It is also a quality culture. It provides the way to do things right the first time and to work smarter using data information. It also provides an atmosphere to solve many critical-to-quality (CTQ) problems through team efforts.

## 3. APPLICATION OF SIX SIGMA IN SERVICES SECTOR

Just as for manufacturing, defects found in service incur a cost to either scrap or to rework. Examples include the need to re-contact a customer to verify an order, providing an incorrect service, providing a substandard service or even over service or providing more than what is required.

Service organisations such as healthcare and finance have been implementing six sigma and are registering benefits. The breadth of applications is now expanding to other services including call centers and human resource and product support services[6].

Literature review shows that most applications are limited to service industries in North America and the European countries, but it is the financial benefits of six sigma that have been publicised, instead of discussing gain in terms of process improvement. Also, important to note is that the applications emphasised the proper identification of critical success factors (CSFs), CTQ characteristics, and key performance indicators (KPIs). These factors have been discussed here.

### 3.1 Critical Success Factors

Critical success factors are necessary for the success of any six sigma effort. The literature review shows that managements' commitment; education and training; culture change; and financial benefits are the most important CSFs for the successful application of six sigma in services. Other CSFs include customer focus, clear performance metrics, and organisational understanding of work processes.

### 3.2 Critical-to-quality Characteristics

Critical-to-quality characteristics are the key measurable indicators of a product or process

whose performance standards or specifications limits must be met to satisfy the customer. In simple term, CTQs are what customers expect of a product or service. Irrespective of differences among services, there exist some common CTQs like time (service time, waiting time, and cycle time), cost, employee behaviour, and information (accurate and timely information).

## 3.3 Key Performance Indicators

Key performance indicators show the success or failure outcome of a process. The outcome of six sigma projects is usually expressed in financial terms. This leads to a direct measure of achievement that is easy to understand[7]. Various KPIs are financial benefits, efficiency, cost reduction, time to deliver, the quality of the service, customer satisfaction, and reduced variation. For a six sigma project to be successful, the proper identification of CTQs and KPIs is necessary. A pilot study on six sigma application for library services identified the CTQs and KPIs specific to library services. Some of the CTQs and KPIs are similar to those from other services. This suggests and is intuitively so, that different services have similarities in the process characteristics.

## 4. LIBRARY SERVICES AND SIX SIGMA APPLICATION

Library is a place where knowledge is discovered. Driven by this philosophy, the present study focused on using the DMAIC (define, measure, analyse, improve, control) methodology to improve the efficiency of a local library. The following process improvement steps were taken for this pilot study.

## 4.1 Define

Define the problem and what the user requires[8]. The define phase sets the expectation of the improvement of project and maintenance of focus of six sigma strategy on user's requirement. The objective here was to improve services offered by the library in order to make these more efficient. This required a review of the CTQs and KPIs such as process costs, staffing level, and outcome measures. The scope of this study included technical service process, library automation, and digital services. The tool used included writing up the project charter.

## 4.2 Measure

To become familiar with the different library processes, an audit was carried out. The audit process included:

✂ Selection of the processes to be audited

✂ A critical examination of selected process

✂ Developing the improved processes.

A critical examination of the library process during the audit helped to identify the important CTQs and KPIs (Table 1). These became the basis to develop improved processes.

Table 1. Important library CTQs and KPIs determined from the pilot study

| CTQs | ➢ Time<br>➢ Staff level<br>➢ Cost of process<br>➢ Volume of output |
|---|---|
| KPIs | ➢ Staff development<br>➢ Timely and quality service<br>➢ Accessibility<br>➢ Image and reputation<br>➢ Positive customer experience |

A brief explanation of the CTQs determined from the study have been given below:

(i) Time: This involves the time to process user's requests through telephone,e-mail or in person, and time spent on checking, updating and shelving the library resource such as books, journals, microfilms, etc.

(ii) Staffing level: This refer to the library staff involved in the technical services, loans, and user services, and library automation and digital services

(iii) Cost of process: This refers to the cost involved in technical services, loans, and user services, and library automation and digital services

(iv) Volume of output: This includes over-the-counter transactions and also transactions using the self-service machines.

The KPIs of the study have been discussed below:

(i) Staff development: Involves developing the skills of the staff through education and training

(ii) Timely and quality service: Needs to be value-added and proactive

(iii) Accessibility: To make the books and digital library services available as quickly and as efficiently as possible

(iv) Image and reputation: This is the status of the library as seen from a customer's point to view

(v) Positive customer experience: To improve the physical ambience of the library premises and to add features such as laptop charging areas etc., to make the library users feel comfortable.

The tools used for this phase included interviewing the library in-charges of the various processes being used by the library.

## 4.3 Analysis

Using process mapping, and causes and effects diagramming, the present status of the library processes was identified. The following shortcomings were identified:

✂ Short time frame for processing requests sent to technical services

✂ Lack of verification of the claims submitted by vendors

✂ Manual inputting and processing of the claims by vendors was laborious

✂ While physically processing the items, there was some degree of work duplication in the receiving and cataloguing sections.

## 4.4 Solutions

A complete analysis of the library provided answers on how the above shortcomings could be eliminated. The solutions suggested to overcome the deficiencies were:

(i) Change in time frame to process requests from daily basis to monthly basis

(ii) Reduction in the cost incurred due to claim. An evaluation system can be created

(iii) Initiation of a process of automated inputs as well as designing the workflow based on the total process, i.e., receiving and cataloguing.

The above improvement may also help in enhancing the accessibility of library resources, which would in turn improve the image and reputation of the library.

## 4.5 Control

Controlling the process, to make sure that defects do not recur, removes the root cause of the problem. All possible related problems of a specific problem identified in the analysis phase can be tackled in the control phase. Control mainly defines plans specifying process monitoring and corrective action; provides systematic re-allocation of resources to ensure the process continues in a new path of optimisation; and ensures that conditions of the new process are documented and monitored. This would involve training the library staff on the improved processes and also through monitoring the system such as by data collection.

## 5. CONCLUSION

The planned framework and focus on process improvement are the major strengths of six sigma. Service industries can utilise this framework, and can benefit by identifying important parameters like CTQs and KPIs. The similarities among these parameters across different services provide an initial basis for service providers to apply six sigma. The pilot study identified a number of important CTQs and KPIs unique to libraries, and that it is entirely possible to tailor a range of six sigma tools fors various library services.

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