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Six Sigma: A Powerful Tool for Service Processes

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ABSTRACT: *This paper attempts to demonstrate the power of six sigma, a disciplined approach to improving product, process or service quality, in the service industry. The paper presents the basic features that characterize six sigma followed by a simple methodology for six sigma applied to service operations. The paper also illustrates a set of tools and techniques used within six sigma for service process performance improvement. Key success factors for the implementation of six sigma in service organizations and the factors for selection of winning projects are also addressed. The paper draws the point that six sigma is not same as other quality initiatives such as TQM due to various misconceptions among many quality practitioners with these two philosophies. There are also limitations of six sigma and these are outlined and discussed. This paper presents the potential areas where six sigma could be exploited in service functions.*

1,Introduction

This powerful business management strategy has been exploited by many world class organisations such as General Electric (GE), Motorola, Honeywell, Bombardier, ABB, Sony, to name a few from the long list. Six sigma applications in the service sector are still limited although it has been embraced by many big service oriented companies such as J P Morgan, American Express, Lloyds TSB, Egg, City Bank, Zurich Financial Services, BT, etc. The concept of six sigma was introduced by Bill Smith in 1986, a senior engineer and scientist within Motorola's communication Division, in response to problems associated with high warranty claims. The success of the efforts at Motorola was not just achieving six sigma quality level rather the focus was on reducing defect rate in processes .

The six sigma logic

The term sigma is a measure indicating the deviation in the performance characteristic of a service from its mean performance. The basic goal of a six sigma strategy is to reduce variation within the tolerance or specification limits of a service performance characteristic. In order to improve the quality of a typical service, it is imperative to measure or quantify variation and then develop potential strategies to reduce variation.

If process drift factor is taken into account due to various sources of external uncontrollable influences (fluctuations of emotional conditions of staff members) over a period of time, then the defect rate is about 3.4 parts per million. In essence, six sigma quality level relates to 3.4 defects per million opportunities (DPMO). The primary means to achieving six sigma quality level is to eliminate the causes of quality or process related problems before they are transformed into defects. The focus of "six sigma" is not on counting the defects in processes, but the number of opportunities within a process that could result in defects.

six sigma in the service industry

Research has shown that most of the service processes like payroll processing, billing, invoicing, shipping, order entry, response to service requests, baggage handling, etc. are performing at less than 3.5 sigma quality level with a defect rate of over 23,000 ppm or yield 97.7 per cent (Yilmaz and Chatterjee, 2000). If we improve the sigma quality level of any of the above mentioned service processes to four sigma quality level, the defect rate will be dropped significantly to 6,210 ppm. This clearly indicates a 3.5-fold improvement in process performance. The process yield will be increased to 99.38 per cent. This would bring significant financial returns to the bottom-line of any organisations (due to reduced defect rate, reduced number of customer complaints, improved customer satisfaction, etc.) engaged in powerful business process improvement methodologies such as six sigma.

Key benefits of six sigma in service organisation

Table I briefly presents the type of quality characteristics within various service functions where six sigma could be employed. The author believes that this table would be useful for those service-oriented companies who are embarking on the six sigma journey for process performance improvement or cost reduction projects. One of the challenges in service processes is about "what to measure and how?" It is important to ensure that the characteristics which you measure from the processes are critical to improve customer satisfaction and the level of service quality.

Table 1.Potential applications of six sigma within service processes

Type of service function	Potential areas where six sigma may be employed
Banking	Wire transfer processing time, number of processing errors, number of customer complaints received per month, number of ATM breakdowns, duration of ATM breakdowns, etc.
Healthcare	Proportion of medical errors, time to be admitted in an emergency room, number of successful surgical operations per week, number of wrong diagnoses, waiting time to be served at the reception in a hospital, etc.
Accounting and finance	Payment errors, invoicing errors, errors in inventory, inaccurate report of income, inaccurate report of cash flow, etc.
Public utilities	Late delivery of service, number of billing errors, waiting time to restore the service after a fault has been reported, call centre of the utility company, etc.
Shipping and transportation	Wrong shipment of items, wrong shipment address, late shipment, wrong customer order, etc.
Airline industry	Baggage handling, number of mistakes in reservation, waiting time at the check-in counter, etc.

Six sigma methodology for service processes

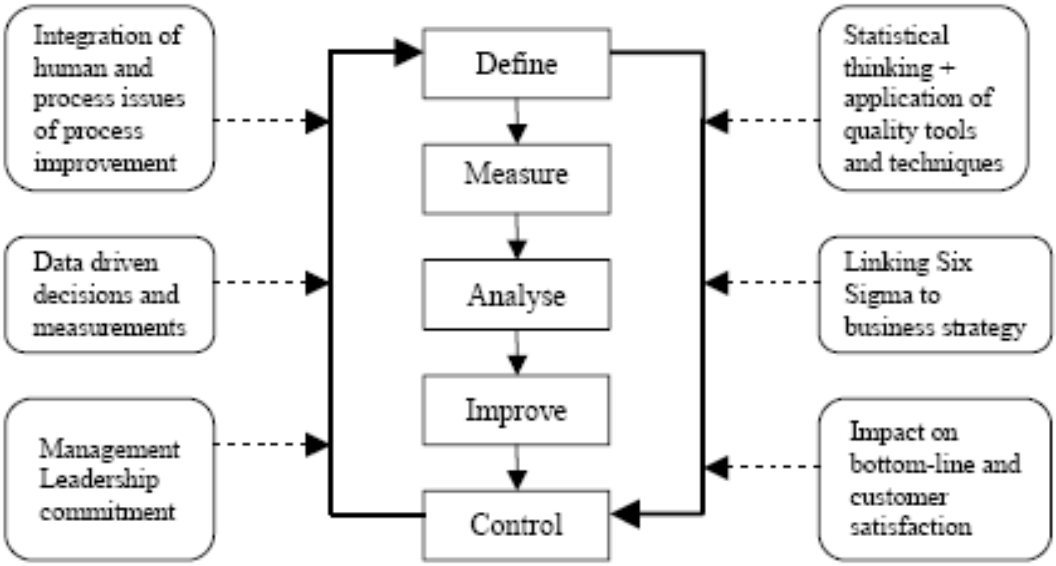
As a problem solving methodology or process improvement framework, six sigma strategy makes use of a series of well-defined steps. The six sigma methodology for service processes is shown in Figure 1.

Define phase

The following steps must be carried out in the define phase:

- Define the problem (as a project) both succinctly and specifically.
- Establish the process inputs, outputs and various controls of the processes.
- Identify all customers (both internal and external) and justify how this problem is linked to customer satisfaction.

Figure 1. Six sigma methodology



Measure phase

The following items should be considered during the measurement phase of the six sigma methodology:

- .determine the current performance of the service process (process yield, DPMO, short-term and long-term capability);
- decide what to measure (critical-to-quality characteristic – CTQ) and how to measure;
- identify the strengths and weaknesses and determine the gaps for improvement.

Analysis phase

The following salient points must be looked at during this phase:

- uncover the root causes of defects in processes;
- understand the root causes of variability which lead to defects and prioritise them for further investigation;
- understand the nature of data and the distribution or patterns of data;
- determine the key service process variables that may be linked to defects; and . financially quantify the improvement opportunity (i.e. estimate of potential financial benefits).

Improve phase

The improvement phase of the methodology encompasses the following issues:

- .Develop potential solutions to fix the problems and prevent them from recurring.
- Evaluate the impact of each potential solution using a criteria-decision matrix.
- Assess risks associated with potential solutions.
- Validate improvement (i.e. reduce defect rate or improve sigma quality level of the process) by pilot studies.
- Re-evaluate the impact of chosen potential solution.

Control phase

The control phase of the methodology should comprise of the following items:

- develop corrective actions to sustain the improved level of service process performance;
- develop new standards and procedures to ensure long-tern gains;
- implement process control plans and determine the capability of the process;
- identify a process owner and establish his/her role;
- verify benefits, cost savings/avoidance;
- document the new methods;

Tools and techniques for service process performance improvement

The successful implementation of six sigma requires stringent application of tools and techniques at different stages of the methodology. It was interesting to observe that many service organisations are gaining significant benefits through the application of basic tools of six sigma (e.g. Pareto analysis, root cause analysis or cause-and-effect analysis, process mapping or flow charting of processes, etc.).These tools and techniques are generally employed by project teams and specially trained black belts with technical expertise to tackle process or quality related problems (Pande et al., 2000). The following six sigma tools and techniques grid (Table II) provides some guidelines for people in the service sector.

Six sigma performance metrics

The key performance indicators (KPIs) vary from process to process, and from company to company. The following are some of the commonly used six sigma performance indictors (KPIs) within service sector:

- cost of poor quality (COPQ);
- DPMO;
- process capability;
- time to respond to customer complaints;

Table II. Six sigma tools and techniques grid for service processes

Tools/techniques	Define	Measure	Analyse	Improve	Control
Process mapping (2)	Y	N	N	N	N
Brainstorming (2)	Y	N	Y	Y	N
Root casue analysis (2)	N	N	Y	Y	N
Quality costing (1)	Y	Y	N	Y	N
Hypothesis testing (2)	N	N	Y	N	N
SPC (1)	N	N	N	N	C
SIPOC (2)	Y	N	Y	N	N
SERVQUAL (2)	N	Y	N	Y	N
GANTT charts (2)	Y	Y	Y	Y	Y
Process capability analysis (1)	N	Y	N	Y	N
Regression + correlation analysis (2)	N	N	Y	N	N
Benchmarking (1)	N	Y	N	N	N
Control charts (2)	N	N	N	N	Y
Pareto analysis (2)	N	N	Y	N	N
Cost-benefit analysis (2)	Y	N	N	N	N
Histograms (2)	N	Y	Y	N	N
Service FMECA (1)	N	Y	N	N	N
QFD (1)	Y	N	N	N	N
Affinity diagram (2)	N	N	Y	N	N
Project team charter (2)	Y	N	N	N	N
KANO model (2)	N	Y	N	N	N

Note: Y = applicable and N = not applicable; (1) = technique and (2) = tool

- processing time (mortgage applications, insurance cover, bank loans, etc.);
- delivery time or speed of delivery;
- waiting time to obtain the service; service reliability;
- accuracy of information provided to customers.

Success factors for the implementation of six sigma in the service sector

The following success factors have been identified from existing literature:

- strong leadership and management commitment;
- organisational culture change;
- aligning six sigma projects to corporate business objectives;
- selection of team members and teamwork;
- six sigma training;
- understanding the DMAIC methodology, tools, techniques and key metrics;
- selection of projects and project management skills;

Project selection process within six sigma program

The project selection process should be listening to three important voices: the voice of the process, the voice of the customer and the voice of the strategic business goals. The following guidelines may be used to select six sigma projects:

(1) Linkage to strategic business plan and organisational goals.
(2) Sense of urgency – how important is the proposed project for improving your overall business performance (both financial improvement and service process performance improvement)?
(3) Select projects which are doable in less than six months. If the project scope is broader, the time to completion increases, the cost of the project deployment will increase. This would lead to frustration among the key players due to lack of progress, diversion of manpower away from other activities, delay in realization of financial benefits, etc.
(4) Project objectives must be clear, succinct, specific, achievable, realistic and measurable.
(5) Establish project selection criteria – the following criteria may be considered during the project selection process:
. impact on customer needs and expectations;
. financial impact on the bottom-line;
. duration of the projects considered;
. risk involved in projects, etc.
(6) Projects have the support and approval of senior management.
(7) Define project deliverables in terms of their impact on one or more critical characteristics in the service such as critical-to-quality, critical-to-cost or critical-to-delivery.
(8) Projects must be selected based on realistic and good metrics (DPMO, sigma quality level, capability indices, etc.).

six sigma different from other quality improvement initiatives

The following aspects of the six sigma strategy are not accentuated in previous quality improvement initiatives:

1, Six sigma strategy places a clear focus on achieving measurable and quantifiable financial returns to the bottom-line of an organisation.

2,Six sigma strategy places an unprecedented importance on strong and passionate leadership and the support required for its successful deployment.

3,Six sigma methodology of problem solving integrates the human elements (culture change, customer focus, belt system infrastructure, etc.) and process elements (process management, statistical analysis of process data, measurement system analysis, etc.) of improvement.

4,Six sigma methodology utilises the tools and techniques for fixing problems in business processes in a sequential and disciplined fashion. Each tool and technique within the six sigma methodology has a role to play and when, where,why and how these tools or techniques should be applied is the difference between success and failure of a six sigma project.

5,Six sigma creates an infrastructure of champions, master black belts, black belts and green belts that lead, deploy and implement the approach.

6, Six sigma emphasises the importance of data and decision-making based on facts and data rather than assumptions and hunches!

7,Six sigma utilises the concept of statistical thinking and encourages the application of well-proven statistical tools and techniques for defect reduction through process variability reduction methods (e.g. statistical process control and design of experiments).

Table III briefly illustrates some of the fundamental but critical differences between six sigma and TQM.
The following common features can be found in both TQM and six sigma philosophies (Hoerl and Snee, 2003):

- customer focus;
- continuous improvement in process/service quality or cost reduction strategies;
- process management;
- fact-based decision-making; and
- use of statistical tools and techniques for problem solving.

Table III. Some fundamental differences between TQM and six sigma

Criteria	TQM	Six sigma
Deployment process to drive fundamental change	Not strong	Strong
Integration of tools and techniques within the problem-solving framework	Missing	Very much emphasised
Role of leadership and infrastructure to enable the successful deployment of tools and techniques	Weak	Strong
Alignment of projects with strategic business objectives of the organisation	Missing	Strongly accentuated
Measurement of results in hard-dollar savings (financial results)	Missing	Probably one of the strong features
Management style	Bottom-up	Emphasis is on top-down leadership
Cultural change	Gradual and slow	Fast change in many cases
Rewards and recognition	Less emphasised	More emphasised

Some final key tips to adapt six sigma strategy to service processes

This section is aimed to provide some key tips about how to adapt six sigma methods to service processes. It is important to note that these tips are just mere guidelines for people from service sector engaged in six sigma endeavours:

1,Identify which processes in your business are the best candidates for six sigma projects.

2,Select problems within business processes that can yield substantial benefits from a six sigma campaign.

3,Determine how the selected process would affect your customers. In other words, determine the impact of the selected process on customer satisfaction.

4,Establish a team and a project charter clearly indicating the roles and responsibilities of individuals, project milestones, benefits and costs involved at each stage of project, risks associated with project, etc.

5,Define what you mean by a service defect and how you intend to measure it.
6,Identify the main contributors or candidates which causes defects in your process.
7,Apply six sigma tools /techniques to remove these defects for process improvement.

Limitations of six sigma

Just like any other quality improvement initiatives we have seen in the past, six sigma has its own limitations. The following are some of the limitations of six sigma and thus creates opportunities for future research:

1,The challenge of having quality data available, especially in processes where no data is available to begin with (sometimes this task could take the largest proportion of the project time).
2,In some cases, there is frustration as the solutions driven by the data are expensive and only a small part of the solution is implemented at the end.
3,The prioritisation of projects in many service-oriented companies is still based on pure subjective judgement. Very few tools are available for prioritising projects although selecting the right projects is one of the critical success factors of six sigma implementation.
4,The statistical definition of six sigma is 3.4 defects or failures per million opportunities. In service processes, a defect may be defined as anything which does not meet customer needs or expectations.
5,Owing to dynamic market demands, the CTQs of today would not necessarily be a meaningful one tomorrow. All CTQs should be critically examined at all times and refined as necessary (Goh, 2002).
6,Assumption of 1.5 sigma shift for all service processes does not make much sense.
7,The start-up cost for institutionalizing six sigma into a corporate culture can be a significant investment.

CONCLUSION

This paper makes an attempt to demonstrate the power of six sigma in the service industry. Although six sigma has been successfully implemented in many manufacturing industries, its application in the service sector is still comparatively limited due to various constraints. This paper briefly presents the potential areas where six sigma could be exploited in service functions. The paper also reveals most common six sigma performance metrics commonly used by service industries. The critical success factors which make the successful deployment of six sigma are discussed, followed by providing some guidelines for six sigma project selection process. The critical differences and commonalities between six sigma and TQM are also highlighted in the paper. The paper culminates with the limitations of six sigma indicating the future research work to be carried out by both six sigma practitioners and research community in the years ahead.

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