9.5 The power of Six Sigma for ITIL Continual Service Improvement

As IT organizations mature, they are realizing that it is no longer adequate to just deliver IT services. They must transform and become a true business partner, effectively supporting business objectives in a cost competitive way. To this aim, ITIL version 3 (V3) has incorporated continual service improvement (CSI). In this article Linh C. Ho and Bryce Dunn explain how Six Sigma techniques can complement CSI, adding a case study as an example.

WHAT IS SIX SIGMA

Six Sigma is a business-driven quality method that brings focus to customer and business priorities while eliminating defects. A defect is defined as a failure to meet the specified requirements of a product or services delivered to the customer. In Six Sigma terms, the corresponding defects should be no more than 3.4 defects per million opportunities (DPMO). This means that 99.9997% of the product or service delivered to the customer is satisfactorily. See table 1 for the corresponding sigma values to the DPMO and yield percentage.

Yield	DPMO	Sigma value
30.9%	690,000	1
69.2%	308,000	2
93.3%	66,800	3
99.4%	6,210	4
99.98%	320	5
99.9997%	3.4	6

Table 1 Sigma values and their different results

Motorola in the 1980s conceptualized Six Sigma, and General Electric evangelized the method with much proven success. In 2006, Motorola has reported savings of seventeen billion dollars. This way, Six Sigma became a proven quality method. Though it has its roots in manufacturing, many industries are now adopting the method with considerable success, among them finance, banking, healthcare, government and, indeed, IT service management. Companies such as Getronics, Sun Microsystems, American Express, Bank of America, Lockheed Martin and Siemens have achieved and published significant returns from the use of Six Sigma in IT.

Like many quality management processes, Six Sigma uses statistical techniques to continuously measure, analyze and improve service quality. These techniques can be applied to any discipline, including service management processes based on ITIL®.

Tools from IT management vendors now automate Six Sigma techniques to analyze the volume of IT management data available. Leading service management vendors with this capability offer techniques such as the Pareto chart, control charts, and failure modes and effects analysis to help organizations improve IT service quality.

Today, Six Sigma is a recognized pragmatic approach for continual service improvement in IT service management. This topic is frequently covered by analysts, journalists, vendors and technology users who have seen success in combining the power of Six Sigma and ITIL.

Six Sigma differs from most quality management processes in that it does not focus on quality for quality's sake. It focuses quality improvement activities on those business processes that really matter to the business, pursuing quality where it matters. Improvement should provide a proven benefit to the business bottom line. Its concept of "CTQ" (Critical to Quality), brings priority to "what's critical" to the customer and the business.

This more pragmatic approach is one of the key reasons for Six Sigma's popularity. The combination of Six Sigma and ITIL provides the most comprehensive quality and service management solution, with a focus on delivering value to the business and customers.

Six Sigma enables organizations to streamline processes by eliminating variation. And variation causes costs. According to an article published in Quality America, companies traditionally accepted three to four sigma, meaning between 25% and 15% of their revenue is spent on fixing problems. At six sigma level, organizations are spending less than 5% of their revenue fixing problems (see figure 1). This difference is known as the Cost of Poor Quality (COPQ), and the dollar cost of this gap is colossal. The article points out that General Electric estimates that the gap between three or four sigma and six sigma was costing them between eight billion and twelve billion dollars per year.

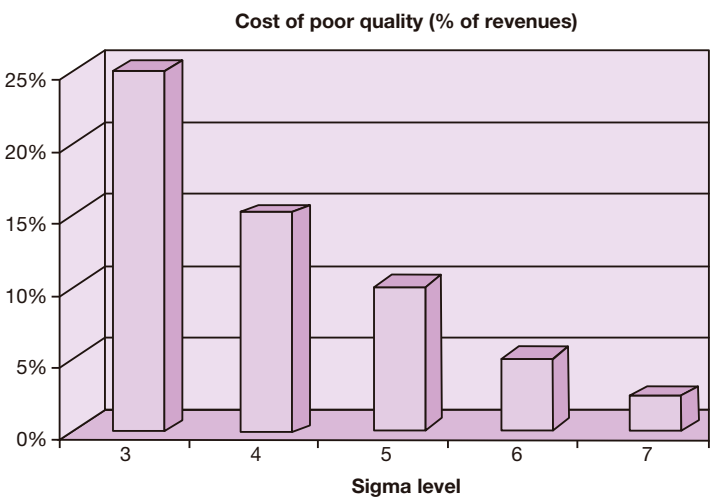

Figure 1 Cost of poor quality at different sigma levels

At the core of Six Sigma is its quality improvement model, called DMAIC, which stands for the key stages of Six Sigma: Define, Measure, Analyze, Improve and Control (although

other models exist for different circumstances such as DMAICV - Verify). Each of the DMAIC phases has clear objectives, tasks and proven techniques:

- **Define** - The key objective in the define phase is to scope a project in terms of the CTQ processes to be investigated and the current COPQ resulting from defects in a process. The tasks in this phase ensure that everyone involved understands the problem, the impact, and goals.
- **Measure** - Relevant data is collected in this phase on existing process quality. Tasks include identifying the CTQ measures and evaluating the availability of measures and the accuracy, integrity, capability and dependability of the measurement system.
- **Analyze** - Root causes of the problem are identified using the data collected in the previous phase. This enables the team to assess the impact, mitigate risks and provide the necessary information to design a solution.
- **Improve** - During the improve phase, action items are developed, solutions assessed and the best solution(s) are recommended and implemented.
- **Control** - The control phase ensures the stability and predictability of the improved process and, more importantly, meeting the customers' requirements. Documenting the new processes, training appropriate staff and undertaking continuous measurement and reporting to avoid slippage are all necessary.

This continual loop provides a quality improvement cycle for products and services, starting with defining key measurable objectives, and resulting in implementing solutions and sustaining improvement.

HOW SIX SIGMA COMPLEMENTS ITIL

Six Sigma is a widely accepted practical approach for service quality improvement that lends itself naturally to ITIL. ITIL highlights the need for service measurement and reporting through service management products. Moreover, ITIL acknowledges that other industry-accepted practices such as Six Sigma and Total Quality Management are complementary to further enhancing the best practice.

While ITIL establishes consistent processes, Six Sigma improves process quality. The two approaches are a powerful combination for continual IT service improvement. ITIL's service management lifecycle focuses on integrating IT with the business—in recognition that IT plays an important part in the business of today. It has five core books supporting this lifecycle:

- service strategy
- service design
- service transition
- service operation
- continual service improvement

Underpinning these five ITIL phases, there are twenty four processes, each with its own objectives and best practice guidelines for process efficiency and for delivering business value of IT services.

If we look at Six Sigma, each of the DMAIC phases has clear objectives, tasks and techniques. The techniques relevant for IT management will be discussed later in the chapter, but in short, Six Sigma brings business-focus to IT by giving priority to what's CTQ.

Moreover, Six Sigma provides IT with a way to baseline service quality levels, prioritize and focus on what's important to the business and customers, quantify improvement for return on investments, and control the improvement achieved.

Finally, Six Sigma comes from the business world with great success, whilst ITIL comes from the world of IT. Combining the two approaches helps IT to be more aligned with the needs of the business. Since Six Sigma is already widely accepted in the business community, it is far more likely to be accepted as a quality methodology by business stakeholders than an IT-specific framework. In addition to that, it also means that Six Sigma skills and consultants are widely available.

Table 2 provides an overview of how Six Sigma complements ITIL. ITIL answers "what?" and Six Sigma answers "how?" ITIL has the mindshare of IT and Six Sigma of the business; together the two industry practices help IT further integrate with the business.

ITIL	Six Sigma
Establishes consistent processes Focus on integration of IT and the business • service strategy • service design • service transition • service operation • continual service improvement	Improves process/service quality Focus on CTQ Reduce variation / costs • define • measure • analyze • improve • control
Guidelines (what?) 5 books 24 processes supporting the lifecycle	**Techniques (how?)** baseline service quality prioritize and focus on CTQ quantify improvement for ROI sustain improvement
Comes from IT	Comes from the business

Table 2 How Six Sigma complements ITIL

SIX SIGMA AND ITIL CONTINUAL SERVICE IMPROVEMENT (CSI)

Continual service improvement (CSI) is an important phase in the IT service management life cycle. Since business demands evolve and change over time, the ability to continually meet and exceed the business requirements becomes critical. ITIL V3 introduces the *seven step improvement process*:

1. Define what you *should* measure.
2. Define what you *can* measure.
3. Gather the data.
4. Process the data.
5. Analyze the data.
6. Present and assess the data.
7. Implement corrective actions.

This process goes hand-in-hand with Six Sigma's DMAIC model, as shown by figure 2.

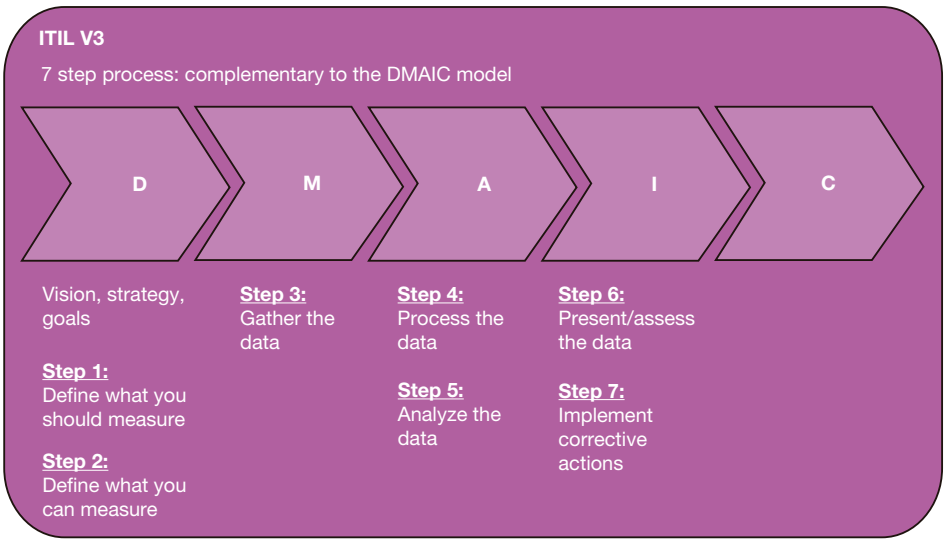

Figure 2 How the CSI improvement process complements the DMAIC model

Each of the seven steps fit under the DMAIC phases very well. As described above in the DMAIC section, each phase has its goals, tasks and tools. We can take a look at each one of these below:

- **Define** - ITIL advises in steps 1 and 2 to define what you should measure and to define what you can measure. This means that, in this stage of the cycle, it is important for the business and IT to come together, as the business drives what should be measured and IT is there to help the business understand what can be measured. If it cannot be measured, then further analysis could be done to see if it is possible to add this measurement capability, and the cost of doing so.
- **Measure** - ITIL suggests that once the definition of what should be measured and its availability are clear, step 3 is collecting the data. Essentially, this is the natural next action item that Six Sigma recommends under the measure phase.
- **Analyze** - In ITIL, steps 4 and 5 are to process the data collected and analyze it so that IT can the make decisions during the next steps.
- **Improve** - Steps 6 and 7 include presenting the data analyzed, and then assess and draw recommendations for improvement from the analyzed data. Step 7 ensures that corrective actions or the selected solutions are actually implemented.
- **Control** - Although ITIL does not provide an eighth step to sustain improvement, Six Sigma does complement it by adding the control phase to the seven step improvement process. Six Sigma provides the tools, such as control charts for ongoing measurement and reporting, to sustain improvement until further enhancements are required. This provides a true continual cycle for service quality improvement.

KEY SIX SIGMA TECHNIQUES

This section provides a sample list of Six Sigma techniques based on the Six Sigma for IT Management book (Den Boer et. al., 2006) and pocket guide (Van Bon, 2007). These are techniques that have been proved useful and are easily applicable to IT.

Pareto charts

The Pareto chart indicates which improvement initiatives result in the greatest return to the business. This is based on the famous "80/20 rule", first coined by Vilfredo Pareto, an Italian economist. This means that 20% of the causes create 80% of the problems. In IT terms, this helps identify key components of the IT infrastructure that are causing the majority of the problems (see figure below).

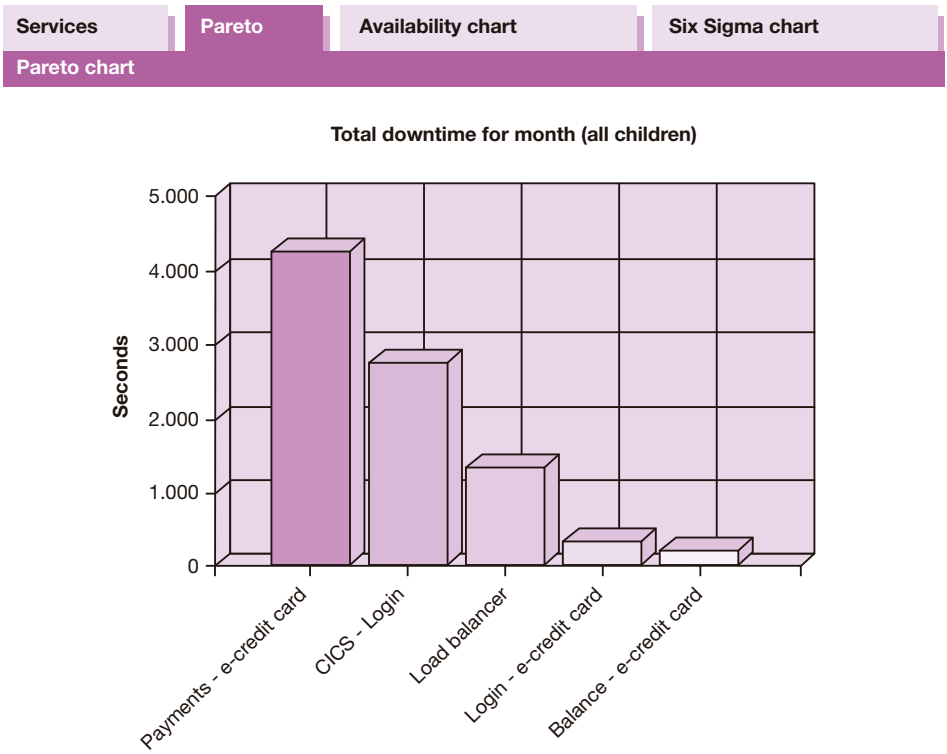

Figure 3 Pareto chart highlighting the most significant issues

Failure modes and effects analysis (FMEA)

FMEA helps mitigate risks by identifying potential failures and the effects of these failures on a process. It also prioritizes the problems using a risk rating system. The rating system consists of three components of failure:

- severity
- probability
- detectability

It uses a score of one to ten for each of these components to find the total Risk Priority Number (RPN) for the potential problem. The RPN is found by multiplying the three numbers together. This technique can easily be applied for risk management and compliance projects, to help identify and mitigate the risks of non-compliance. Specifically, the RPN helps to understand the current IT operational risks and alleviate those that underpin critical business services. Applying the FMEA lowers the risk of exposure to failures and disastrous consequences.

Control charts

Control charts ensure that a process or service performance is within an acceptable range, bound by an upper and lower limit. Should performance criteria act abnormally, the user can take immediate action. For example, a trend-line might deviate from the mean—known as centreline—or cross over specified limits.

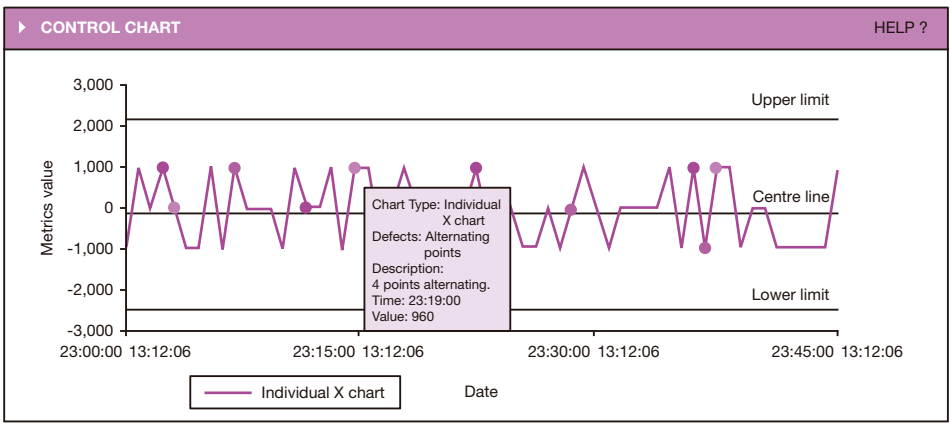

Figure 4 Control chart example

Process sigma value

This metric measures the number of defects per million opportunities (DPMO), providing a key measure of IT service availability and performance. The objective is to achieve the sigma level that is most appropriate to the organization's business needs. For example, an airline company should have a very low DPMO level, possibly even higher than six sigma. Other companies might be satisfied with a lower sigma level, especially for less critical services.

Process map

Process mapping helps to understand the people, processes, technology and their relationships. This provides an overview of how the IT service supports the process and what infrastructure is used by the IT service. It helps to collect data on how the process works and to identify data that is not currently available but needs to be located. The process map can also be used to map the critical to quality business processes and their underlying IT services and components. This information can then be used to create service models for business service management and service level management products or vice versa.

Figure 5 shows an example of a service model highlighting some of the key business services based on process map information.

Cause and Effect (C&E, Fishbone or Ishikawa) diagram

This helps to get a clear understanding of the causes and effects of problems in the define phase. It is used to find all the factors that influence an outcome. Potential problem areas are being mapped onto this diagram, for example during a brainstorming session. These results can be used as input for the FMEA.

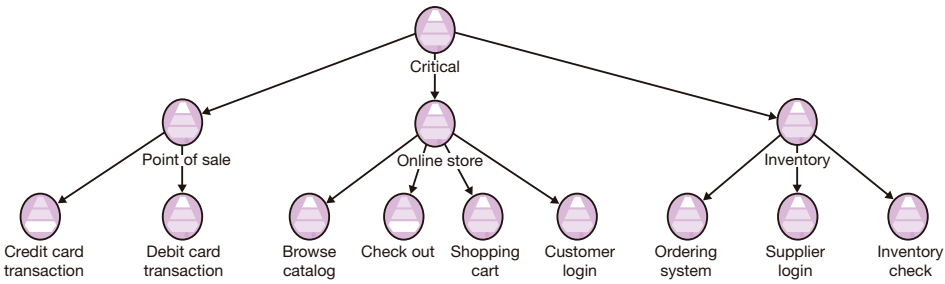

Figure 5 Service model with key business services based on process map information

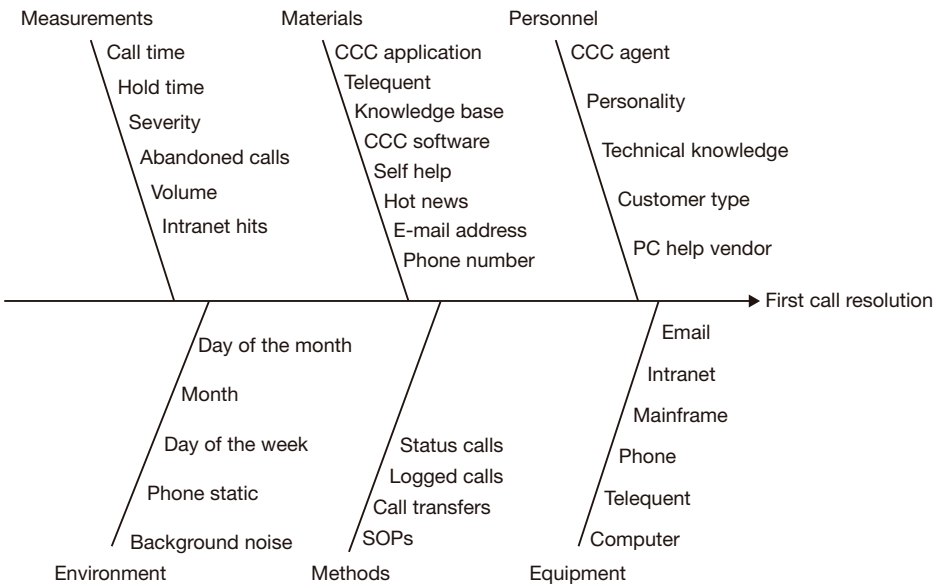

Figure 6 Cause and effect diagram service desk

The C&E Diagram helps focus on the causes of the issues that need to be resolved. Inputs include:

- the CTQs from the early "voice of the customer" surveys
- the CTQ components in the CTQ tree
- the controllable and non-controllable Key Process Input Variables (KPIVs) from the process map
- the metrics from the process assessments

Voice of the customer (VOC)

Both ITIL and Six Sigma strongly advocate listening to your customers. Voice of the customer assists in identifying appropriate service improvement programs (SIPs) to gather customer requirements and quantify the cost of poor quality, helping initiate the right SIP supporting CTQ processes.

This is an important survey in both the define ("what should be improved?") and the control phase ("does the improvement affect customer satisfaction as expected?"). It helps to capture ideas, opinions, and feedback, eventually resulting into CTQ requirements.

Also, participants with intimate knowledge of their respective processes might participate. Furthermore, supervisor participation is critical. After all, it is this group that will be tapped for resources and budget if the results of the exercise establish the direction for an improvement initiative. Taking part in the VOC enables participants to gain an understanding of the exercise and allows them to contribute.

Voice of the customer can be executed through:

- email
- websites
- phone calls
- conference calls
- face-to-face interviews
- group meetings or workshops

Correlation diagrams

Correlation calculations help indicate the relationships and dependencies between variables. This helps determine the degree of correlation between them. An example might be a high traffic and transaction volume for retail websites during holidays. Correlation charts help IT analyze the data points and its dependencies.

CASE STUDY

This case study is based on a leading financial institution in Europe, where the DMAIC model was used to improve service quality. To simplify things, the study focuses on only one business service: its online banking and, more specifically, the bank's e-credit card payment system. The case study also reflects the following ITIL disciplines: availability, capacity, incident and problem management.

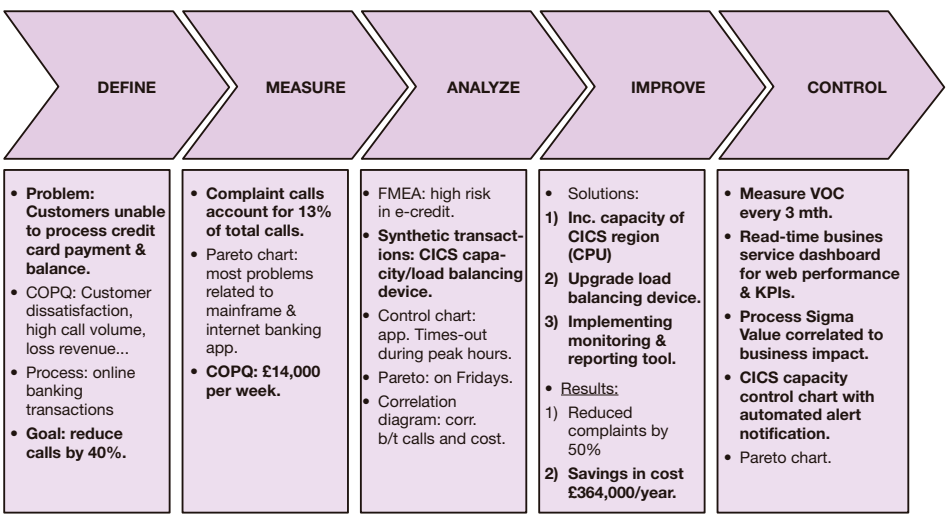

Figure 7 Case study overview

Define

The key objectives in the define phase are to identify the problem, client requirements, process, and measurable objectives (end results). The tasks include brainstorming to ensure that everyone involved understands the problem, impact, and end goal.

Problem: *Availability of the bank's online credit-card system. The bank's customers were unable to make credit-card payments over the internet.*

In order to define the problem, there were a number of different analyses undertaken. Incident and problem records were examined to determine which problems were causing the highest business impact at the bank. The service level manager was consulted and service level reports inspected to verify this target and assess the impact on the customer.

Impact on the organization:

- **customer dissatisfaction** - complaints flooding the call centre
- **cost of problem investigation** - £70 per complaint
- **revenue lost** and late payment interest fees waived

Process identified: e-credit card payment

Objective: *Reduce complaints associated with e-credit card process by 40%. This measurable objective came from a consensus by the project team that it was realistic and achievable, while it would have enough positive impact on the business.*

Measure

The measure phase is where information is collected on current process performance. Tasks include identifying and baselining the CTQ measures.

Metrics collected:

- e-credit card payment problems accounted for 13% of all customer complaints
- the number of incidents recorded against the e-credit card application in the period
- an average of 200 investigations per week

The cost of complaints was estimated at £14,000 per week.

The technique used was the Pareto chart, which identified that the areas needing investigation were the mainframe and the internet banking application.

Analyze

In the analyze phase, the root cause of the problems is identified using the data collected in the previous phase. To analyze the problem, the error control process is undertaken to identify the error, assess the impact and cost of error, and provide the necessary information to design a solution. The overall goal is to identify the root cause of the errors and provide justification for fixing them. The intended outcome is to reduce incident volume as the most common problems are solved.

Techniques used to process and analyze data (steps 4 and 5 of the CSI improvement process):

- **Failure mode and effects analysis (FMEA)** showed a high risk priority number (RPN) in the e-credit card business process.

- **Control charts** - Application timed-out during peak hours.
- **Pareto chart** showed high volume, particularly on Friday.
- **Correlation diagram** showed the higher the number of complaints (calls), the higher the cost (and the higher the impact on the business).

Improve

The improve phase involves instigating a service improvement program (SIP). This involves determining the areas of improvement, implementing the improvement, tracking it over time, and then performing a post implementation review to confirm the results. During this phase, action items are developed, solutions are assessed and the best solution(s) are recommended and implemented.

Recommended solutions:

- Increase CPU capacity in the mainframe Customer Information Control System (CICS) region.
- Upgrade load balancing device.
- Implement adequate monitoring and reporting tools, in particular a business service management solution to understand the impact of IT issues on the business users. One of the key metrics that was collected by this solution was end user experience to show the response time of the e-credit card system.

Results (measured over four weeks):

- 50% reduction in complaints related to e-credit card process
- £364,000 cost-avoidance in investigation per year, for e-credit card area only

Control

To control the improvement of the process, steps are taken to ensure the DMAIC cycle is a continuous closed-loop system. This ensures the stability and predictability of the newly improved process.

New control systems:

- **Voice of the customer (VOC)** - Measure client and internal call centre staff for “real world” feedback every month.
- Deploy a real-time business service dashboard for web performance and related key performance metrics.
- Implement a CICS capacity control chart with automated alert notification, also as part of capacity management.

The example dashboard reports in real time to the service managers on the average response time for each critical business service. This provides IT with an ongoing mechanism for measurement and reporting, helping it to control what’s important to the business.

Case study summary

The bank improved client satisfaction, as measured through positive feedback in the next VOC survey, and reduced client complaints from 13% to 6.5% (a reduction of l 50%). Moreover, by decreasing the number of investigations related to e-credit card, the costs avoided were estimated at *364,000 per year. From an IT perspective, communication between IT and the client service call centre improved by sharing real time business service dashboards.

SIX SIGMA KEY METRICS

Since Six Sigma emphasizes the need for a focus on business objectives and business outcomes, one of the key metrics for Six Sigma is not the statistical metrics mentioned in Six Sigma books. It is actually the need to start to measure what is important for that particular business process and evaluate the results of the improvement by examining changes in these metrics over time. The most important metric is the one that a successful Six Sigma project should be improving. For example, if the most important issue is customer loss, and it is possible to measure the loss of customers, it is through this metric that the success and failure of each iteration of the DMIAC model can be measured.

Six Sigma helps drive better metrics because it brings business context into IT. Six Sigma quantifies benefits and quality improvements that can help IT increase their credibility to the business. Examples of metrics that can be used are:

- **process sigma value for quality of service** - including yield percentage, DPMO and defect/opportunity counts
- **cost of poor quality** - in monetary value tied to CTQ service degradation or failure (to show business impact):
  - lost revenue
  - penalty fees
  - other costs associated with fixing service issues.
- **specification limits and control limits** - based on CTQ customer requirements to ensure client needs are met
- **risk metrics** - such as FMEA RPN to prioritize improvement targets
- **process capability indices** - to gage how close a process or service performance is to the specified limits
- **customer perception of service** - through VOC to measure client satisfaction
- **employee productivity** - number of users, business units and locations impacted due to IT outage (to show business impact)

ITIL also advocates a number of metrics ranging from service desk availability and capacity to service level management metrics. The question is which ones apply to your environment and why? Adopting a “less is more” approach, and carefully selecting the appropriate metrics is highly recommended. Not all metrics apply, what’s important is selecting CTQ metrics that show business value to the customers and the business. Many will recommend using monetary units whenever possible as they are easy to understand and widely valued.

SUMMARY

Improving the quality of service delivery will continue to be on the agenda for many IT executives. Six Sigma has already gained significant mindshare in the ITSM world, with global and fortune organizations embracing it for ITSM and proving its value. Even service management vendors (e.g. Compuware, IBM) are automating key Six Sigma techniques in their technologies to meet their customers’ needs. Currently, many tools are available to automate Six Sigma techniques and ITIL disciplines.

It is a step forward that ITIL V3 recognizes and emphasizes the need for continual service improvement, rather than a one off improvement project. Moreover, CSI also points out the need for other quality practices such as Six Sigma, Total Quality Management, Lean and ISO 9000 to complement ITIL.

Arguably, ITIL V3's CSI could have adopted Six Sigma as an industry practice for quality improvement that can easily be related to ITSM. This would have also addressed the lacking "control" step in the CSI seven step process to sustain momentum and improvement.

Six Sigma continues to be complementary to ITIL and its new CSI phase. However, Six Sigma can also be independent of ITIL, because ITIL provides a set of guidelines to manage and improve every facet of the IT organization, while Six Sigma provides the techniques to measure and improve IT service quality.

Combining both methods provides a powerful quality and service management solution, but they clearly do not need to be implemented in tandem. The power of Six Sigma for IT service management is a strong discipline for quality improvement with customer focus, as well as eliminating errors that impact critical business processes. While IT service providers (internal or external) continue to work hard towards aligning themselves with the business needs, Six Sigma is a business-driven approach to help IT do that. Together, they improve communication, drive better metric selection and prove the business value of IT services.

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