

The Usage of the Six Sigma Method for the Improvement of Support for ICT Services

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Abstract. *This paper discusses the application of the Six Sigma method for the managing, control and continuous improvement of ICT services.*

This method enables the improvement of business processes, and, until now, it has been applied in the manufacturing industry and some other parts of the service sector. But, lately it has penetrated other application areas, including the ICT area.

The pragmatic Six Sigma method approach is based on the implementation of statistical techniques based on historical data, which enables the continuous analysis and control of ICT services improvement.

The principle scope of the paper is to analyze the relationship between ITIL framework, its ITIL Service Delivery and the Six Sigma method.

The DMAIC (Define, Measure, Analyze, Improve, Control) cycle modeling will be explained, as well as particular data as a result of the implementation of this method for the improvement of the module's function: Service Desk, Incident Management and Problem Management.

Apart from that, the potential usage of the DMAIC method will be presented in other segments of the ICT service management.

Keywords. Six Sigma, ICT services management, ITIL, ITIL Support, DMAIC, continuous improvement.

1 Introduction

Understanding, meeting and not rarely exceeding the client's expectations and forecasting the future needs of

the client are among the most important conditions needed to run a successful business. Other important conditions are quality, added value and just-in-time delivery of services to clients. In order to fulfill those conditions, it is necessary to have the support of the IT department which has to provide reliability and stability of work. Even the profitability of the IT department is expected, which has brought to the development of IT Service Management. IT Services Management has become a business organisation's main tool for the integration of organisation strategy with its goals, processes and procedures.

The Six Sigma methodology and the ITIL¹ standard for IT Service Management, each in their own way, provide substantial help in the management and quality contribution of the IT department.

The Six Sigma methodology with its quantitative approach based on real numeric data (measured data) transforms organisational and process problems into statistical problems, solvable by statistical methods and tools. The implementation of the DMAIC² methodology ensures the detection, control and solving of problems that have the biggest impact on business results, resulting in the increase of the value of services as well. As opposed to other Quality Management tools that are focused on the quality of the final product, the Six Sigma methodology is focused on the measurement of factors that have a large impact on service management and a controlled and continuous improvement of those factors. The Six Sigma methodology can measure if Service Management delivers services that meet customer requirements. The methodology's integrated

¹ ITIL - Information Technology Infrastructure Library

² Define, Measure, Analyze, Improve, Control

and unique approach can give a clear picture about the process availability of delivered services.

ITIL was developed in the late 1980's by the British government and in the middle of the 1990's it became the world known de facto standard for IT Services Management based on the best practices in maintaining and delivering IT services. ITIL can be very useful in the process of improving IT services. ITIL can be seen as a guide that systematically and in a simplified way explains the relationship between processes and its corresponding activities necessary for the implementation and management of IT services. Books written on how to understand the ITIL concept address the question of "what" but not "how" IT services management should be organized.

The aim of this paper is to show the advantages of the integration of ITIL and Six Sigma methodology, and the influence of the synergy of these two concepts on the business results of organisations. Furthermore, the paper shows the results of applying DMAIC on ITIL service support, customer support and incident management.

2 The Six Sigma Methodology – theoretical overview

The Six Sigma methodology was named after the Greek letter *sigma* which in statistics represents the label for standard deviation or statistical measure of deviation from the mean value, with the basic assumption that the observation population is normally distributed, according to the known Gaussian curve. The business interpretation of standard deviation represents the measure of errors or inconsistencies in a business process.

When a business process is organized on the Six Sigma level, the variation is so small that it produces 99.99966% of good products/services. In the context of a million products/services, the process organized on the Six Sigma level produces only 3.4 defected products/services (3.4 DPMO).³

The Six Sigma method doesn't insist that every organization should achieve 3,4 DPMO level. Instead, the methodology ensures quantitative methodology for continuous improvement and reduction of costs by cutting the variation in outputs to the level appropriate for a particular organisation. The latest estimates show that for

the majority of products and services three or four sigma⁴ levels are acceptable, which doesn't mean that there is no need for further improvement.

The main point of every Six Sigma project is the Voice of the Customer. Upper and lower specification limits (USL⁵ and LSL⁶) are based on the voice of the customer. The customer is defined as anyone who uses the output of the process that is being analyzed. It gives the freedom to define the customer as the next activity within the process that is being analyzed.

The aim of the Six Sigma project is the re-engineering of the business process in the way that the variation of outputs and factors is within the upper and lower specification limits.

Every product/service delivered to a client outside of USL and LSL represents a defect and, consequently, an unnecessary cost. Even though the Six Sigma method has its roots in the manufacturing industry, it provides an approach for improving processes, how to do things better, faster and with less costs. Hence, the Six Sigma methodology can be applied to many different business processes, from manufacturing to human resources business processes.

In order to implement the Six Sigma methodology one of the following methods can be used: DMAIC (Define, Measure, Analyze, Improve, Control) and DMADV (Define, Measure, Analyze, Design, Verify). The DMAIC method is used to improve the existing business process. On the other hand, DMAVD is used when it's necessary to develop a new business process or create a new product/services. DMAVD can also be used when a complete re-engineering of the whole company or its single department is required. The Six Sigma project applied by the DMAIC method is performed in 5 stages⁷:

- (1) defining customers' requests (product quality, time of providing the service);
- (2) measuring the performances of existing processes (defining criteria, collecting data);

⁴ Pyzdek, T.: The Six Sigma Handbook, McGraw-Hill, Columbus, 2003

⁵ USL – Upper Specification Limit

⁶ LSL – Lower Specification limit

⁷ Bosilj-Vukšić, V.; Kovačić, A. Upravljanje poslovnim procesima, Sinergija, Zagreb, 2004.

³ DPMO Defects per Million Opportunities

(3) analyzing existing processes (analyzing the collected data about processes, comparing them with required data, researching and identifying the causes of gaps between observed and required data);

(4) the improvement of processes (proposing improved processes, developing and testing the improved process, implementation);

(5) result control (monitoring results, comparing them with required data).

Every organization that is concentrated on costs, time and quality of results can benefit from the Six Sigma approach. As opposed to the other methods for quality improvement, the Six Sigma approach is using a specific philosophy, measurability and methodology to ensure cost savings which can be easily measured and proven.

3 ITIL Concept

The ITIL concept integrates the best practices in IT Services management with the focus on continuous service quality measurement and improvement of delivered services from both the business and the client's point of view. The implementation of ITIL in everyday business guarantees the advantages such as⁸: the increase of customer satisfaction; the improvement of service availability that directly influences the rise of the business revenues; money saved by the reduction of unnecessary work; the growth of the market caused by the development of new products and services; the improvement of decision making process and the risk optimization.

The ITIL describes the architecture based on which it is possible to completely organize the IT services management. The IT services management is designed according to the size of the company, its internal culture and, above all, according to the company's requests. The books about the ITIL concept represent a wide, free and publicly available process library for the IT field. During 2007 the third ITIL concept version was released, represented with the five basic books. Every book represents one stage of a life cycle, as shown in the Fig. 1.

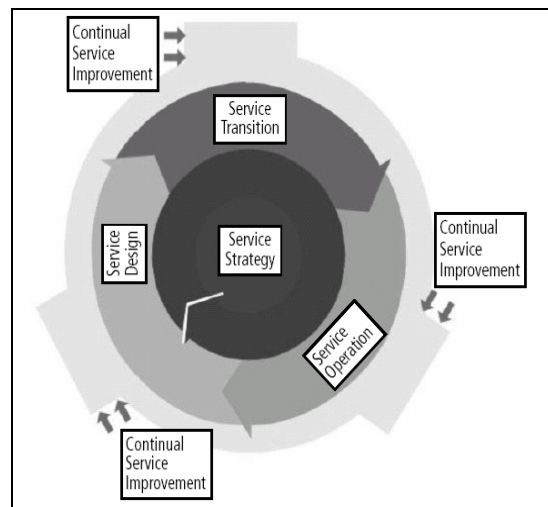


Figure 1. Life cycle of an IT service⁹

What follows is a description of every single stage of the life cycle of an IT service.

The Service Strategy has to develop every service provider based on to whom his services are offered, how much they cost and what the efficiency criteria are.

The Service Design – the aim of this stage is to design adequate and inovative IT services, following the architecture, processes and documentation in order to achieve current and future business goals.

The Service Transition has the purpose of service delivery, according to the business requests, with all the necessary elements for service maint in the stage of operational maintenance. Based on business requests, it is allowed to change the service's design made in the previous stage. The aim is to implement the service in the way to ensure its delivery under normal circumstances as well as its availability in extreme situations.

The Service Operation is a life cycle stage that is responsible for service delivery to a customer with a specific level of quality and for the management of applications, technology and infrastructure that enables service delivery. During this stage the service has been delivered to a customer and it ensures added value to the

⁸ An Introductory Overview of ITIL V3,
http://www.itsmfi.org/files/itSMF_ITILV3_Intro_Overview.pdf

⁹ An Introductory Overview of ITIL V3,
http://www.itsmfi.org/files/itSMF_ITILV3_Intro_Overview.pdf

business. This stage is made of the following processes:

- Event Management Process,
- Incident Management Process,
- Request Fulfillment Process,
- Access Management Process,
- Problem Management Process,
- Common Service Operation Activities,
- Service Desk Function,
- Technical Management Function,
- Application Management Function,
- IT Operations Management Function.

The Continual Service Improvement is a life cycle stage responsible for maintaining the value of delivered services by continuous reevaluation and service's quality improvement through the improvement of the whole life cycle of the IT service.

The value of the ITIL framework is increasing because the business organizations become more and more IT dependent. An IT department has to meet organizational expectations and achieve business goals. The main purpose of ITIL is to harmonise IT goals with business goals, deploying and maintaining IT services customized according to the specific requirements of a particular organization. The ITIL processes are made to lead, not to dictate, business activities within a business organization.

The services maintenance is responsible for ensuring that clients have the access to the services which help them do their work.

The Customer service department is a central point in the communication between a customer and a servis provider. In contrast to other processes, it represents the crucial function in terms of service management. All the problems the clients experience using IT services are reported to the Customer service department. Furthermore, the Customer service department informs the clients about the progress in the process of solving their problems.

The process of incident management has the objective to reestablish the full functionality of the IT service as soon as possible with minimum influence on everyday business, ensuring the quality of service and its availability according to the Service Level Agreement.

The process of incident management has a purpose to minimize the influence of incidents and

problems on everyday business caused by IT infrastructure. Having reactive approach, precisely and generally analyzing incidents in order to identify the cause of the incidents and preventing them from occurring again in the future, incident management has to have a proactive approach with a purpose to prevent incidents before they occur.

4 The Integration of the Six Sigma methodology and the ITIL concept

The ITIL concept and the Six Sigma methodology are two different approaches, but in their essence they are both focused on customer satisfaction. Recently, many business organizations have recognized the value and strength of the ITIL and Six Sigma integrated approach.

Service Desk ITIL's working procedure says that every reported IT incident has to be given a certain priority, but it doesn't say how it should be given, which means that every business organization has to find its own way, according to their own processes, a way to assign the priorities to the reported incidents. It can be said that ITIL defines the "what" in IT service management, while Six Sigma defines the "how". Hence, these two approaches can have a significant synergic effect on the quality of IT support and services delivery. In Table 1. I have shown a systematic view of the ITIL concept and the Six Sigma methodology.

Table 1. Six Sigma vs. ITIL

	Six Sigma	ITIL	Synergic effect of the two approaches
Source	Business area	IT	IT processes improvement, efficiency and service quality improvement while minimizing costs
Focus	CTQ and variation/cost/errors reduction	Integration of IT and core business	Better integration and coordination of the IT department and core business
Aim	Process and service quality improvement	Establishing processes in IT department	Continous improvement of the IT services quality

Implementation concept	DMAIC (Define Measure Analyze Improve Control)	Guide through five books: (Service strategy, Service design, Service transition, Service operation, Continual service improvement)	Six sigma concept for continuous improvement of existing IT services according to ITIL instructions integrated approach for advanced IT service management
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An attempt to integrate these two approaches isn't simple. It can be done in organizations that have already implemented Six Sigma and are trying to implement the ITIL concept, in organizations that have already implemented the ITIL concept and are trying to implement Six Sigma, or in organizations that haven't implemented neither ITIL nor Six Sigma. The approaches to the integration of these two concepts are very different. In this paper I will analyze the case in which an organization has already implemented the ITIL concept and is trying to integrate a new Six Sigma concept with the existing ITIL concept.

4.1 The similarities between the Six Sigma DMAIC concept and the ITIL steps for continual service improvement

By integrating the existing practices, principles and methods of quality management the ITIL offers a solution for continuous improvement of services. With the solution properly implemented, business organizations can recognise and control the improvement of every single stage of the service's life cycle. The continuous improvement of ITIL services is determined by three key processes: Service Reporting, Service Measurement and 7-steps for process improvement where there is overlapping with DMAIC concept of Six Sigma methodology, as is shown in Fig. 2.

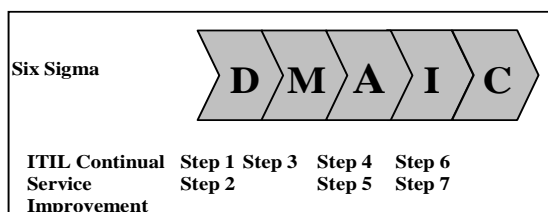


Figure 2. Comparison DMAIC model and ITIL service continuous improvement¹⁰

The identifying of problems, the defining of measurable goals and a desired goal in the Six Sigma methodology is done in the *Define* stage, while in ITIL it's done in Step 1 and Step 2 where it has to be decided what should be measured and what can be measured. During the Measure stage the benchmarking of a current performance should be done and all the data should be collected that are recommended by ITIL in the third step. The analysis stage has to identify roots of a cause and analyze data, as well as find the possible opportunities for improvement. The data analysis is recommended by ITIL's Step 3 and 4. Six Sigma's Improve stage should propose and implement a solution, which is covered by ITIL's Step 6 and 7. ITIL's Step 6 and 7 recommend the interpretation of data and are based on the implementation of necessary actions. The last stage of the DMAIC concept is control that has a purpose to maintain continuous improvement and forecast the behaviour of the processes. This stage doesn't correspond to any ITIL's step.

4.2 The implementation of the DMAIC cycle in the enhancement of IT services in the ITIL surrounding

The deployment of every stage of the Six Sigma cycle is well specified. Every stage has defined goals, activities and tools. The DMAIC stages are connected in the sense that the output of one stage is the input of another stage.

The application of the DMAIC cycle on the ITIL Support adjusted processes guarantees the integration of these two approaches. The key elements of the stages are explained in the detail in the following sections.

Define stage.

The first step of this stage is to identify services that IT has to deliver. These services will be used to determine business CTQ (Critical to Quality). The aim of the stage is done by the Six Sigma project team and business sponsors.

¹⁰ An Introductory Overview of ITIL V3, http://www.itsmf.org/files/itSMF_ITILV3_Intro_Overview.pdf

The Service Desk is a place of contact with serviceusers where the users can place their requests by using a variety of communication channels. The user requests are captured into a database system. That way all the user request are well organized and easy to analyze. By analyzing the captured user requests, we can quickly and easily identify the problems which have or might have influence on the quality of business. When the problems are identified, the next step is to detect which processes in the system are causing them. Usually, the large number of problems can be identified. But the Six Sigma team has to pick one or two sevice to improve. The main criteria in picking the services is the cost of poor quality; the higher the cost of poor quality is, the more important the service is to be improved.

It's not unusual that IT perspective on problems is not the same as the service users' perspective. IT departments are very often selfcontent and don't see themselves as service providers to the business clients. Rather, they are focused on meeting the infrastructure SLA,¹¹ instead of metting the business SLA. For that reason, a big task of this stage is to introduce team members, to communicate the project goals to all team members, because it's the only way that all team members have the right focus.

Furthermore, this is the stage in which the so-called project map is done. The project map defines the project scope and team members responsibility. Also, during the project the project map is used as a control document, to verify that the project's stages are done according to the previously defined plan.

The measurement stage.

Based on the aim defined in the previous stage, the critical parameters for quality improvement have been identified. There are a few critical quality parameters which can be measured: critical to cost – cost cutting; critical to quality – quality improvement; critical to time – service delivery time cutting; critical to satisfaction – client's satisfaction improvement. Based on the chosen critical factor, the measurement of the project's output is defined.

In this stage it's necessary to describe the current (as-is) process state. In order to achieve it, we can use process maps to establish how IT

department is supporting the process and which infrastructure has been used in IT services. Process maps share the user's perspective on the process. Every step of the process is made of a set of factors (Xs) which are used as inputs for a particular step. Therefore, a single process or a single step takes an input factor X and transforms it into a few different output factors (Ys). Some of the output factors are acceptable to the user, some of them are not. Every process that has more than one output factor has to be analyzed more carefully.

The aim of this stage is to define key processes that have a negative impact on the wanted output. Whether an output is wanted or not, depends on the user's specification.

The Service Desk and Incident Management are directy connected. The majority of reported incidents are dealt with in the Service Desk. Incident Management ensures that every incident is recorded and controlled. Stored information is crucial in the Six Sigma project because it gives the information on how frequently a particular incident occurs and how the incident has been resolved. Using this data, the cost of particular incidents can be calculated or the cost of all incidents in a particular time range that are subjects of the Six Sigma project.

The analysis stage.

In this stage the key causes of problems are identified. The data collected in the previous stage are used as a starting point for detecting the causes of variations in a process.

It is necessary to conduct the Process Capability Analysis in order to determine the current process performances and define the potential system improvement according to the Six Sigma methodology principles. If 99.99967% of all outcomes of a process is within the upper and lower specification level previously defined by service users, we can say that the process has reached the Six Sigma level and it doesn't need any further improvements.

The potential problem causes can be detected by the usage of different methods like brainstorming. The base for these activities is creating a cause and effect diagram (Fishbone digram) where the variety of input processes can be identified. It is important as all the input processes are potential problem causes. Hence, when analyzing service processes the mostly used method is the 4P method (People, Policy, Procedures, Plant). Once the

¹¹ SLA – Service Level Agreement

potential problem causes are identified, it is necessary to determine the key factors that have to be improved in order to improve the whole process.

In the end, the financial benefits of the process have to be estimated.

The improvement stage

In the improvement stage it is necessary to define new solutions that can be represented in the form of a completely redesigned process or only as a slight change in some conditions in the existing process. As a starting point in this stage the potential problem causes identified in the previous analysis stage are used. If based on the given data more than one solution is found, than all the potential solutions have to be marked with certain grades. The grades can be established by using several methods: benchmarking (comparing with other practical cases), brainstorming, brainwriting, creative thinking, modelling, simulation and experimental design. A pilot project has to be done for the selected solution with the purpose to improve the selected solution in order to ensure that it will enable meeting the project's goals.

The Control stage has a purpose to:

- ensure the standardizations of new methods in the practice;
- forecast the financial influence of implemented improvements and continuously check the delivery of the project;
- document everything that has been performed and acquired.¹²

In the implementation stage the changes have been made and the processes have been improved, which resulted in the change in the way the business was done and new procedures implemented. Process maps which hold information about who, what, when, where and why is something being done or monitored it the case an incident should occur.

In order to prevent the return to the former organization processes, which would cause the increase of the variation in the process, it is necessary to establish the process of control of the improved process, resulting in its higher stability. The control process can be ensured by preventive error correction or by detecting errors before the service user notices them. The crucial importance, along with establishing the control process, is in

the monitoring of the financial benefits for every single element in the definition stage. All the project results should be documented, so that in the case of the reoccurrence of the incident or a similar one, it could be used as a starting point for new projects. In the case of similar projects, the existing results can be used without need to redo all the previous steps.

4.3 The ITIL and Six Sigma implementation results

Companies such as GE, Raytheon Aircraft, Textron, Fidelity Wide Processing, Sun Microsystems, American Express, Barclays' Bank and Bank of America¹³ have implemented the combination of ITIL and Six Sigma methodology in their IT departments.

The Service Desk Customer Call Center in American companies has been improved by the implementation of the Six Sigma methodology. The CCC's purpose is to provide technical support to internal clients in the way that an agent captures every received call into the system. If the agent has the proper knowledge, he solves the problem immediately (solving level I), but if that's not the case, the agent should forward the problem to the IT specialist (solving level II).

Every Six Sigma project is focused on the improvement of the limited set of processes or problems. In this case, the main problem is the fact that only 58% of the problems have been processed on the proper way of the CCC's claims by the solving level I. The rest of the claims have been reported to the second level solvers, which caused the cost of \$5.000.000 a year because the IT experts of level II cost the company more, significantly more than the employees on the support level I.

The time spent on the problem solving cost the company additional \$6.000.000 a year because there were drawbacks on the new products development projects, which is the main task of the IT experts of solving level II. The project team was solving the problem through DMAIC cycle and the results of all the stages are shown in the Table 2. DMAIC Cycle Results.

¹² Keller, P.: Six Sigma Demystified, McGraw-Hill, 2004.

¹³ http://www.sixsigmazone.com/assets/Article_-_Six_Sigma_for_IT_Management.pdf

Table 2. DMAIC Cycle Results

DMAIC	The results
Define	The goal is to increase the claims through second level I to 85%.
Measure	The key process has a negative influence on the following variables: 1. the user's request is moved from one IT expert to the another 2. the time of solving the user's request 3. the (un)ability to solve the user's request
Analyze	The potential improvements have been identified: 1. the implementation of ITIL Incident Management to identify, record and control incidents; 2. the integration of the knowledge database into the ITIL Incident Management in order to enable agents for solving complicated tasks; 3. the implementation of the remote system in order to enable the remote connection and remote user's requests solving; 4. the establishment of the training system in order to increase technical knowledge and skills; 5. the conduct of a campaign to introduce the Service Desk to all the employees and to show its functions; 6. the implementation of the ITIL Problem Management in order to facilitate the transfer toward Solving Level I and Solving Level II; 7. the implementation of the ACD to automatically lead users through the operator's tree based on the problem.
Improve	The implementation of the solutions suggested in the analysis stage.
Control	The creation of the continuous model for the implemented changes influences measurement.

The implementation of the steps defined in the analysis stage resulted in the increase of the problems processed through the solving level I, from 58% before the Six Sigma implementation to 70% a few months after the Six Sigma implementation project was completed. The Six Sigma implementation project on the Service Desk's processes resulted in direct financial savings of \$667.000 a year plus indirect savings of \$1.200.000 a year.

The function of the Service Desk is specific, it represents the central communication point between the service provider and the user in the context of reporting problems that occurred during the usage of services. Mainly because of this way in which the Service Desk works it has a big impact on client satisfaction. The client satisfaction, along with financial savings, represents the ultimate advantage for every business organization.

The case study shows how the Six Sigma methodology can be implemented in the process of creating new processes and improving the existing processes within the Service Desk, which resulted in the increase of client satisfaction by 80%. During the Six Sigma implementation the possible improvement within the existing processes has been identified and the Incident and Problem

Management have been suggested. The result of the improvement of the Six Sigma methodology is the implementation of the ITIL subset that was missing in the Service Desk. With that kind of improvement, the Service Desk became not only the place of problem solving but also the place for change implementation.

By implementing the Six Sigma methodology on IT processes, organized by the ITIL concept or by the company's own needs, the continuous improvement of IT services is ensured, based on measurable data which results in the improvement of services and client satisfaction.

5 Conclusion

ITIL and the Six Sigma methodology help business organizations to improve the quality of their IT services from the client's requests point of view. ITIL and the Six Sigma methodology are complementary, since ITIL enables the frame for IT service's management based on the best practices. The Six Sigma methodology, on the other hand, gives statistical techniques for the measure, analysis, improvement and control of the service's quality.

By integrating the ITIL concept and the Six Sigma methodology, the measurable financial savings and the increase of the quality of the IT services can be achieved and in the end it can result in the increase of IT services client satisfaction.

References

- [1] Boer den Sven: Six Sigma for IT Management, Van Haren Publishing, Zaltbommel, 2006.
- [2] Bosilj-Vukšić, V.: Kovačić, A. Upravljanje poslovnim procesima, Sinergija, Zagreb, 2004.
- [3] Keller, P.: Six Sigma Demystified, McGraw-Hill, 2004.
- [4] Brussee, W.: Statistics for six sigma made easy, McGraw-Hill Publication Co., 2004.
- [5] Pyzdek, T.: The Six Sigma Handbook, McGraw-Hill, Columbus, 2003
- [6] An Introductory Overview of ITIL V3, http://www.itsmfi.org/files/itSMF_ITILV3_Intro_Ovverview.pdf, Accessed: 17th May 2008.