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Applying Six Sigma Concepts, Techniques and Method for Service Management: Business and IT Service Management (BSM & ITSM)

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1. Introduction

Six Sigma methods and techniques are applied in business & IT projects for product (Goods and Services) & process design (Define, Measure, Analyze, Design and Verify or DMADV) and improvements (Define, Measure, Analyze, Improve and Control or DMAIC). Six sigma methodologies have been applied within the IT Service Management disciplines primarily for Service and Process Improvement and Optimization.

Six Sigma methods and techniques have a relatively rich history with the manufacturing industry and tangible products vis-à-vis intangible and perishable services. As the services industries look forward to the advent of productization of services or service products, there is an attempt to minimize variations in service quality via service design and service improvement projects. The focus of these projects range from service definition to service systems to service automation (i.e. making service less labour intensive). As such, six sigma methods and techniques have a major role to play in both design and improvement of services and service management processes.

Even though Six Sigma concepts & techniques can be applied for most if not all IT Service management processes (see ITIL v3 for taxonomy of Service Management processes mapped to the Service Life Cycle), they will primarily relate to Service Quality Management processes such as:

- Service Availability Management
- Service Capacity Management
- Service Performance Management
- Service Continuity Management
- Service Security Management
- (Service) Event Management
- (Service) Incident Management and
- (Service) Problem Management

This paper discusses six sigma methods (both DMAIDV and DMAIC) and techniques as they apply to the five stages of Process Maturity (or Service Management Maturity)

- Ad hoc
- Defined
- Measured

- Matured &
- Optimized

Note: Some of the techniques discussed here are generally used within the Six Sigma and Quality Control and Management context and projects, but are also used in several non six sigma projects and context.

Note: Design for Six Sigma (DFSS) has not only been applied to Service Management processes but also for sub-processes such as Root Cause Analysis (RCA) as a sub-process within problem management or Incident Reporting (IR) as a sub-process within incident management.

IT Service Management Process Improvement relates to IT Service Management Maturity and the Continuous Process Improvement or CPI program. Service Quality is a function of (or depends on) People, Processes, Information and Technology and the maturity level of Service Quality Management as an IT process domain. Service Quality Management processes as IT processes play a critical role in understanding and achieving service quality objectives and targets.

Service Management as a practice has five maturity levels and each service management domain or IT process can be at different levels of maturity at a given time (see figure 1 below for the five different maturity levels and the corresponding process capabilities / features). Process maturity (and higher ratings of process maturity level) is attained via incremental process improvement projects. It is important to note that processes can only be improved from one maturity level to another sequentially. It is extremely difficult to skip maturity levels.

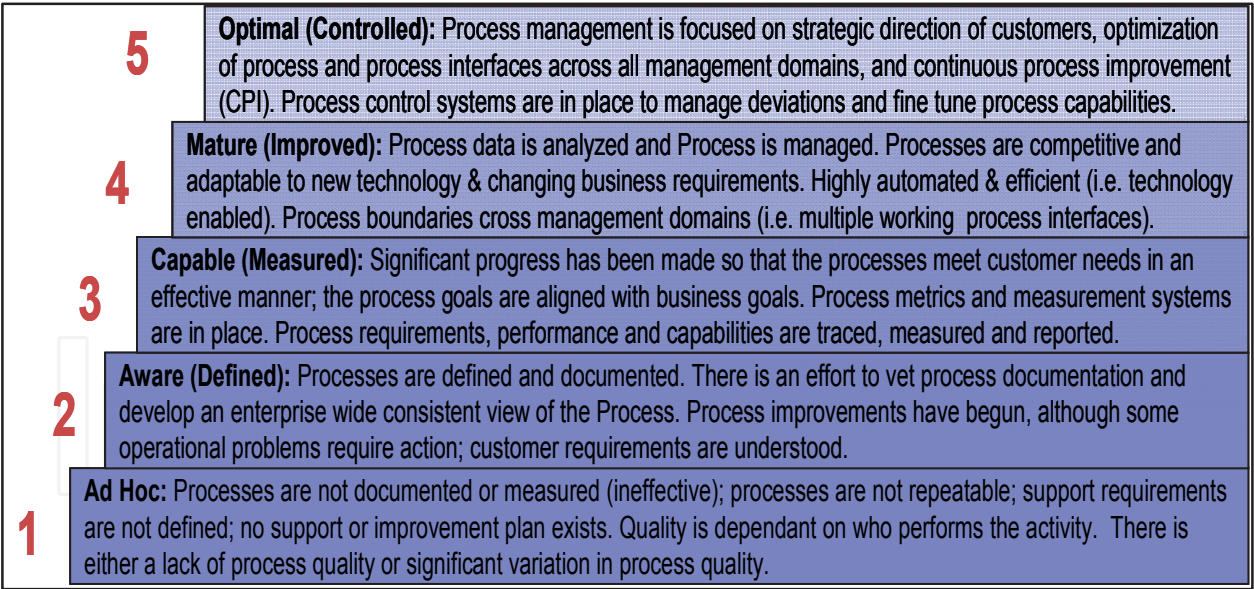


Fig. 1. IT Service Management (ITSM) Process Maturity Levels

Six Sigma DMADV – Define (Process), Measure, Analyze, Design and Verify methodology is relevant for moving from level 1 to level 2 i.e. essentially developing an enterprise wide definition of an IT process and gathering requirements as part of the process design work. Six Sigma DMAIC – Define (Process Improvement Problem), Measure, Analyze, Improve and Control as a methodology is relevant for growing the process from maturity level 2 to maturity level 3, 4 and 5.

See figure 2 below.

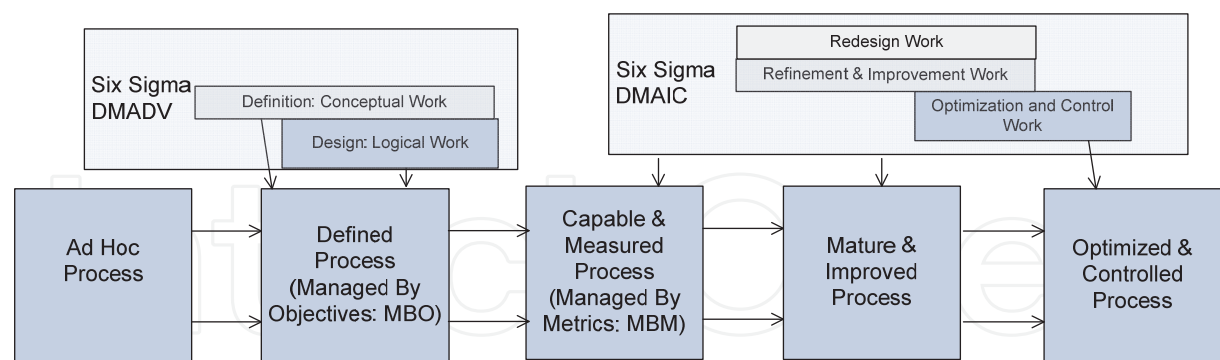


Fig. 2. Six Sigma and IT Service Management (ITSM) Process Maturity Levels

2. Process maturity levels

- Ad Hoc (Level 1)
A process is at maturity level 1, when the enterprise does NOT have an enterprise wide consistent view of the process i.e. the process is NOT defined via documentation and published to spread process awareness within the extended enterprise. It is likely that certain process activities are defined and implemented in certain silos in the enterprise such as a business unit or a domain team (e.g. an enterprise network team).
Application of six sigma example: several lean six sigma concepts such as reducing or eliminating process waste can be applied during this stage of process maturity.
- Defined and Aware (Level 2)
Level 2 maturity implies the process has been well defined; the process definition documents have been vetted among the process community and approved by key process stakeholders as well as published enterprise wide. This implies that the enterprise has a consistent view of the process and the different organizations are aware of the process, current process capabilities (activities, interfaces, tools, organization, among others). Process interfaces are also defined. There can be several qualitative process improvement projects (type 1 process improvement projects – see section below for a discussion on Type 1 and Type 2 projects) at this level of maturity as the process metrics (critical success factors, key goal indicators, key performance indicators, among others) are understood and documented. At this stage of process maturity, the process management team should be focused on managing the process with Management by Objective (MBO) principle.
Application of six sigma example: development of smart process metrics that align with the process principles, policies and guidelines. A process principle can map to multiple process policies and a process policy can map to multiple process guidelines (detailed guidelines) and rules. SMART metrics can directly map to guidelines. The principles to policies to guidelines (rules) heirarchy can provide guidance to automate the process and certain process activities.
Fishbone or Ishikawa diagrams can be used help define process and process scope. As an example: Faulty components impacting service availability is a service availability management process issue while a denial of service attack impacting service availability is a security management process issue.
DMADV method directly related to process maturity level 2.
- Capable and Measured (Level 3)

Level 3 maturity implies that the qualitative process improvement projects initiated and completed at Level 2 have improved the process capabilities. The process management team has the capability to implement all relevant process activities, process interfaces and process related projects. More importantly, the process management is now focused on managing the process with Management by Metrics (MbM) principles. This implies that there is a robust and reliable measurement system in place to collect data on the SMART (Specific, Measurable, Attainable, Relevant and Time bound) process metrics. At this stage, the process management can initiate type 2 process improvement projects for those process metrics which already have an appropriate measurement system. The six sigma DMAIC method directly relates to process maturity levels 3, 4 and 5.

Application of six sigma example: development of a measurement system to gather data on specific SMART process metrics that align with the process principles, policies and guidelines.

- Improved and Mature (Level 4)

At this level of maturity, the process management team is actively engaged in analyzing the process data and managing the process based on the results of the analysis. The process should be performing relatively well on most relevant process Key Performance Indicators (KPIs) based on the results of the improvement projects initiated at Level 2 and Level 3. The process and process capabilities are competitive as several of them have been technology enabled. Process is significantly technology enabled and as such is adaptable to changing business needs and requirements. Process Interfaces are not only defined, but also implemented and relatively mature. Process interfaces with other Business and IT Processes and Services are implemented, mature and efficient. Most process improvement projects are type 2 projects.

Note: Very few IT organizations reach maturity level 4 and 5.

Application of six sigma example: six sigma process improvement projects focused on a specific quantifiable process improvement problem that improves the process along one or more key process metric (SMART metric). Optimized and Controlled (Level 5)

Very few organizations in the world have reached this level of maturity for process management. At this level of maturity, process management is focused on process efficiency, optimization and control as well as the strategic direction of the customer (business), and improving alignment with business, optimization of the process, process activities and process interfaces via a set of Type 2 process improvement projects. The process management team has also established a process control system to manage process deviations (outliers, drift, among others) i.e. a process exception handling system and sustain the process performance at the improved level.

Application of six sigma example: six sigma process improvement project focused on the development of one or more control systems focused on specific Process related KPIs. ITSM Process specific control systems are being developed by leading IT companies, as a case in point, an intelligent scaling engine or ISE (patented by author) can use real time service and resource data to make analytics based decisions to scale up or down specific services, service components and infrastructure resources that enable the service. ISE is specifically applicable to the performance and capacity management as an IT process.

3. Type 1 process improvement projects i.e. quantitative improvement projects

These projects occur when the process has reached level 3 or higher levels of maturity (i.e. Process measurement systems are in place with process metrics and data for those metrics)

and the improvement projects are focused on improving the process performance with regard to specific process metric or process related metrics (SMART objectives – Specific, Measurable, Attainable, Relevant and Time-Bound Objectives). Six Sigma as a process improvement method which leverages the define (define a process improvement problem / opportunity) , measure, analyze, improve and control or DMAIC method, is very relevant for these types of process improvement projects.

The process and process related metrics can be metrics associated with the process inputs, actual processing (process activities), process outputs as well as process outcomes. In general, it is a good practice to focus Type 1 process improvement projects on metrics associated with the process outcomes (which are, generally, of more interest to business & process stakeholders). The process could focus on improving a measure of central tendency (such as mean – example mean time to recover/restore service) or a measure of variation (such as standard deviation – variation associated with the time to recover/restore service by service incident).

An example would be a six sigma project to improve average and variation (standard deviation) associated with the time to restore service via service recovery plans (which focus on fast recovery and restore technologies and updated service and component recovery plans and procedures for a set of services). The average time to restore service after a service incident can be measured before and after the project was implemented to study the impact of the six sigma project.

4. Type 2 process improvement projects i.e. qualitative improvement projects

These projects can occur at any level of process maturity and do NOT have quantitative process or process related metrics associated with them.

An example would be a documentation project to define the process conceptually and logically and bring about a consistent enterprise wide view of the process and process objectives, scope, activities, among others. This would typically be done when a process is at level 1 in a process maturity scale.

Another example would be designing and building measurement systems to collect data around process metrics. This would typically be done when a process is at level 3 in a process maturity scale and aims to achieve the next level of process maturity.

In a purely technical sense, type 1 process improvement projects are the true process improvement projects and relate to the technical definition of improvement (shown below).

Definition of Improvement:

Improvements are Outcomes that when compared to the 'before' state, show a measurable increase in a desirable metric or decrease in an undesirable metric

5. Salient characteristics of six sigma for service management

Some of the key characteristics of six sigma methods and tools that are relevant for Business and IT service management and service quality management are discussed below:

- Customer Centered (Customer or End User Centricity)

Several six sigma concepts such as Voice of the Customer (VOC) and Critical Customer Requirements are relevant for the service quality or non functional requirements gathering and documentation process.

- **Process Focused**

Extraordinary Process for Ordinary People

ITIL v3 and other IT operating models focus on multiple IT process domains. Service Quality Management itself is a set of processes in the service design phase of the service life cycle but has implications for the entire service life cycle. Six sigma takes a process approach to quality management & quality improvement (both product/service as well as process quality) and as such can be applied to

1. IT enabled Business Service Quality & IT Service Quality as well as
2. Quality Management as a process domain in Business Service Management and IT Service Management models.

- **Data Driven**

Six sigma projects are data driven and depend on data and analysis of data for quality improvements. Service and process quality data is generated from multiple tools, including monitoring and management tools. IT organizations can and do maintain historical and current service and process quality data which are relevant for applying six sigma projects.

- **Follows a structured method & roadmap**

DMAIC and DMAIDV are two methods applied for

Product (such as Hardware) and Service (such as messaging) design

Product / Service Improvements

Process Design (such as Service Incident Management) and

Process Improvements

- **Oriented toward Business results.**

The primary objectives of Business Service Management (BSM) and IT Service Management (ITSM) focus on business outcomes and aligning business and IT, as such six sigma's focus on business results maps to service management focus on business objectives.

6. Six sigma tools for service management

In general the tools and techniques discussed here can be used for both process design and process improvement projects, however, few of them are more applicable for process definition and design while others are more applicable for process improvement and control projects.

7. QFD and NFR Framework

Quality Function Deployment and the House of Quality are critical tools for identifying, gathering, prioritizing, implementing and tracing service quality or non-functional requirements (both IT service and IT process requirements). IT processes are generally automated and implemented with a set of ITSM tools and technologies – hence QFD and HOQ can be applied to these tooling requirements also.

In my Non Functional (or Service Quality) Requirements (NFR) framework paper (The Open Group White Papers 2009 – see references), I discuss how service quality objectives such as service availability, or service continuity or service usability objectives can be documented as funded requirements (business, customer and end user centric), which then can be translated to design specifications and configuration parameters for service run time environment. I have also argued that we can develop enterprise specific and enterprise

level service quality models, that document these objectives, requirements, specifications, parameters and metrics (measurable) to allow for reuse (do not have to reinvent the wheel with every service and every business unit) and traceability of service quality requirements.

8. DPMO for ITSM processes and services

Defects Per Million Opportunities (DPMO) is a relatively simple concept and is applied using a simple approach for the manufacturing industry engaged in producing tangible products. However, DPMO can be applied in the service industries engaged in producing intangible, inseparable (production & consumption), perishable and more variable services using a different approach.

Specifically for the IT services and IT enabled business services, we can take two simultaneous approaches toward DPMO, i.e. a) DPMO associated with the service systems or systems that enable the service and b) DPMO associated with the customer experience or parts of the customer experience. Here we elaborate DPMO associated with the customer experience.

DPMO can be applied to each instance of customer interaction (example: Browsing an ecommerce site dedicated for the travel industry – hotels, rental cars, flights among others) i.e. treating each interaction as an opportunity.

DPMO can be applied to each instance of customer transaction (example: request and purchase of an online e-ticket) i.e. treating each customer transaction (or request for a transaction) as an opportunity.

DPMO can be applied to each instance of customer consumption (service provider production) – (example: The acts of checking in & choosing seat, boarding, taking an airline seat, experiencing air travel and off-boarding an airplane) i.e. treating each act of consumption as an opportunity.

DPMO can be applied to each instance of the customer experience (example: all of the three above, plus post sales service etc) i.e. treating the individual customer experience as an opportunity.

Therefore, TCI, TCT, TCC and TCE (Total Customer Interaction, Transactions, Consumption and Experience) can all be related to total opportunities (TO) and are relevant for determining defects per million opportunities.

The CRM, CIM and CEM (Customer Relationship Management, Customer Interaction Management and Customer Experience Management) software suites as well as Interactive Intelligence (Customer Interactive Intelligence) software and tools help service providers collect data to support objectives and metrics around defects per million opportunities (DPMO). In other words, these tools provide data for these measurements related to service DPMOs. This is true for IT enabled business services and IT services as well as IT enabled business processes and IT processes.

9. Critical to Quality (CTQ) and Vital Business Functions (VBFs)

CTQ tree maps Customer Key Goal Indicators or Broad Customer / End User related Objectives to more specific customer related performance indicators or KPIs using such approaches as VOC or Voice of the Customer. When CTQ is applied in the context of IT enabled Business Services we get vital business functions (within a Business Service), which is an ITSM term. Therefore CTQ provides a means to arrive at VBFs.

Note: Key Goal Indicators (KGIs) and Key Performance Indicators (KPIs) are commonly used by CIO Offices and IT management and are also part of such IT frameworks as COBIT (Control Objectives for Information and related Technologies) and ITIL (IT Information Library). However, CTQs focus on broad customer objectives (KGI) and translating the same to more specific customer requirements (and metrics or KPIs associated with them).

10. Objectives (KGI) and SMART metrics (KPI)

Process KGI or Process Objectives are critical for Management by Objectives or MBO particularly at process maturity levels of 1 and 2. As the process measurement system is designed and implemented at the maturity level 3, MBM or Management by Metrics can be initiated to reach maturity level 4 and above. SMART (Specific, Measurable, Achievable, Relevant and Time Bound) Process Metrics and Process Analytics play a key role for MBM.

11. Process analytics

Both statistical and non-statistical analytical techniques propagated via the six sigma methods, particularly during the analyze phase of six sigma project have great relevance for service management process analytics. As an example: Event Tree Analysis, Fault Tree Analysis and Decision Tree Analysis, a set of related non-statistical analytical techniques (used in six sigma projects) have direct relevance for event, incident and problem management (three operational processes in service management) and indirect relevance for availability, continuity, performance & capacity, and security management (four design processes in service management). Most, if not all, analytical techniques covered by the six sigma methods are either directly relevant or indirectly relevant for one or more of service management processes.

12. Fishbone or ishikawa analysis

Fishbone diagrams can be useful to identify and analyze potential causes for Service Quality issues. In this case we are using fishbone diagrams to better understand service availability issues. Fishbone analysis and diagrams can be useful tools to identify and analyze potential causes for Service Unavailability. Overall service availability and service unavailability are a function of multiple capabilities (see Fishbone One):

- Technology Capabilities (see Fishbone Two)
- Process Capabilities (see Fishbone Three)
- Organizational Capabilities and
- Information Capabilities

The fishbone diagrams are generic diagrams and can be used to for multiple purposes including conceptualizing service availability models. The diagrams below depict the Y is F_n of x (x₁, x₂, x₃ ...) model. You can further decompose these models by making each of the x (or independent variable) a Y or dependent variable. These models can and need to be customized for each service. The x or independent variables impact overall service availability can also change with time. Fishbone diagrams can also be used as input for problem management.

Fishbone Diagrams for Understanding Service Availability:

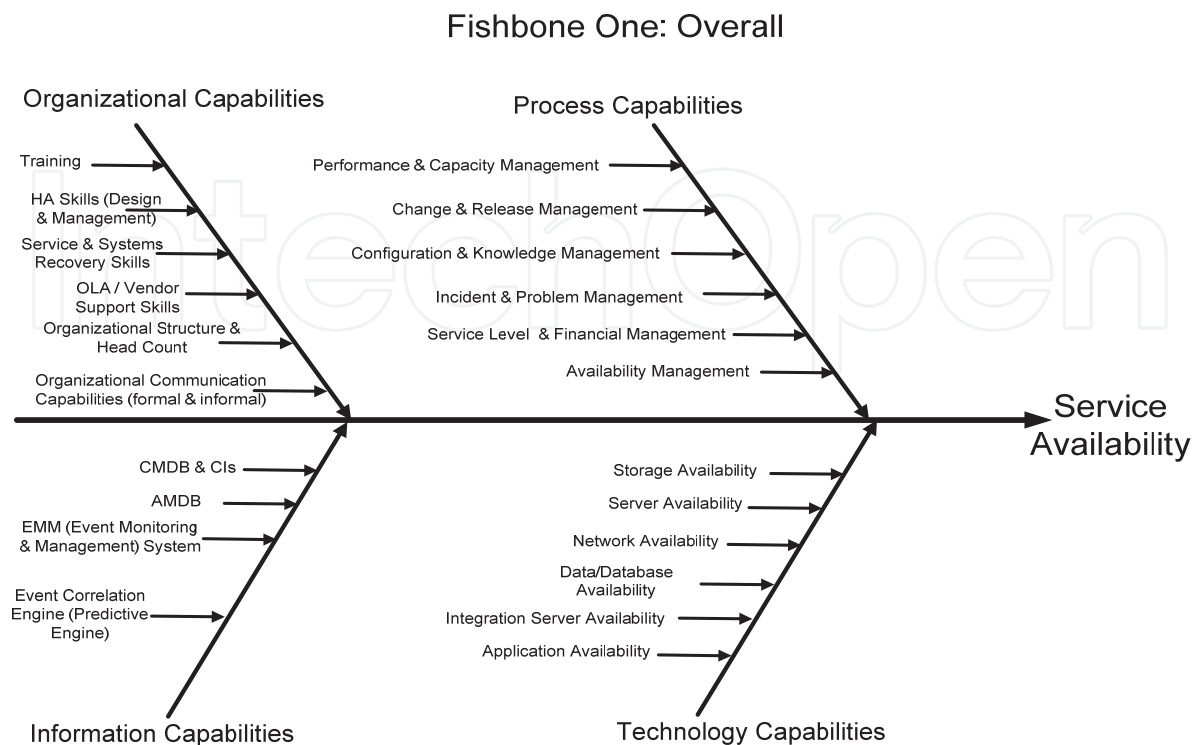


Fig. 3. Fishbone One for Overall Service Availability

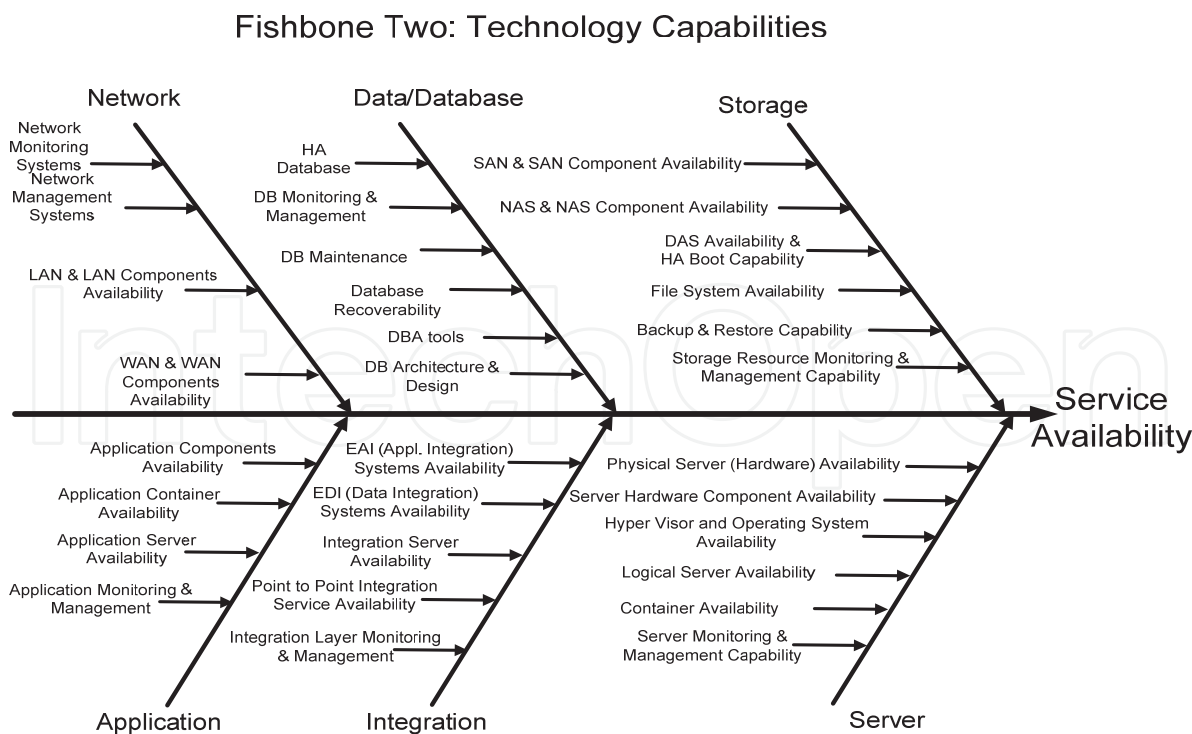


Fig. 4. Fishbone Two for Technology Factors

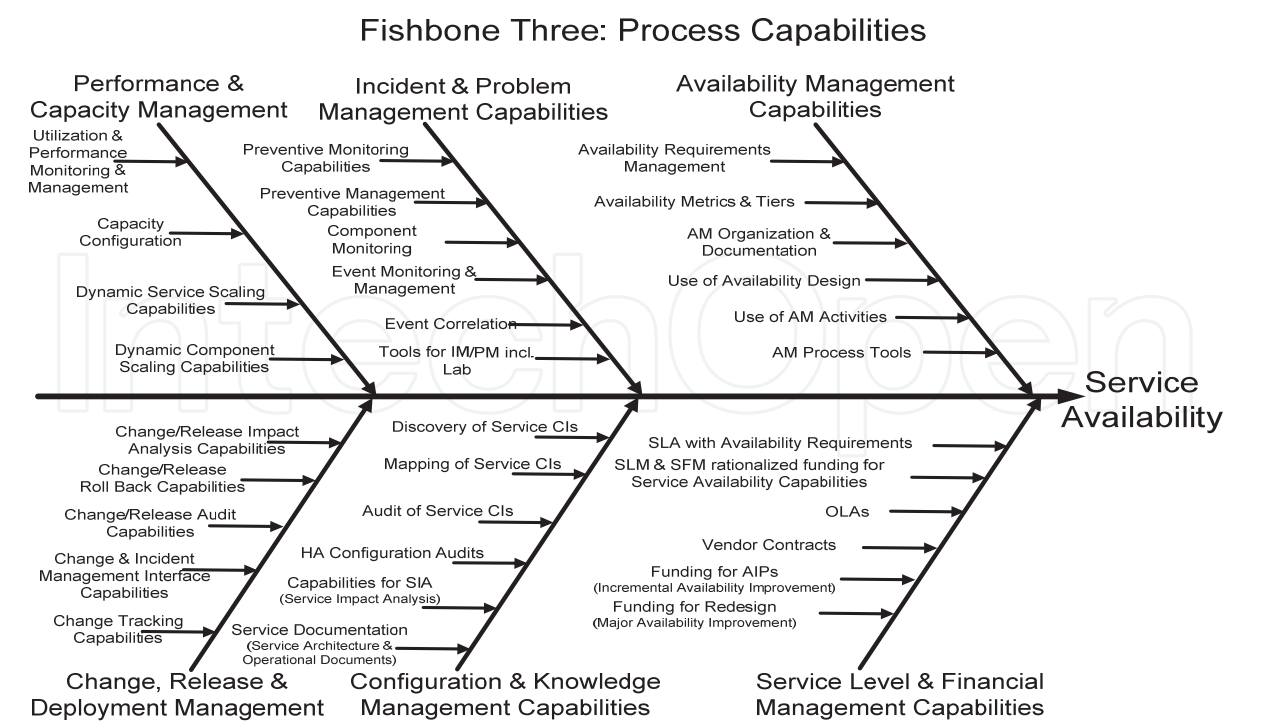


Fig. 5. Fishbone Three for Process Factors

We have only discussed a few key examples of Six Sigma tools and techniques and their application to business and IT service management. Therefore, this is not an exhaustive list of relevant six sigma tools applicable for service management.

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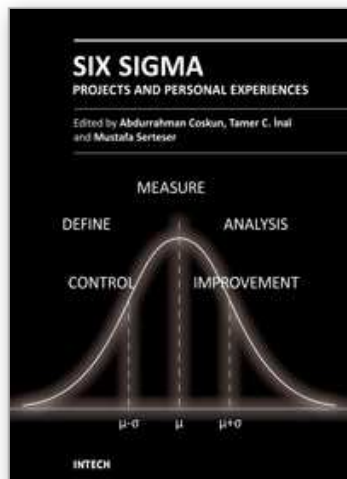
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In the new millennium the increasing expectation of customers and products complexity has forced companies to find new solutions and better alternatives to improve the quality of their products. Lean and Six Sigma methodology provides the best solutions to many problems and can be used as an accelerator in industry, business and even health care sectors. Due to its flexible nature, the Lean and Six Sigma methodology was rapidly adopted by many top and even small companies. This book provides the necessary guidance for selecting, performing and evaluating various procedures of Lean and Six Sigma. In the book you will find personal experiences in the field of Lean and Six Sigma projects in business, industry and health sectors.

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