# Measuring the level of quality of IT Service Management

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**Abstract**. *Many organizations have started with the implementation of Information Technology Service Management (ITSM) in order to achieve the alignment between business and Information Technology (IT). ITSM is concerned with planning, sourcing, designing, implementing, operating, supporting and improving IT services that are appropriate to business needs. There are different concepts and standards for assessing the maturity of ITSM such as ITIL, ISO/IEC 20000-1, ISO/IEC 15504-8, CMMI-SVC. The goal of the paper is to analyze how specific IT service organization uses ITIL, ISO/IEC 20000-1 and CMMI-SVC standards for the measuring the level of quality of the ITSM. The obtained results were compared in order to represent the actual quality level of ITSM in the IT organization.*

**Keywords.** ITSM, ITIL, ISO/IEC 20000, CMMI-SVC, quality assessment

## 1 Introduction

Modern business companies continually increase their dependence on Information Technology (IT) and its effective support in the implementation of business strategies. This tendency leads to a growing need for providing quality IT applications and services that are in line with business requirements.

Accordingly, the strategic goal for the IT organizations is how to improve the quality of IT services by applying standards for the planning and management of Information Technology Service Management (ITSM).

What is done by other researchers to address the problem of the quality of IT services? There are different models and standards for measuring the level of the quality of ITSM such as Information Technology Infrastructure Library (ITIL), ISO/IEC 20000, ISO/IEC 15504-8, CMMI-SVC. Each of them has its own procedural rules or practices, their methods and approaches to assess maturity and improvement so it is useful to apply more standards in order to get the objective maturity level of ITSM in the IT organization.

The assessment results obtained using the ITIL and ISO/IEC 2000-1 are analyzed and described in the chapter 2.

Capability Maturity Model Integration for Services (CMMI-SVC) is modern Software Process Improvement (SPI) model that offer the possibility of integration of the best practice for the planning, design, transition, operation and improvement of the IT services and approaches for the process capability assessment and the relevant improvements. The structure of the CMMI-SVC is described in the Chapter 3.

The conducted assessment of the level of quality of the ITSM using CMMI-SVC is described in the Chapter 4. The applied CMMI-SVC model within our research is very effective since it integrates the best practices based on integrated process and service development as well as the approaches for the maturity assessment of these practices. The management support is the critical success factor for the implementation of this practice because it is very expensive for the business company.

In conclusion, the obtained results are compared in order to represent the actual maturity level of the ITSM in the IT organization.

The research method is mainly based on the interviews with the process owners within the specific IT organization and their documentation (work products as the main assessment indicators). Incomplete documentation and largely subjective responses were the main limitations of this research method.

## 2 Measuring the level of quality of ITSM using ITIL and ISO/IEC 20000-1 standard

ITIL ensures a consistent best practice concept for setting up the IT service management processes built into the IT organization [5]. Developed toward the end of 1980's for the government of Great Britain, ITIL, in time, became a *de facto* standard in setting up IT service management processes. ITIL V3 includes 5

phases of lifecycle of IT services: *strategy*, *design*, *transition*, *operation and continual service improvement* [6]. For research purposes, each process from ITIL framework (the lifecycle of IT services) is evaluated in order to define its process capability [8],[9],[10],[11]. Criteria for process capability assessment and the levels of capabilities are shown in Fig.1. The conducted assessment is analyzed on the example of the Incident Management. Criteria are:

a) understanding of requirements of the Incident Management

b) procedure for implementing the requirements of the Incident Management

c) responsibilities for implementing the requirements of the Incident Management

d) available documentation related to the Incident Management

e) Practice of Incident Management

| CRITERIA for Process Capability Assessment | Example of ITIL process: Incident management | | Level of process capability |
|---|---|---|---|
| 1. Understanding of requirements | 2 | | 0 - the request is not performed<br>1 - there is the need to the request, but there is no defined process; there is no documentation<br>2 - the request is performed, but there are no documented procedures<br>3 - procedures for implementing the request are fully documented, but not sophisticated<br>4 - procedures for implementing the request are fully documented and continually improving<br>5 - procedures for implementing the request becomes a best practice |
| 2. Procedure for implementing the requirements | 1 | | |
| 3. Responsibilities | 1 | | |
| 4. Documentation | 1 | | |
| 5. Practice | 1 | | |
| AVERAGE capability | 1,2 | | |

**Fig. 1. Process Capability Assessment**

Each phase of lifecycle services is also evaluated as well as the overall maturity of ITSM in the IT organization. Results are shown in Fig.2. Overall maturity of ITSM is less than 2 (IT organization has undocumented ITSM processes).

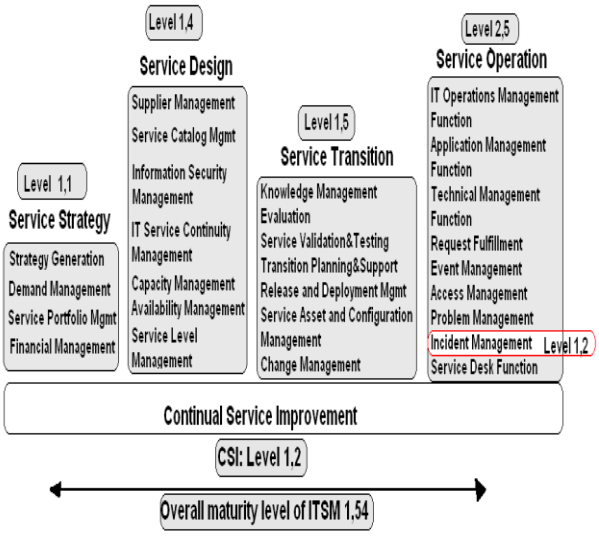



**Fig. 2. Maturity Assessment of ITSM in the IT organization**

ISO/IEC 20000-1:2011 requirements and the results of the conducted audit within IT organization, are shown in Fig.3 [4]. MS Office Excell was used as the supporting tool for conducting the audit. During the assessment for each group of requirements used the same criteria (understanding of requirements, procedure for implementing the requirements, responsibilities, documentation and practice). Percentage of their fulfillment is associated with levels of maturity as follows: 0% (Level 0); 10% (Level 1); 30% (Level 2); 50% (Level 3); 80% (Level 4); 100% (Level 5). According to the obtained results, IT organization meets the requirements of 24% (Level 1).

| ISO/IEC 20000-1 Requirements | Fulfillment of the Requirements % |
|---|---|
| 4. Service management systems general requirements | 27 |
| 5. Design and transition of new or changed services | 12 |
| 6. Service delivery process | 20 |
| 6.1. Service level management | 17 |
| 6.2. Service reporting | 18 |
| 6.3. Service continuity and availability management) | 18 |
| 6.4. Budgeting and accounting for services | 33 |
| 6.5.Capacity management | 19 |
| 6.6.Information Security management | 16 |
| 7. Relationship processes | 37 |
| 7.1.Business relationship management | 42 |
| 7.2.Supplier Management | 33 |
| 8. Resolution processes | 27 |
| 8.1.Incident and service request management | 30 |
| 8.2.Problem management | 23 |
| 9. Control processes | 23 |
| 9.1.Configuration management | 21 |
| 9.2.Change management | 25 |
| 9.3. Release and deployment management | 23 |
| OVERALL Fulfillment of the Requirements | 24% (Level 1) |

**Fig. 3. Assessment of the use of ISO/IEC 20000-1 in the IT organization**

# 3 CMMI-SVC structure

CMMI-SVC model is based on the PDCA concept - plan the purpose of the process in such a way that the process action can be audited for successful achievement and improved [3]. Process Imrovement Life Cycle concept is shown in Fig.4 [2].

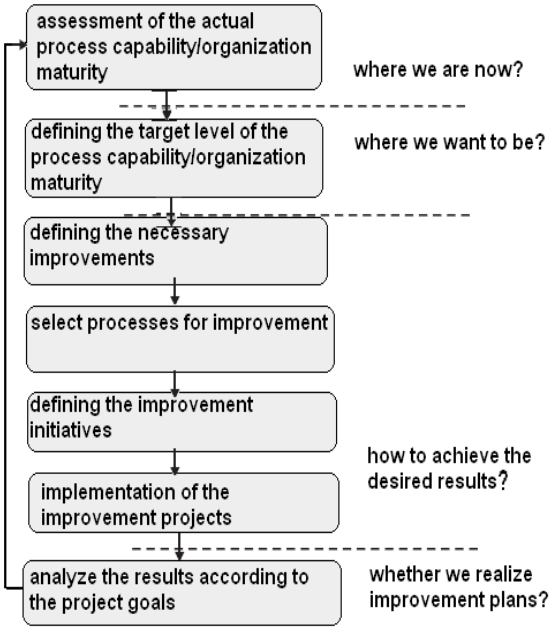



**Fig. 4. Process Imrovement Life Cycle**

CMMI-SVC 1.2 contains 24 process areas. Each process area has its defined purpose. In addition, the goal (specific/generic) is achieved by implementing effective practices (specific/generic) [2]. The practice describes the activities that are important for the implementation of the objectives (goals).

The work products are the results of the specific practice (typical work products) as well as the results of the generic practice. The work products are the important indicators for the assessment of the practice implementation and achieving the goals. The structure of the CMMI-SVC is shown in Fig.5 [3].

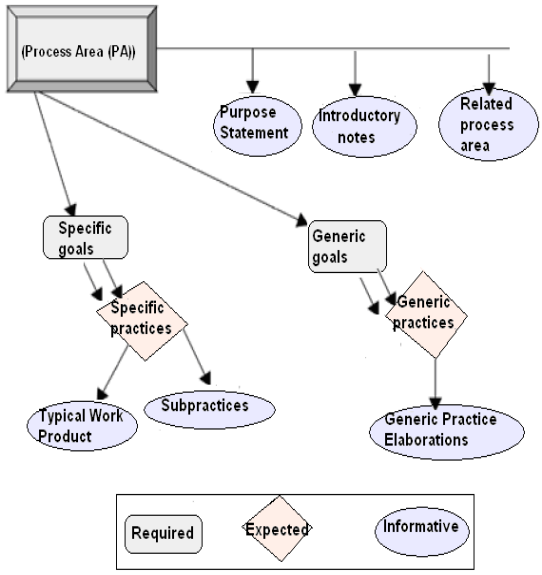



**Fig. 5. Components of the CMMI-SVC**

The process areas within the CMMI-SVC are organized by maturity level 2, 3, 4 and 5, shown in Fig.6[2][3]. *The conducted research in the paper evaluates the target level of the organization maturity 2 (Managed).*

| Maturity Level | Focus | CMMI SVC Process Area |
|---|---|---|
| 2 Managed | Basic Project Management | Project Monitoring and Control<br>Project Planning<br>Requirements Management<br>Supplier Agreement Management<br>Configuration Management<br>Measurement and Analysis<br>Process and Product Quality Assurance<br>Service Delivery |
| 3 Defined | Process Standardization | Organizational Process Definition<br>Organizational Process Focus<br>Organizational Training<br>Integrated Project Management<br>Risk Management<br>Capacity and Availability Management<br>Service Continuity<br>Decision Analysis and Resolution<br>Strategic Service Management<br>Service System Development<br>Service System Transition<br>Incident Resolution and Prevention |
| 4 Quantitatively Managed | Quantitative Management | Organizational Process Performance<br>Quantitative Project Management |
| 5 Optimizing | Continual Process Improvement | Organizational Innovation and Deployment<br>Causal Analysis and Resolution |

**Fig. 6. Process areas of the CMMI-SVC**

# 4 Measuring the level of quality of ITSM using the CMMI-SVC model

CMMI for Services (CMMI-SVC V1.2) was selected for the practical assessment conducted in the paper as well as its support tools – Appraisal Assistant Beta 3 (version 2.0.9). Rating scale for the **practice implementation** defines the following levels: fully implemented practice (80-100%); largely implemented practice(50-80%); partially implemented practice (20-50%); not implemented practice (0-20%); not yet (0%). Rating scale for the **goal satisfaction** defines the following levels: satisfied goal, unsatisfied goal. Rating scale for the **process area satisfaction** defines the following levels: not applicable process area, unsatisfied process area and satisfied process area. Rating scale for the process area capability level (CL) defines the following levels: CL0 (incomplete), CL1 (performed), CL2 (managed), CL3 (defined), CL4 (quantitative managed), CL5 (optimizing). **Maturity Level (ML1-Initial)** for IT organization means that processes are ad hoc, organization usually does not provide a stable environment. **ML2 (managed)** means that IT organization has the established processes and

responsibilities with no documented procedures. The following is:

**ML3 (defined)**- processes are well characterized, defined, documented and integrated into each other. Measurement and improvement is partially satisfied.

**ML4 (Quantitative Managed)** - processes are measured by collecting detailed data on the processes and their quality.

**ML5 (Optimizing)** - continuous process improvement is established.

It is necessary to first conduct an assessment for the 8 key process areas organized by maturity level 2, shown in Fig.6.

The example of the practical capability level assessment for the one of eight process area is described and analyzed in the paper in detail. **This is the Service Delivery process area**. The results of the assessment indicate a relationship between the target and the actual level of capability for the selected process area. Target capability level CL2 was 2.

First, the assessment was conducted on the implementation specific practices based on the assessment indicators (different work products) as shown in Fig.7.

| Goal SG | SPECIFIC PRACTICE (SP) | EVIDENCE OF THE WORK PRODUCT (assessment indicators) |
|---|---|---|
| SG1 | Establish service Agreements | |
| SP 1.1 | Analyze Existing Agreements and Service Data | - Customer descriptions of plans, goals, and service needs<br>- Results of customer and end-user satisfaction surveys and questionnaires<br>- Results of assessments of provider capability to meet customer needs |
| SP 1.2 | Establish the Service Agreement | - Service agreement |
| SG2 | Prepare for service Delivery | |
| SP 2.1 | Establish the Service Delivery Approach | - Service delivery approach<br>- Contact and roster lists<br>- Service request criteria |
| SP 2.2 | Prepare for Service System Operations | - Consumables validation report<br>- Logs of consumable acquisition and use<br>- Results from demonstrated service system operation |
| SP 2.3 | Establish a Request Management System | - A request management system with controlled work products<br>- Access control procedures for the request management system |
| SG3 | Deliver services | |
| SP 3.1 | Receive and Process Service Requests | - Request management record<br>- Action proposal<br>- Customer satisfaction data |
| SP 3.2 | Operate the Service System | - List of services delivered<br>- Service logs<br>- Performance reports and dashboards |
| SP 3.3 | Maintain the Service System | - Corrective or preventive maintenance change requests<br>- Maintenance notifications<br>- Preventive maintenance schedules |

**Fig. 7. Specific Practice Implementation Indicators (CMMI-SVC standard)**

The assessment results for the implementation of the specific practices of the Service Delivery process area are shown in Fig.8.

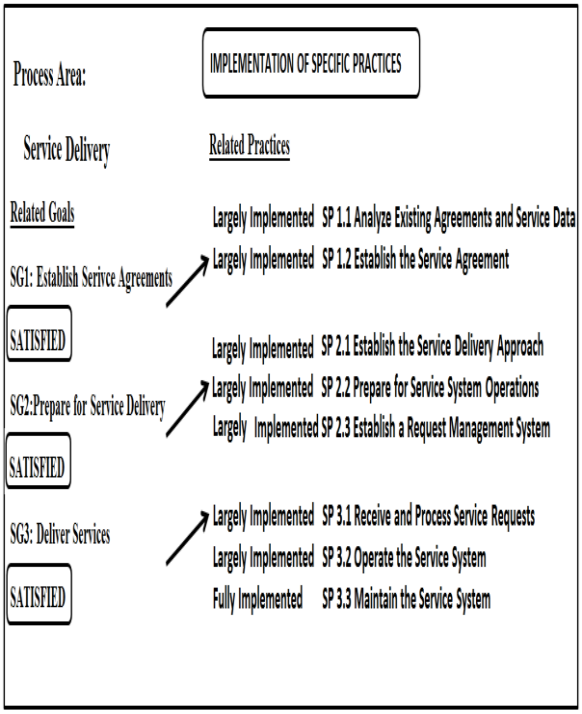



**Fig. 8. Practical capability level assessment for Service Delivery – specific dimension**

Same assessment procedure was conducted for the generic goals and practices, shown in Fig.9. Assessment results for the implementation of the generic practices of the Service Delivery process area are shown in Fig.9.

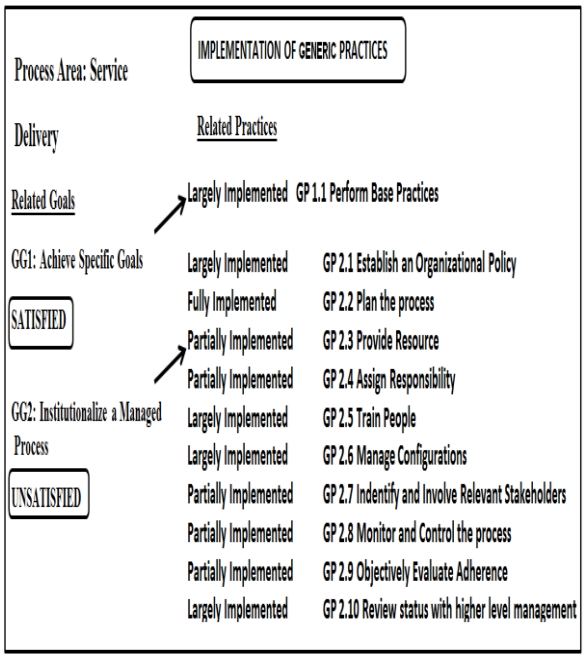
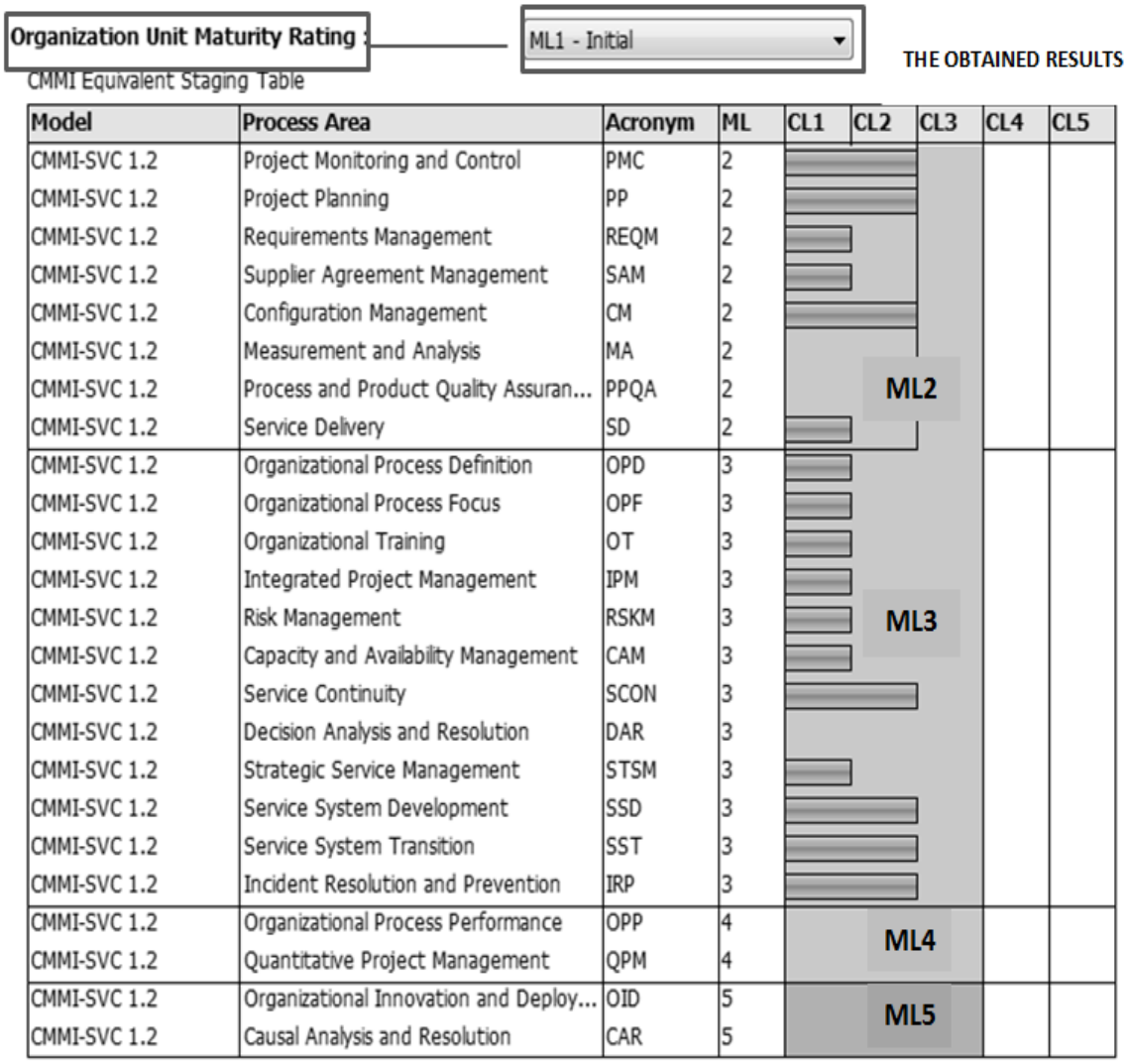



**Fig.9. Practical capability level assessment for Service Delivery – generic dimension**

Overall assessment results of the Service Delivery process area indicate that the capability level of this process area is CL1 (Performed), not CL2 (Managed). Same assessment procedure was conducted for the other 7 process area organized by maturity level 2 in the IT organization. The most process area has the capability level **CL1** i.e. performed process areas. It is not enough for the organization maturity level ML2.

In addition, the other process areas organized by maturity level 3, 4 and 5 in the IT organization are also analyzed and assessed. **Overall results are shown in Fig. 10.** The authors used the continuous CMMI model for the assessment and mapped the obtained the results through the staged CMMI model [1]. The obtained results show that the IT organization has maturity level **ML1 (Initial)** and achieves its business goals based on the processes that are not well managed. In this organization the management should first decide about the improvements related to the processes of maturity level ML2 (especially Service Delivery, Measurement and Analysis, Process and Product Quality Assurance, Requirements Management and Supplier Agreement Management).

According to the overall results, shown in Fig.10, we can see that IT organization have to also improve the practices of the ML3 and invest into maturity level ML4 and ML5.




| Model | Process Area | Acronym | ML | CL1 | CL2 | CL3 | CL4 | CL5 |
|---|---|---|---|---|---|---|---|---|
| CMMI-SVC 1.2 | Project Monitoring and Control | PMC | 2 | | | | | |
| CMMI-SVC 1.2 | Project Planning | PP | 2 | | | | | |
| CMMI-SVC 1.2 | Requirements Management | REQM | 2 | | | | | |
| CMMI-SVC 1.2 | Supplier Agreement Management | SAM | 2 | | | | | |
| CMMI-SVC 1.2 | Configuration Management | CM | 2 | | | | | |
| CMMI-SVC 1.2 | Measurement and Analysis | MA | 2 | | | | | |
| CMMI-SVC 1.2 | Process and Product Quality Assuran... | PPQA | 2 | | | | | |
| CMMI-SVC 1.2 | Service Delivery | SD | 2 | | | | | |
| CMMI-SVC 1.2 | Organizational Process Definition | OPD | 3 | | | | | |
| CMMI-SVC 1.2 | Organizational Process Focus | OPF | 3 | | | | | |
| CMMI-SVC 1.2 | Organizational Training | OT | 3 | | | | | |
| CMMI-SVC 1.2 | Integrated Project Management | IPM | 3 | | | | | |
| CMMI-SVC 1.2 | Risk Management | RSKM | 3 | | | | | |
| CMMI-SVC 1.2 | Capacity and Availability Management | CAM | 3 | | | | | |
| CMMI-SVC 1.2 | Service Continuity | SCON | 3 | | | | | |
| CMMI-SVC 1.2 | Decision Analysis and Resolution | DAR | 3 | | | | | |
| CMMI-SVC 1.2 | Strategic Service Management | STSM | 3 | | | | | |
| CMMI-SVC 1.2 | Service System Development | SSD | 3 | | | | | |
| CMMI-SVC 1.2 | Service System Transition | SST | 3 | | | | | |
| CMMI-SVC 1.2 | Incident Resolution and Prevention | IRP | 3 | | | | | |
| CMMI-SVC 1.2 | Organizational Process Performance | OPP | 4 | | | | | |
| CMMI-SVC 1.2 | Quantitative Project Management | QPM | 4 | | | | | |
| CMMI-SVC 1.2 | Organizational Innovation and Deploy... | OID | 5 | | | | | |
| CMMI-SVC 1.2 | Causal Analysis and Resolution | CAR | 5 | | | | | |

**Fig. 10. Overall results of the organizational maturity level (CMMI-SVC Appraisal Assistant)**

# 5 Conclusion

The goal of the paper was to analyze how specific IT service organization uses **ITIL, ISO/IEC 20000-1 and CMMI-SVC standards** for the measuring the level of quality of the ITSM.

According to the general maturity model, used within our research, we can differ five levels of maturity: 1 (initial) - processes are ad hoc, no documented; 2 (managed) - established processes and responsibilities with no documented procedures; 3 (defined): standardized and defined processes, responsibilities and documentation; 4 (quantitative managed): measurement and control are established for the ITSM practice; 5 (optimized): continual service improvement is established within integrated process organization.

The obtained results according to ITIL standard show that the overall maturity level of ITSM in the organization is about 1.54 (initial maturity level). The obtained results according to CMMI-SVC standard show a similar result - the maturity level of ITSM usage in the organization is ML1 (initial maturity level). The assessment of the use of ISO/IEC 20000-1 in the IT organization show that the overall fulfillment of the ISO 20000-1 requirements is about 24% (initial maturity level).

Each of standard/method we used has its own rules and practices, and it is necessary to use more than one method to get the actual quality level of ITSM in the organization.

The conducted research in the paper evaluates the target level of the organization maturity 2, but analysis shows that IT organization has maturity level 1, and many improvement are needed to achieve higher maturity level. Through methods we used, we can make the conclusion that IT organization has good basis for improvement, but it needs more investments in business processes and training.

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