Service Level Management For it Ser-vices in Small Settings: A Systematic Review

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Abstract: This work presents the application of a systematic review protocol for Software Engineering. This protocol is used as a formal model by applying systematic review to Service Level Management. The objective is to search for papers related to Service Level Management for IT Services in small settings (including small and medium enterprises). Results obtained show that Service Level Management area is an increasing research field and there is a need for more in-depth studies.

Keywords: Slm, Itsm, Small Settings, Systematic Review, IT Services.

I. Introduction

Nowadays, most countries have transitioned from agriculture and manufacturing economies to service based economies. More than 75% of the economies of industrialized nations are based on business services [1]. According to the document “Capability Maturity Model Integration for Service (CMMI-SVC) Overview” published by Software Engineering Institute [2], demand for process improvement in services is likely to grow: services constitute more than 80% of the US and global economy. According to Gartner [3], 80% of the cost of an infrastructure is in service delivery and service support. Therefore, services are gaining significant importance day by day in industry.

Hence, industries need some sort of framework, standards to manage their services, specially the IT Services, because the development of IT has had a greater impact in the processes of businesses in the last years [9]. For this reason, IT Service Management (ITSM) has been developed. ITSM is a discipline for managing information technology systems, philosophically centered on the customer's perspective of IT's contribution to the business. The IT infrastructure needs to be aligned to the busi-ness requirements such that business unit and IT operate in a coordinated effort to achieve the goal of the organization. There are different frameworks for ITSM. Standards, process and evaluation models or framework help organizations to improve the management of their services projects. Some public framework and standards assessed relevant to service management are: ISO/IEC 20000 [13], Information Technology Infrastructure library (ITIL) [5], Capability Maturity Model Integration for Services (CMMI-SVC) [2], Control Objectives for Information and related Technology (COBIT) [8], eSourcing Capability Model for Service Providers (eSCM-SP) [4].

The previous models consider the IT Services from large companies’ perspective. But the fact is, nowadays small companies are gaining more importance. In Spain, according to Central Business Directory (DIRCE) [14], most companies are categorized as Small and Medium Enterprises (SMEs). In January of 2007, 99,81% of businesses, representing three million enterprises were small or medium. This statistic shows the importance that SMEs have in microeconomics (see Table 1).

Due to previous issues, a growing number of organizations are focusing on Service Level Management (SLM) process to determinate the level of IT Services that is needed to support the services offered. SLM provides an approach combining process management and industry best practices to ensure that the required and cost justifiable service quality is maintained and gradually improved [5]. As a result, SLM becomes a key concern nowadays.

This work addresses SLM process, from the point of view of small settings (include SMEs). Section 2 shows the importance of Service Level Management for IT Services. Section 3 and 4 describes the Systematic Review Method applied in this research work. Section 5 shows the results obtained. Finally, section 6 establishes a brief summary.

II. Importance of Service Level Management for IT Services

SLM is a vital process for every IT service provider organization in that it is responsible for agreeing and documenting service level targets and responsibilities within Service Level Agreements (SLAs) and Service Level Requirements (SLRs), for every activity within IT [6].
Moreover one of the important processes to regulate the qualities and to decrease the cost of IT services is the Service Level Management [15]. Also the ITSM models, standards and proposals give high importance to Service Level Management in the IT Service Management context. The main factors to carry out this research focused in a systematic review for SLM from the point of view of small settings are:

- The growing current trend to acquire Technology and IT Services derivate of this acquisition by organizations [16].
- The importance of IT Service Management in small settings.
- The absence of models that help to implement the Service Level Management process in the context of the IT Service Management for Small Settings.

The statistics compiled by the National Statistical Institute (INE) and the Central Business Directory [8], show that small companies represent the highest percentage. The data are linked to factors such as income and sectorial concentration of such companies. The INE and DIRCE analyze their situation within the European Union and their relationship with the employees they recruit.

Table 1 summarizes the study for Spanish companies based on the employee stratum and total percentage [8]. The interest in showing this study is due to the current importance that small companies have.

<table>
<thead>
<tr>
<th>Micro-enterprise</th>
<th>Small</th>
<th>Medium</th>
<th>Large</th>
<th>Total</th>
<th>SMEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,137.46</td>
<td>169.60</td>
<td>23.52</td>
<td>6.07</td>
<td>3,336.66</td>
<td>3,330.58</td>
</tr>
<tr>
<td>94,03%</td>
<td>5,08%</td>
<td>0,70%</td>
<td>0,18%</td>
<td>100%</td>
<td>99,818%</td>
</tr>
</tbody>
</table>

Table 1. Spanish Companies (employee’s stratum and total percentage).

Systematic review gives a summary of the state of the art for this specific topic. In this case for IT Services Management in small settings. In addition systematic review identifies the existing gap in some topics related with SLM in SMEs. This results can help users who are working with SLM or can help to know current initiatives in this domain.

III. Description of Systematic Review Method

3.1 Systematic Review Background

Integration of research results was introduced for the first time in twenty century. In 1904, Pearson calculated the average of correlations between the typhoid fever inoculation and morality. Then, systematic review began to be formalized and at the end of the 80’s systematic review achieves legitimacy as a field of research [10]. Later, Kitchenham [11] evolves the idea of Evidence-Based Software Engineering and proposes a guideline for systematic reviews that is appropriate for software engineering researchers.

3.2 What is a Systematic Review

Systematic Review (SR) is used to refer to a specific methodology of research, developed in order to gather and evaluate the available evidence pertaining to a focused topic [10]. This is the process of summarize all existing information about a phenomena in thorough and empirical way. At the end, systematic review draws a general conclusion from individual studies on any phenomena. A systematic type of review follows a very well defined and strict sequence of methodological steps. A systematic review begins when researchers are confident that it is necessary to carry it out. It aims to integrate empirical research in order to create generalizations. In this regard, defined assessment objectives, reference source, data extraction method are some of the aspects contained in the protocol used for this systematic review [10].

3.3 Protocol Description

Birolchini et al [10] have drawn up a proposal for how to conduct a systematic review focused on Software Engineering adapting it from other study area such as medicine. Hence, for this work, the protocol proposed is applied to the “Service Level Management for IT Services in small settings: a Systematic Review”.

IV. Prototype Development

Next, the prototype development used for the systematic review of the subject is presented: Service Level management for IT Services in small settings.

4.1 Question Formulation

The systematic review objective should be clearly established in order to formalize the question:

4.1.1 Question Focus

The systematic review is carried out to identify initiatives and experience reports on Service Level Management for IT Services in small settings.

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4.1.2 Question Quality and Amplitude

This section aims at defining the syntax of the research question (the context in which the review is applied and the question the study must answer) and its semantic specificity (or question range) described by the remaining items of this section - intervention, effect, outcome measure, population and application. Next, each of them are described [10] specifically for Service Level Management for IT Services in small settings.

- **Problem:** Service Level Management (SLM) is a vital process for every IT service provider organization in that it is responsible for agreeing and documenting service level targets and responsibilities within SLAs and SLRs, for every activity within IT. SLM implementation is needed to ensure that an agreed level of IT service is provided for all current IT services, and that future services are delivered to agreed achievable targets [5].
- **Question:** What initiatives have been carried out to evaluate processes for Service Level Management in IT service context?
- **Intervention:** Service Level Management for IT Services in small settings.
- **Effect:** Service Level Management initiatives and proposals for IT services in small settings.
- **Outcome measure:** Number of identified initiatives.
- **Population:** Publications related to Service Level Management, IT Services and small settings.
- **Application:** Organizations that use IT services and those who provide them.
- **Experimental Design:** None experimental design will be performed.

4.2 Source Selection

The objective of this section is to select the sources where the primary studies will be executed [10]. To perform the selection the author of the systematic review protocol proposes to address the following issues:

4.2.1 Source Selection Criteria Definition

- Use search mechanism with keywords and sites suggested by experts.
- Use papers recommended by other experts.
- Use papers available on the website.

4.2.2 Studies Language

- English.

4.2.3 Source Identification

Sources Search. The identification of sources has been based on the criterion of experts in our re-search area. These sources include journals as: European Journal of Operational Research, Information and Software Technology, Software: Practice and Experience, Software Process: Improvement and Practice, IEEE Software, Software Technology and Engineering Practice, Computer and research workshops & technical reports of Software Engineering Institute – SEI, among others.

Search Strings. Keywords from the word set defined in the question were extracted. Combining these keywords with the logical operators ‘AND’ and ‘OR’, two search strings were obtained (see Table 2). These search strings have been adapted for each web browser of the sources.

<table>
<thead>
<tr>
<th>Search String</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  itsm or sim and sla and ((iti or asl or 20000 or 15000 or cmmi-svc or mof or tsccm) and (small and (company or organization or enterprise or setting)))</td>
</tr>
<tr>
<td>2  ‘it service management’ and ‘service level management’ and (small and (company or organization or enterprise or setting))</td>
</tr>
</tbody>
</table>

Table 2. Search strings

Source List. These sources have been selected taking into account the defined source search method (see Table 3).

<table>
<thead>
<tr>
<th>#</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACM Digital Library</td>
</tr>
<tr>
<td>2</td>
<td>IEEE Computer Science Digital Library</td>
</tr>
<tr>
<td>3</td>
<td>Springer Link</td>
</tr>
<tr>
<td>4</td>
<td>ScienceDirect</td>
</tr>
<tr>
<td>5</td>
<td>Software Engineering Institute</td>
</tr>
</tbody>
</table>

Table 3. Source List
4.2.4 Source Selection After Assessment

First, it was evaluated if the sources fit all defined criteria. Initially, the complete list is right. After applying the search string to all sources, it was found that some items were common in the IEEE Computer Science Digital Library and ACM sources.

4.2.5 Reference Checking

Three researchers from the Research Group of Software Process Improvement for Spain and Latin American Region evaluated the sources list obtained from the previous section and determined, at first instance, all references as approved.

4.3 Studies Selection

In this systematic review an iterative and incremental procedure is used for studies selection: a) Iterative, to group all activities that could be repeated during the procedure, and b) Incremental, because the studies are approached and recorded one by one until obtaining the systematic review results [12]. This iterative and incremental procedure is used due to its functionality in other systematic reviews. This section describes the process and criteria for studies selection and evaluation.

4.3.1 Studies Definition

The studies inclusion (IC) and exclusion criteria (EC) definitions [11] are as follows:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Criteria Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1</td>
<td>Include papers whose title is related to Service Level</td>
</tr>
<tr>
<td>IC2</td>
<td>Management and IT Services and small settings</td>
</tr>
<tr>
<td>IC3</td>
<td>Include papers that contains keywords that match with</td>
</tr>
<tr>
<td></td>
<td>those define in the search string</td>
</tr>
<tr>
<td>IC4</td>
<td>Include papers whose abstract is related to the topic</td>
</tr>
<tr>
<td>EC1</td>
<td>Exclude those papers that do not match with the previous</td>
</tr>
<tr>
<td></td>
<td>inclusion criteria</td>
</tr>
<tr>
<td>EC2</td>
<td>Exclude all duplicate papers</td>
</tr>
</tbody>
</table>

Table 4. Studies inclusion and exclusion criteria definition

Studies Types Definition. Initially all studies related to Service Level Management will be taken into account. However, the greatest interest will focus on studies that show results on Service Level Management for IT services in small settings.

Procedures for studies selection. With regards to the selection criteria, the title was initially the main criterion; nevertheless, in some cases it did not provide enough information, thereby reading the summary of each of them was necessary and in some cases a review of the full text was required.

4.3.2 Selection Execution

- Initial Studies Selection. At first a search execution was conducted to verify the parameters used by each engine and adapt search string to them. Table 5 shows in the column “Found” the obtained value.
- Study Quality Evaluation. To determine the quality of the study, some participants of the research group, applying IC and EC, obtained the primary studies (see Table 5).

<table>
<thead>
<tr>
<th>Sources</th>
<th>Search date</th>
<th>Found</th>
<th>Primary studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE</td>
<td>05/11/09</td>
<td>59</td>
<td>11</td>
</tr>
<tr>
<td>ACM</td>
<td>05/11/09</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Springer</td>
<td>05/12/09</td>
<td>59</td>
<td>12</td>
</tr>
<tr>
<td>Science@Direct</td>
<td>05/13/09</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>SEI</td>
<td>05/14/09</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>182</td>
<td>31</td>
</tr>
</tbody>
</table>

Next, a quality study is evaluated to obtain the assessment results that permit us to quantify those studies that effectively support the stated objectives. The previous information constitutes the study basis for following the systematic review process, and checking the quality of the study.

4.4 Information Extraction

This section begins once primary studies are selected. Then, in this section, extraction criteria and result are described.
4.4.1 Information Inclusion (ICinf) and Exclusion (ECinf) Criteria Definition

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Criteria Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1inf</td>
<td>Collect Information about the organization’s trend respect to service level management.</td>
</tr>
<tr>
<td>IC2inf</td>
<td>Classify processes followed by companies for IT service management.</td>
</tr>
<tr>
<td>IC3inf</td>
<td>Identify proposed methodologies, methods and procedures in studies for IT service management.</td>
</tr>
<tr>
<td>EC1inf</td>
<td>Exclusion the information that is not related to the inclusion criteria defined above.</td>
</tr>
</tbody>
</table>

Table 6. Information Inclusion and Exclusion Criteria Definition

4.4.2 Data Extraction Forms

To analyze data and information submitted in selected studies, relevant remarks of the main studies ideas were made and recorded in a document with a sequence number identification that matches with the sequential paper number given when it was stored a primary study.

4.4.3 Extraction Execution

Objective Results Extraction: A complete and detailed reading from these studies allowed us to organize and classify them for a later analysis. With an unbiased evaluation of the information, identified and classified studies records were generated in a structured table containing the following rows: Consecutive Study (sequential paper number), Study methodology (remarks of the main ideas concerned with the methodology), and Study outcome (data and information of the conclusion presented in each study).

Subjective Result Extraction: The following rows were added to the previous table: Data about Authors (full names and available contact information in the studies) and Additional Notes (a specific field to store general information related to subject covered in the study).

4.4.4 Resolution of divergences between reviewers

In the development procedure for the extraction of the information contained in the selected primary studies, different perceptions among authors of the studies were presented. However, none of them is considered as an important divergence, but rather, the findings were complemented to obtain a comprehensive analysis of the paper.

V. Result Summary

After the systematic review execution, the results must be summarized and analyzed using the statistical methods defined during the planning phase. This section presents a summary of the data resulting from the selected studies. This summary is obtained from statistical calculus.

5.1 Studies Trends

In order to know organization trend respect to Service Level Management (SLM), studies related to any aspect of SLM were classified, taking into account that ”SLM” term refers to both Service Level Agreement (SLA) and Service Level Operation (SLO) terms.

Figure 1 shows two types of trends. 1) Between 2002 and 2006, there is a polynomial trend of order 3 because data fluctuate along the graphic. And, B) from 2006 to 2008 data have a linear trend because the studies are increasing at a constant rate. The trend shows from year 2006 the increasing interest related to Service Level Management.

Fig. 1. Studies Trend
5.2 Studies Classification

During the protocol development, and using the studies selection’s methodology and information analysis found in each study, it was possible to determine that studies could be classified into four items. Those studies covering:

A) topics related only to ITSM and SLM.
B) topics related only to ITSM and small settings.
C) a relationship of three topics (ITSM and SLM and small settings), and
D) other studies that have no relationship with these issues (ITSM and SLM and small settings).

Figure 2 shows the studies percentage for each item according to the previous classification.

![Fig. 2. Studies Classification](image)

Figure 2 shows that the 45% of the primary studies (see Table 5) are related to ITSM and SLM what confirms the trend shown in Figure 1. The 26% shows information related to ITSM and small settings. However, it is necessary to highlight that only 23% is related to item C) that grouped the three topics (ITSM, SLM and small settings). Finally a 6% has been eliminated by the exclusion criteria EC1inf.

5.3 Analysis of those studies covering the relationship of three topics (ITSM, SLM and small settings)

Figure 3 shows the results of relationship related to topics (ITSM, SLM and small settings). In the analysis, it is noted that 23% of the papers comprise three aspects (basis of the ongoing systematic re-view). From here all analyses are referred to this 23% (item C).

5.3.1 Analysis by country

The source of 23% of the papers is shown in Figure 3. United States of America is one of the main countries involved in the study of ITSM, SLM and small settings, with 29%. The remaining studies are divided in the countries South Korea, Sweden, French, Canada and Germany with 14% respectively.

![Fig. 3. Studies Classified by country](image)
5.3.2 Analysis by company size

Figure 4 shows information about companies’ size. Due to most of the studies are short of information about companies, Figure 4 has been made taking into account two criterions: 1) the application of studies in the companies’ size, 2) the studies did not mention the companies’ size. Hence, according to Figure 4, most of the companies that support their research are small companies, 85.7%. Remaining 14.3% companies are not mentioned.

![Fig. 4. Studies by companies size](image)

5.3.3 Analysis by models

With respect to item C only the 78% have used ITIL, COBIT and ISO 20000.

![Fig. 5. Studies Classified by models](image)

VI. Conclusions

This work shows the results for Systematic Review of the studies related to Service Level Management in small settings. It was obtained using the protocol proposed by Biolchini et al [10] The obtained results show the status of the art for “Service Level Management in small settings”. We can see most of the works have been performed in year 2008. According to the statistics we find from year 2005 the works on Service Level Management are increasing significantly. This trend confirms the interest over SLM process showed by Gartner and CMMI-SVC reports.

Other relevant data showed in this work is that 45 % of studies papers deal with IT service management in terms of SLM (include SLA and SLO). The 26% of the studies is related to small setting (in- clude SMEs). Moreover, 23 % of studies are related to SLM and small settings. The studies show that ITIL, COBIT, and ISO2000 are the most important models in a Service Level management context. These results can help users who are working with SLM or can help to know current initiatives in this domain.
Acknowledgments
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Appendix A: List of primary studies in the systematic review
Next are presented the selected primary studies in the development of this systematic review.

References


Literature


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