

ITIL in small to medium-sized enterprises software companies: towards an implementation sequence

Lohana Lema¹, José-Antonio Calvo-Manzano¹,

Ricardo Colomo-Palacios^{2*}†, and Magdalena Arcilla³

¹*Universidad Politécnica de Madrid, Madrid, Spain*

²*Østfold University College, Norway*

³*Universidad Nacional de Educación a Distancia, Madrid, Spain*

ABSTRACT

Information Technology Infrastructure Library, ITIL framework, is a set of comprehensive publications providing descriptive guidance on the management of IT processes, functions, roles and responsibilities related to Information Technology Service Management. However, and in spite of its repercussion and popularity, the ITIL framework does not suggest an implementation order for their processes. This decision constitutes the first challenge that an organization must overcome when starting an ITIL implementation, the enterprise size being one of the leading factors to be considered in the decision making process. In the scenario of Small and Medium Enterprises dedicated to producing software, this paper is devoted to investigating which processes are the most selected to start the implementation of ITIL in these organizations. This is done by means of two different instruments. Firstly, a systematic literature review on the topic and secondly, a survey conducted among experts and practitioners. Results show in both cases that Incident Management Process should be the first process when implementing ITIL framework.

KEYWORDS: ITIL, SMEs, implementation sequence, systematic review, questionnaire, survey, Incident Management Process, ITSM.

1. INTRODUCTION

Small- and medium-sized enterprises (SMEs) are of great importance for economic growth, employment and wealth creation [1]. On the other hand, the software industry has also been identified as one of the most important industries in the world [2]. Within the software industry, a majority of firms on the international landscape are relatively small [3]. Regardless of the industry and size of organization, information technology (IT) has been fundamental for improving productivity as well as for the development of knowledge-intensive products and services [4]. The increasing use of information management technologies within firms has resulted in IT usage-dependent organizations seeking to have increasingly efficient and innovative technological services and solutions [5]. For all kinds of organization, IT services, either internal or external, are becoming crucial and their management and improvement are a fashionable management phenomenon [6]. Information Technology Service Management (ITSM) refers to the implementation and management of quality IT services that meet the needs of a business [7]. Other authors define the discipline as an approach to IT operations that is characterized by its emphasis on IT services, customers, service level agreements, and

* Correspondence to: Ricardo Colomo-Palacios, Østfold University College, Norway

† E-mail: ricardo.colomo-palacios@hiof.no

an IT function's handling of its daily activities through processes [8]. In any case, ITSM can be seen as a part of the Service Sciences and it concentrates on IT Operations [9]. According to Mora, et al. [10], the seven key international ITSM processes frameworks are: ITIL v2, ITIL v3, ISO 20000-4, CobIT 4.0, CMMI-SVC v1.3, MOF 4.0 and ITUP. Nevertheless, the most globally influential approach (of the various IT service management approaches) is ITIL [6]. Although the exact number of organizations adopting ITIL is not known, there are many indicators of growing awareness and adoption [11]. One of these indicators is the interest in the topic in scientific literature, e.g. [12–15] citing the most recent and relevant cases.

ITIL also has its impact in SMEs scenarios. The literature also reflects this interest [16] in general studies. For instance, Valdés et al. [17] underline that SMEs cannot easily adopt ITIL, so they implement only useful concepts and selected parts. In this scenario, which in most cases only some processes are installed, the order of implementation of these processes is not trivial to warrant a soft adoption. This is the aim of the paper. In the context of software SMEs, the authors conducted a systematic literature review on implementation order for ITIL along with a set of studies to identify best practices and desirable process sequencing. After that, the authors conducted a set of studies to find out more about ITIL processes implementation in software SMEs.

2. BACKGROUND

2.1 SMEs and the software industry

An SME can be defined as a company that has less than 250 employees, or less than 500 employees according to European (EU) regulations [18]. Focusing on Europe (http://ec.europa.eu/enterprise/policies/sme/index_en.htm), the more than 20 million SMEs represent 99% of businesses.

The software industry is SMEs predominant. For any small and very small software companies, implementing controls and structures to properly manage their software development and operation activity is a major challenge [19]. According to [20], there is a strong relation between software process improvement initiatives and ITSM practices, given that many software producers have implemented ITSM standards to assure their continuity and maximize their return of investment and business opportunities. However, although software improvement initiatives can influence the business success of software SMEs [21], some aspects, like lack of resources and day to day pressures, are barriers to their implementation. In words of Sulayman et al. [22], software process improvements models used for large organizations, like CMMI or ISO/IEC 15504, are not considered suitable for SMEs due to their complex nature and high costs. ITIL implementations have been reported as difficult, expensive and risky, making its adoption by SMEs very challenging. Moreover, in the service arena, according to [23], while small software organizations often have relatively simple internal structures, they typically design software for complex external environments, making the governance of their services complicated and tedious.

2.2 Information Technology Infrastructure Library

ITIL gathers a series of documents containing best practices to aid the implementation of an ITSM framework. In other words, ITIL can be seen as a set of prescribed practices that an IT function may employ in order to achieve IT Service Management [24]. ITIL is focused on the continual measurement and the quality improvement of the services, from both business and client perspectives [20].

Regarding its history, ITIL V.1 was developed during the 1980s by the British Central Computer and Telecommunications Agency (CCTA); ITIL V.2 was released between 2000

and 2002. The current version, ITIL V.3, released in 2007 and later revised in 2011, explains in five volumes the various tasks an IT services supplier must perform [25].

Threats and challenges in ITIL adoption is a common topic in literature. Thus, several works have been devoted to assess these benefits, e.g. [8,26]. Some of these benefits are higher levels of maturity in Business-IT alignment [27], clarity of roles and responsibilities [28], smoother negotiation of service level agreements and reduced server faults [29], improved client/service orientation and quality of IT services [30], increased customer satisfaction, enhanced productivity, and reduced costs [28], to cite just some of the most reported benefits. However, the literature also highlights several barriers that limit the deployment of ITIL processes in organizations. Marrone et al. [11] state that organization size, country, and industry sector influence the adoption of ITIL while Wang [31] emphasizes that its implementation requires training as well as investment in software tools. Finally, there are also works devoted to analyzing critical success factors in ITIL implementation. The work of Iden and Eikebrokk [25] presents a recent and relevant literature review on the topic.

Regarding implementation order issues, the ITIL V3 framework does not prescribe what processes/activities should be implemented or their implementation order. Moreover, according to Marrone et al. [11], the fact is that most organizations commence their ITIL adoption with the incident management process. Incident management is strongly linked to other operational processes (i.e., change management and configuration management) and according to [11], the first process selected influences the cohort of processes adopted after that. The process sequencing problem in ITIL is not new in the literature, e.g. [32]. However, to the best of the authors' knowledge there is no study devoted to investigating the ITIL implementation order based on systematic literature review and a survey.

Thus, as stated before, in this paper an ITIL implementation sequence for SMEs will be defined by means of a systematic literature review and a study based on a questionnaire.

3. SYSTEMATIC LITERATURE REVIEW

To the best of the authors' knowledge, there is no systematic literature review on ITIL's implementation sequence. Consequently, this paper will facilitate the understanding of the current status of research on the topic and address further investigation in the area.

3.1 Research method

The goal of a systematic review is "to identify, evaluate, and interpret all available research relevant to a particular research question, or topic area, or phenomenon of interest. Individual studies contributing to a systematic review are called primary studies; a systematic review is a form of a secondary study" [33]. In the field of software engineering, Kitchenham first introduced the topic in the first decade of XXI century [34] and her guidelines, published together with Charters, have been followed by hundreds of publications since then. In this paper, the authors chose the reference manual adapted from [34].

3.2 Planning

A systematic literature review was adapted from [34] to achieve the goals of the study in an accurate way. The protocol included a description of the method, research questions, search strategy and process, data extraction, and results. The study was conducted during spring-summer 2014.

3.3 Research Questions

The authors formulated the following research questions:

- RQ1: What is the implementation sequence (of 3 items) of ITIL V3 processes most suggested/used in SMEs?
- RQ2: What are the most suggested/used criteria for determining an implementation sequence of ITIL V3 processes in SMEs?

3.4 Search Strategy

To search the databases, defined later on, several strings were used:

- 1 (case study or lesson learned or adoption or exploratory study) and ((implementation or implementing) and (ITIL or IT framework or IT infrastructure library)).
- 2 “ITIL V3” and “implementation”.
- 3 “ITIL” and “implementation”.
- 4 “implementing” and “ITIL V3”.
- 5 “implementing” and “ITIL”.

Given the diversity of sources to be consulted electronically via the web, a set of electronic databases of established literature resources were used for the study (ACM Digital Library, ACM Digital Library, IEEE Computer Science Digital Library, Springer Link, Springer Author Mapper, Science@Direct, Software Engineering Institute, ISI – Web of Knowledge and Google Scholar).

3.5 Search Process

The search process is presented in Figure 1.

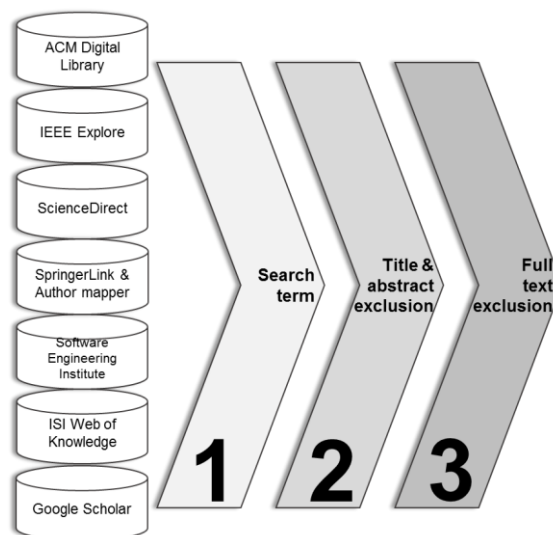


Figure 1. Search process

The procedure for selecting the papers is as follows. In the first step, the search string was executed in the search engine of each selected source of information. In the second step, papers were reviewed based on titles, abstracts, conclusions, references and keywords, and then were classified into three different groups:

- Relevant papers: the paper satisfies the inclusion criteria.
- Process assessment papers: if the paper is somehow related to the topic.

- Excluded papers: other papers, which are not relevant to the topic or are duplicated.

When there was doubt about the classification of a paper, it was included in the relevant group, allowing the possibility of discarding it during the next phase when the full texts of the papers were studied. Third, each full article was retrieved and read to verify its inclusion or exclusion. The reason for the exclusion or inclusion in this third phase was documented. Inclusion and exclusion criteria were as follows:

- Inclusion criteria:
 - Papers published after 2006.
 - Papers related to ITIL V3 and its implementation will be marked as relevant.
 - Papers that show specific aspects regarding implementation sequence for ITIL V3 will be marked as primary.
- Exclusion criteria
 - Publications whose text is not available.
 - Papers that are not related to the topic.

3.6 Data extraction

The data extracted from each paper was documented and kept in a reference manager. In this tool, groups of elements based on the result obtained in each filter were created. And for items that passed the first filter, the full text was recovered, and was also stored in the reference manager. To be able to analyse the final set of papers, it was necessary to classify and sub-classify them in more ways than just according to the framework defined previously. With the information collected in this form, it was possible to obtain qualitative and quantitative information to answer the research questions in a feasible way.

3.7 Results

Table 1 shows the main results of the systematic literature review, including the source where papers were found, and how many of them were considered relevant and primary.

Table 1. Systematic Literature Review results.

Sources	Found	Relevant	Primarys
ACM Digital Library (String 1)	80	5	0
ACM Digital Library (String 2)	468	7	2
IEEE Computer Science Digital Library	23	2	2
Springer Link	43	1	1
Springer Author Mapper	319	19	0
Science@Direct	281	14	4
Software Engineering Institute	7	1	0
ISI – Web of Knowledge	44	21	0
Google Scholar	11	7	0
Total	1276	77	9

Focusing on Primary Studies, these are as follows:

- 1 Meziani, R., & Saleh, I. (2010, November). e-government: Itil-based service management case study. In Proceedings of the 12th International Conference on Information Integration and Web-based Applications & Services (pp. 509-516). ACM.
- 2 Lahtela, A., Jantti, M., & Kaukola, J. (2010, February). Implementing an ITIL-based IT service management measurement system. In Digital Society, 2010. ICDS'10. Fourth International Conference on (pp. 249-254). IEEE.

- 3 Wang, H., Sun, S., Huang, Y., & Cheng, S. (2008, December). An ITIL-Based IT Service Management Model for Garment Enterprises. In *Information Management, Innovation Management and Industrial Engineering, 2008. ICIII'08. International Conference on* (Vol. 2, pp. 47-51). IEEE.
- 4 Hoerbst, A., Hackl, W. O., Blomer, R., & Ammenwerth, E. (2011). The status of IT service management in healthcare-ITIL® in selected European countries. *BMC medical informatics and decision making*, 11(1), 76.
- 5 Lucio-Nieto, T., Colomo-Palacios, R., Soto-Acosta, P., Popa, S., & Amescua-Seco, A. (2012). Implementing an IT service information management framework: The case of COTEMAR. *International Journal of Information Management*, 32(6), 589-594.
- 6 Esteves, R., & Alves, P. (2013). Implementation of an information technology infrastructure library process—the resistance to change. *Procedia Technology*, 9, 505-510.
- 7 Abreu, J., Martins, P. V., Fernandes, S., & Zacarias, M. (2013). Business processes improvement on maintenance management: A case study. *Procedia Technology*, 9, 320-330.
- 8 Stauffer, G., & Scott, R. (2013, November). Adventures in change management: getting everyone on the same page. In *Proceedings of the 41st annual ACM SIGUCCS conference on User services* (pp. 23-26). ACM.
- 9 Valiente, M. C., Garcia-Barriocanal, E., & Sicilia, M. A. (2012). Applying an ontology approach to IT service management for business-IT integration. *Knowledge-Based Systems*, 28, 76-87.

In order to present the specific findings of this systematic review, a comparison table is constructed (see Table 2), where the primary studies are analyzed using the following three questions:

- A. Is the implementation conducted within SMEs?
- B. Is there a sequence of implementation defined?
- C. Is there any criteria defined for this implementation?

Table 2. Primary Studies Evaluation

Primary Study	A	B	C
1	○	●	◐
2	◐	●	●
3	●	◐	●
4	◐	◐	●
5	○	◐	◐
6	○	●	●
7	◐	●	●
8	○	●	●
9	○	●	●

Legend: ● Yes, ○ No, ◐ Not explicitly specified.

In general, it can be observed that only one study reported ITIL implementation in an SME; five studies were performed on large enterprises, and in the remaining 3 studies, the information about the size of the enterprise was not mentioned. Six studies mentioned explicitly an implementation sequence of ITIL processes; however, in three studies, ITIL processes were mentioned as part of a implementation case study but the order was not

specified. Finally, in seven cases, one or more selection criteria were used in order to decide an implementation sequence of ITIL processes.

Using the previous analysis, the ITIL implementation sequence is obtained, whereas in cases where the ITIL processes are not mentioned as an explicit implementation sequence, the sequence was constructed based on the order of appearance of processes in the article. So, the ITIL process that was most suggested as the first process to be implemented is Incident Management, which was suggested 7 times. In the implementation sequence, Request Fulfillment Process is the second most suggested process in primary studies. Finally, Service Level Management Process occupies third place in the implementation sequence. The results are shown in Figure 2.

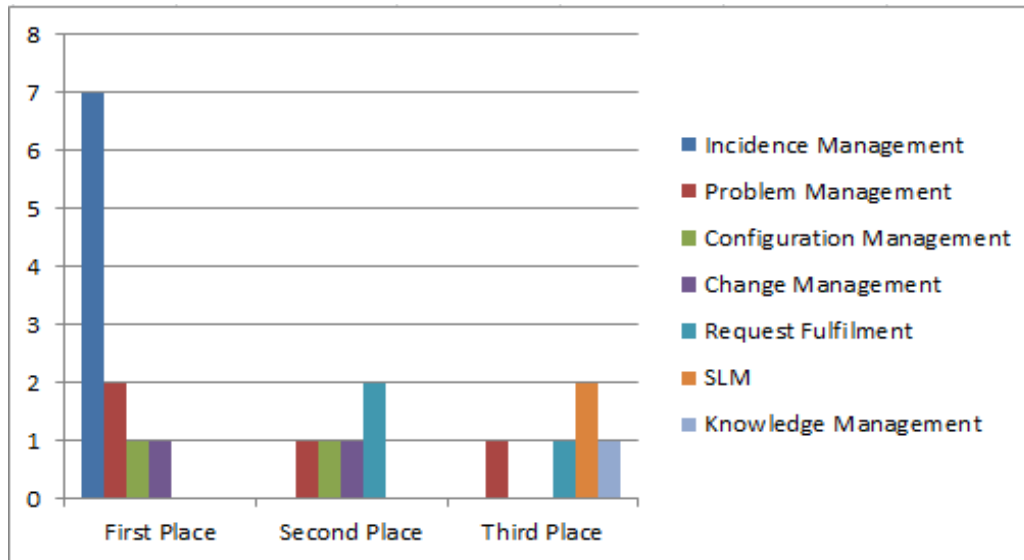


Figure 2. ITIL implementation sequence obtained from systematic review results.

Related to the criteria used in order to select the implementation order of ITIL processes, seven criteria are identified in selecting primary studies although sometimes more than one criterion was mentioned per study or no criterion was explicitly specified. Thus, Business needs and Quick wins are the criteria most suggested by the authors, criteria such as Customer Demands, Strengthen Service Support and Feasibility, are suggested too.

4. THE STUDIES

4.1 Study 1: Processes delimitation

The ITIL framework is comprised of 26 processes. The aim of Study 1 is to focus on just the ones that, according to the study, will be of importance in the context of a small software enterprise.

PLANNING

To achieve the objective of the study, five professionals with experience in ITIL application in small software companies were selected on the basis of their experience. The subjects were selected from those who answered positively to a personal invitation sent by the authors among their personal contacts. The average age of the sample was 42.2 years old. One participant was female and four were male. Participants' nationalities were: Spanish (3), Mexican (1) and Brazilian (1).

DATA COLLECTION

The Delphi study consisted of choosing the most important processes from the 26 presented in ITIL. The meeting was performed by means of videoconference. In the first round, an initial record was obtained based on responses from the experts. This record was later presented to panelists in the second round, who had to agree on a group response. Subjects took 22 minutes on average to complete these two rounds.

THREATS TO VALIDITY

Agreeing with [35], Delphi studies are affected by their own threats to validity that arise from pressures for convergence of predictions, but in this case, the level of expertise and common interest in the topic help to increase the content validity. Regarding internal validity, the authors ensured a similar level of knowledge among participants. Finally, with regards to external validity, the authors believe that the sampling method is acceptable in terms of number and diversity.

RESULTS

According to panelists, the list of processes is as follows:

1. Service Portfolio Management Process
2. Financial Management for IT Services Process.
3. Demand Management Process.
4. Service Catalogue Management Process.
5. Service Level Management Process.
6. Availability Management Process.
7. Capacity Management Process.
8. IT Service Continuity Management Process.
9. Information Security Management Process.
10. Supplier Management Process.
11. Change Management Process.
12. Service Asset and Configuration Management Process.
13. Release and Deployment Management Process.
14. Knowledge Management Process.
15. Event Management Process.
16. Incident Management Process.
17. Request Fulfillment Process.
18. Problem Management Process.
19. Access Management Process.
20. Continual Service Improvement.

The consensus can be described by Kendall's coefficient of concordance (W), which measures the degree of association among k sets of rankings. Schmidt (1997) proposed that strong consensus exists for $W \geq 0.7$; moderate consensus for $W = 0.5$; and weak consensus for $W < 0.3$. In our case, the Kendall's coefficient of concordance test reached $W = 0.709$ ($n = 5$, $P < 0.01$). This shows a strong consensus among panelists.

4.2 Study 2: Sequencing ITIL implementation in software SMEs

Taking into account results obtained in Study 1, Study 2 aims to determine the implementation sequence for ITIL in the scenario of a software SME.

PLANNING

The authors employed a questionnaire to investigate ITIL implementation sequence. The questionnaire was created with the LimeSurvey platform, which enables the construction of electronic online questionnaires. In the survey a set of introductory and sample data is formulated, including the country of the respondent. In addition, the experts were asked to choose whether they were answering as individual experts or in the name of their company. The list of 20 ITIL processes from Study 1 was presented and experts were asked to choose the first 3-5 processes from that. Finally, the subject was asked to provide the criteria used for selecting these processes.

DATA COLLECTION

As stated before, an online survey was employed in the study. A solicitation letter was transmitted by e-mail to a set of contacts during the last months of 2014. The authors invited individuals experienced enough, according to their profiles, to answer the survey. The e-mail message described the purpose of the research while inviting each receiver to participate in the survey by clicking on a link. The responses from 47 participants were collected on the web. According to the number of responses received, the validity of results was 85.11%. In the end, 40 responses obtained were complete and valid.

THREATS TO VALIDITY

Several threats to validity were identified by the authors and will be presented below. Regarding content validity, a pilot questionnaire was made prior to the final implementation of the instrument to enhance the questionnaire. The sample for this study was composed of three ITIL experts. The process ended with an enhancement of the questionnaire in terms of expressions. This process can be applicable also to construct validity and reliability, which are tackled by means of multiple tests to the questionnaire.

With regards to conclusion validity, the authors considered that, given the composition and size of the sample, it is representative and significant enough for the aims of this research.

Concerning internal validity, the respondents were in all cases chosen because of their expertise and experience, and the authors believe that, given that all respondents are ITIL certified, they may present comparable levels of knowledge or expertise on the topic.

Finally, on the subject of external validity, two different threats are assumed by the authors. The first is the size of the sample, which can complicate the generalization of the results. The second is the fact that the sample was not taken randomly; it depended on the selection of the authors.

RESULTS

The sample, as stated before, was composed of 40 respondents. The distribution of respondents among countries can be seen in Figure 3:

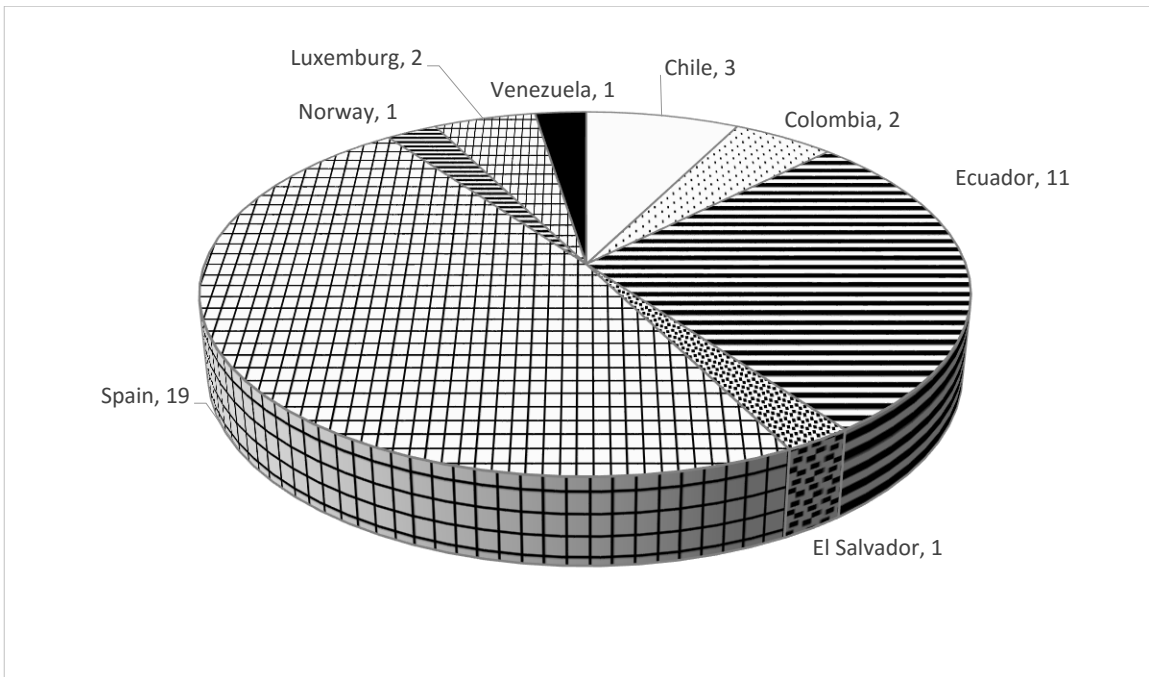


Figure 3. Study 2 sample by country.

The results of the analysis show that the most suggested ITIL process as the first process to be implemented is the Incident Management process, which was selected in the survey 8 times. Service Level Management process and Service Catalogue Management process are the second most suggested processes. Finally, Service Asset and Configuration Management Process occupies the third place in the implementation sequence. The results are shown in detail in Figure 4.

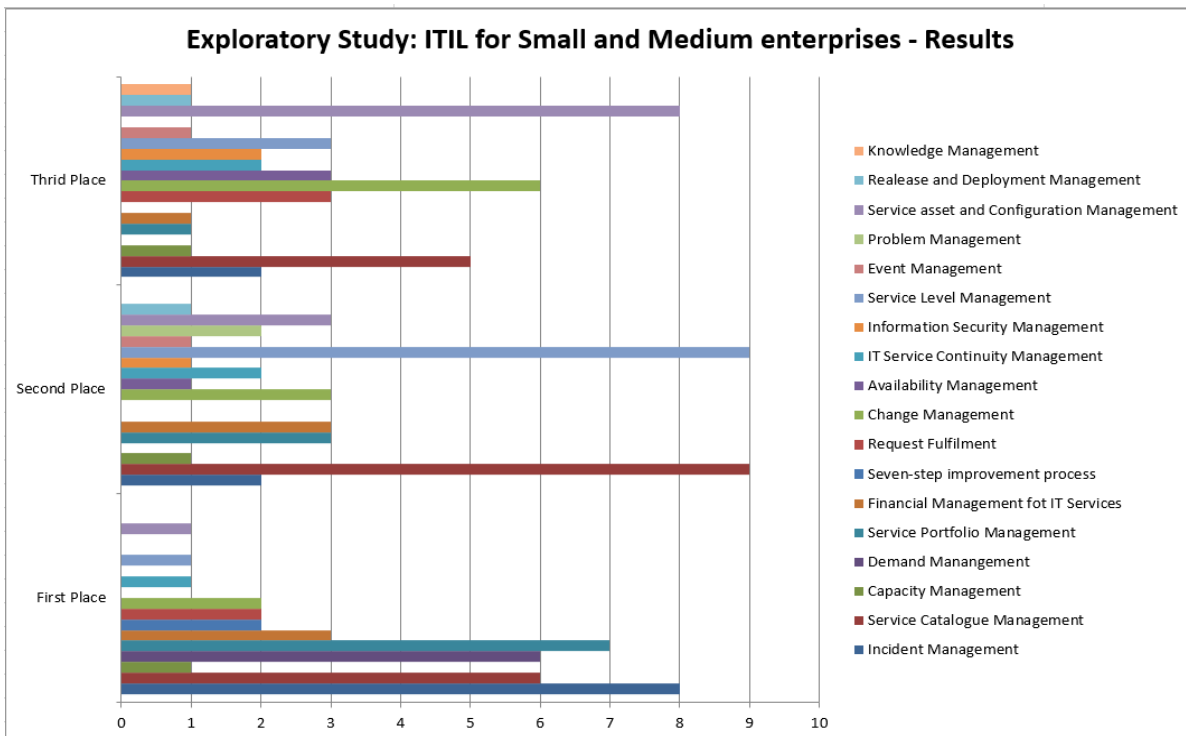


Figure 4. ITIL implementation sequence obtained from survey results.

Related to the criteria used to select the implementation order of ITIL processes, 10 criteria were used by the respondents, although sometimes more than one criterion was mentioned per

response. Thus, “Quick wins” is the criterion most reported by experts; criteria such as Strengthen Service Support, Customer Services and Demands Prioritization are suggested too.

5. DISCUSSION AND CONCLUSIONS

Our study shows that the Incident Management process is the first ITIL process to be implemented by Software SMEs. This is a finding that is aligned with Marrone et al. [11], who note that Incident Management is adopted by 95% of organizations using ITIL. However, the authors believe that the reasons for choosing this process are rooted in the fact that this process shows results more quickly than other processes related to the ITIL life cycle, especially from the customer perspective, through increased user satisfaction. This case has been reflected in the literature and highlighted by Valiente et al. [36], who emphasize that incident management is one of the main candidates as a starting point, given that it is highly visible to the business, and it is therefore easier to demonstrate its value.

Thus, criteria for ITIL implementation are related to the business needs and the challenge to improve the service offered to customers and the way this situation is resolved by enterprise employees in order to satisfy customer demands.

Limitations in the study include three major aspects. First, regarding the composition of the sample in terms of countries, number of subjects and organizations. Second, the underlying introductory approach adopted in the study can be reflected in the target universe of study, software SMEs and the methods employed. Finally, the design of the study is seen as a limitation; in the case of this paper subjects select ITIL processes without taking into account the previous implemented processes. According to Marrone et al. [11], the first process selected influences the cohort of processes adopted subsequently, so this is an important limitation in terms of research design.

Future research will be focused on tackling these limitations by expanding the composition of the sample and adopting a broader approach in the research design and by investigating specific limitations or paths present in ITIL implementations. The authors also propose research on interconnections between ITSM approaches with software process improvement initiatives in terms of best practices and other enablers. Finally, the authors believe it is necessary to investigate ITIL implementation issues in all organizations in the software industry regardless of their size and country.

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