

Building an IT service catalog in a small company as the main input for the IT financial management

Magdalena Arcilla ^a, Jose A. Calvo-Manzano ^{b,*}, Tomás San Felu ^b

^a Universidad Nacional de Educación a Distancia, Escuela Técnica Superior de Ingeniería Informática, C/Juan del Rosal 16, 28040 Madrid, Spain

^b Universidad Politécnica de Madrid, Facultad de Informática, Campus de Montegancedo s/n, 28660 Boadilla del Monte, Madrid, Spain

ABSTRACT

IT departments in non-IT small companies lack guidelines for defining the services they provide and for assigning costs to these services. This article compares international models and standards and describes an approach that can be used by these companies in order to define and implement their service catalog to be used as an input for their IT financial management. The proposed solution is based on the concept of a process asset library. The proposal has been tested in a non-IT small company. The results provide useful insights for companies interested in defining their own service catalog from a standard service catalog.

1. Introduction

The past few decades have supposed a drastic transformation in the use of Information Technology (IT) [1]. Since the early 80's until today, the data centers, large and expensive, have been replaced by personal computers that are affordable even for very small and small companies. The current presence of computers in business supports its growth in terms of productivity, regardless of size or industry [2,3]. Also, it is not surprising that IT investments are an ever-increasing cost of business. According to a business report conducted in the U.S. [4], the majority of CEOs (Chief Executive Officers) and CIOs (Chief Information Officers) consider IT as a strategic advantage.

Therefore it would be logical to assume that IT spending is under control, after all, it is essential for productivity growth and is considered an important asset, especially for very small and small companies. However, this is not what happens: according to Schneider [5], 86% of U.S. financial executives reported that their IT expenditures are not under adequate control. These are alarming news for the corporate world, especially for very small and small companies that are a total of 99% of companies worldwide [6] and, particularly, in Spain [7] (see Table 1).

It is also a common practice in companies that their financial departments include the costs of the IT infrastructure without making any

distinction with other existing costs. This is worse, if the company does not know what services associate to these costs (lack of service catalog) [8].

In most very small and small companies, the IT department is often seen as a cost center [9]. A cost center is a department whose cost is added to the overall cost of the company, but only contributes indirectly to the profits (its costs must be paid whether the company does business or not). Thus, according to Trastour and Christodoulou [10], IT managers are under increasing pressure to justify IT costs and show the other managers of the company that they can transform IT assets into business services, while they clearly link costs identified with the company profits.

On the one hand, there are many methodologies that quantify the return on IT investments, and on the other hand, those companies (mainly very small and small companies) where the IT department is a cost center, are left to chance the assessment and allocation of IT costs. Therefore, the very small and small companies that consider IT as a cost center [9] are lacking in the financial management of IT.

This policy of financial management (cost center and traditional accounting system) together with the lack of a service catalog does not help one understand the actual costs associated with different IT services due to their complexity. It can also create a false perception of disconnection from the internal and/or external client, between price and quality. In fact, one of the main problems is to determine the costs of IT services that users receive. The users perceive IT services as a tool for their day to day activities, without being worried, mostly, to make adequate use of them. Customers are not worried about the proper use of services and do not assess objectively whether the services received

* Corresponding author. Tel.: +34 913366924; fax: +34 913366917.
E-mail addresses: marcilla@isi.uhed.es (M. Arcilla), joseantonio.calvomanzano@upm.es (J.A. Calvo-Manzano), tomassanfelu@upm.es (T. San Felu).

Table 1

Spanish companies by layer of employees and their percentages (source: DIRCE 2012).

	Self-employed	Very small 1-9	Small 10-49	Medium 50-199	Large 200-499	Very large +500
# of employees	1,764,987	1,255,390	122,183	19,134	3214	1709
% total	55.16%	40.27%	3.82%	0.60%	0.10%	0.05%
% accumulated	55.16%	95.43%	99.25%	99.85%	99.95%	100%

are balanced between price and expected quality because users are not being aware of the services they receive and their associated cost, and costs are not imputed. Any complaints, from customers or users, about such services will never have an objective basis, creating a gap between the business and the IT department.

When an organization detects that some services are not working well or the perception that the customer has about the services provided by IT is very poor, we begin to question where we are doing things wrong. So we need to take an internal look at the IT department and identify how to improve it. To do this, indicators related to a poor or deficient service level are often used, and can assist in identifying where improvement is needed and where to take appropriate action. According to Esterkin [11], among the typical indicators of a poor service level are the absence of a service catalog and not controlling the costs (i.e., the processes of IT service catalog management and IT financial management).

All these issues would be solved if a company gets to have a good IT service management [12]. It should include the process related to IT service catalog management (available services) and the process related to IT financial management (budgets, costs and charging of the services). The purpose of this research is to create a standard catalog of IT services for helping very small and small companies to define their own IT service catalog as one of the main inputs for their IT financial management process (this process is outside of the scope of this article).

To do this, companies try to implement some of the models and/or standards of best practices related to IT service management used as reference. However, these models and/or standards do not provide guidelines for implementing them. The research methodology that has been followed is presented in Section 2.

This paper is organized into the following sections: Section 2 presents the research methodology that has been followed so that readers can have a better understanding of the article. In Section 3, the main service models and/or standards in terms of IT service catalog management and IT financial management are presented as well as other related works (a summary of the systematic review carried out and some final considerations about IT service management) and the concept of process asset library. Then, in Section 4, the proposed model based on the concept of process asset library is presented. Section 5 presents a case study and the obtained results. Finally, conclusions are presented in Section 6.

2. Research methodology

The research methodology has consisted of the following steps:

- First, a thorough study of the literature related to IT service catalog and IT financial management was performed. In this direction,
 - The main standard and/or process models have been studied in depth.
 - A systematic review related to the topics of IT service catalog and IT financial management were carried out to uncover relevant academic publications and to know if there were some approaches to these topics that can help us for implementing them in a very small or small company.
- The knowledge gained studying the literature is used to conceive a solution that can be applied in very small or small companies.
- Then, a solution has been proposed based on:

- The concept of process asset library. In this way, a standard solution will be provided and each company will have to adapt this solution though the tailoring guidelines (called defined solution). While the standard solution will be the same for all companies, the defined solution will be unique for each one. It is important to indicate that the solution has also included the IT financial management process (although it is outside the scope of this article).
- The requirements of a specific, non-IT small company.
- A survey from the National (Spanish) Statistics Institute related to the use of IT infrastructure by company size obtained through the systematic reviews.
- Finally, the solution has been experienced in the non-IT small company and has been validated by them.

3. Context

An overview of the main IT service management models and/or standards is presented and references to the processes related to service catalog management and financial management are included. Then, the IT service catalog management process and the IT financial management process are briefly described in general terms as well as other related work performed (a systematic reviews). Finally, some considerations related to the IT service catalog management and IT financial management are presented.

3.1. IT service management models and/or standards

The IT service management models and/or standards provide guidance on how services can be managed effectively during their life cycle [13]. The main service management models as they relate to the IT service catalog and IT financial management are: Information Technology Infrastructure Library (ITIL) [14-18], Microsoft Operational Framework (MOF) [19], ISO/IEC 20000 [20-24] and CMMI for services (CMMI-SVC) [25]. Next, an overview of these models is presented.

- ITIL v3 is a collection of guidelines aimed at helping commercial business and government agencies to conduct IT services. The guidelines are maintained by many collaborators under supervision of the United Kingdom's Office of Government Commerce (OGC), which published the 3rd version of the standard composed of five books, each describing a phase in the ITIL's service life cycle as shown in Fig. 1: Service Strategy [14], Service Design [15], Service Transition [16], Service Operation [17] and Continual Service Improvement [18].
- Service portfolio management (which includes the service catalog) and the financial management for IT services are included in the service strategy phase. Detailed information about the service catalog is also included in the process of service catalog management that is included in the Service Design publication phase.
- Microsoft® Operational Framework (MOF) 4.0 [19] is a meta-framework released in 2008 – that is, it incorporates the core requirements of the service management industry's best practices and frameworks into one free, easy-to-understand set of guidance.

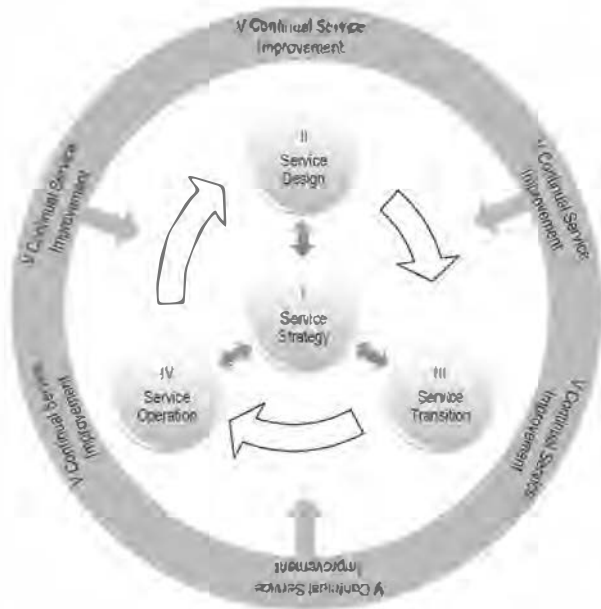


Fig. 1. ITIL v3 service lifecycle (from [14]).

The goal of MOF is to provide guidance to IT organizations to help them create, operate, and support IT services while ensuring that the investment in IT delivers an expected business value at an acceptable level of risk. The IT service lifecycle is composed of three ongoing phases (plan, deliver and operate), and one foundational layer (manage) that operates throughout all of the other phases. MOF organizes the processes into Service Management Functions (SMFs). Fig. 2 shows the IT service lifecycle phases and the SMFs within each phase.

The plan phase is related to IT service portfolio, services and IT financial management. The SMFs are the *business/IT alignment* for the IT service portfolio and services, and the *financial management* for the IT financial management.

- ISO/IEC 20000 is the first international standard for IT service management. It was developed in 2005, by ISO/IEC JTC1 SC7 and revised in 2011 [20]. It specifies requirements for the service provider to plan, establish, implement, operate, monitor, review, maintain and improve an SMS. The requirements include the design, transition, delivery and improvement of services to fulfill agreed service requirements. The standard is divided into five parts as follows: ISO/IEC 20000-1:2011 Service management system requirements [20], ISO/IEC 20000-2:2012 Guidance on the application of service management systems [21], ISO/IEC TR 20000-3:2012 Guidance on scope definition and applicability of ISO/IEC 20000-1 [22], ISO/IEC TR 20000-4:2010 Information technology – Service management – Part 4: Process reference model [23], ISO/IEC TR 20000-5:2010 (Information technology – Service management – Part 5: Exemplar implementation plan for ISO/IEC 20000-1) [24].

Processes related to service management are classified into categories (see Fig. 3): Processes related to the IT service catalog and IT financial management are under the service delivery category.

- The CMMI-SVC model [25] provides guidance for applying CMMI best practices in a service provider organization. Best practices in the model focus on activities for providing quality services to customers and end users. CMMI-SVC integrates bodies of knowledge that are essential for a service provider. CMMI-SVC contains 24 process areas. All CMMI-SVC practices focus on the activities of the service provider. Seven process areas focus on practices specific to services, addressing capacity and availability management, service

continuity, service delivery, incident resolution and prevention, service transition, service system development, and strategic service management processes.

The process area related to service catalog and financial management is Strategic Service Management.

3.2. IT service catalog and IT financial management

All models and/or standards explain these processes in a similar way. Therefore, both processes (IT service catalog and IT financial management) are going to be briefly explained in a general way in the next two subsections. As a summary, it is important to define the services (service catalog) that the IT department will provide the organization. Besides, IT financial management provides a way to measure, control and cover the costs of IT services which have been defined previously in the catalog of services.

3.2.1. Service portfolio management and service catalog management

The service portfolio is a complete set of services that is managed by a service provider. It describes the services of a provider in terms of business value. It represents the commitments and investments of the service provider across all customers and market spaces. It includes three categories of service:

1. Service pipeline. All services that are under consideration or development but are not available to customers. It provides a business view of possible future services and is not normally published to customers.
2. Service catalog. All live IT services, including those available for deployment. It is the only part of the service portfolio published to customers.
3. Retired services. All services that have been retired. Retired services are not available to new customers unless a special business case is made.

An IT service catalog is like a restaurant menu: it presents the IT services that can be provided and supported to customers. This definitely influences the decisions that customers have about what IT can help.

The goal of the service catalog management process is to ensure that the service catalog is produced and maintained, containing accurate information on all operational services and those being prepared to be run operationally. So, it is necessary to define the services, and produce and maintain an accurate service catalog.

In most very small and small companies the IT service catalog is not considered or its usefulness is not understood and where it exists, it has a very technical guidance or is never aligned with business objectives [11]. In addition, an added difficulty is that there are no operational guidelines to guide us in building the IT service catalog oriented or not to very small and small companies (what to do is indicated in all models, but how to do so is not established). So, defining an IT service catalog becomes a very difficult task to be performed by a very small or small company.

3.2.2. IT financial management

Financial management for IT services identifies the balance between the cost and quality of service and maintains the balance of supply and demand between the service provider and their customers. It consists of three main activities:

1. Budgeting. This is the activity of predicting and controlling the income and expenditure of a money within the organization. Budgeting consists of a periodic negotiation cycle to set budgets (usually annual) and the monthly monitoring of the current budgets.
2. Accounting. This is the activity that enables the IT organization to account fully for the way its money is spent. It is necessary to define the cost model to be used (by IT organization, by service, by customer, by location), the categories to record expenses



Fig. 2. The IT service lifecycle phases and SMFs (from [19]).

(cost types and cost elements), and the cost classification (capital or operational costs, direct or indirect costs, and fixed or variable costs).

3. Charging. This is the activity required to bill customers for the services supplied to them. It is necessary to define the charging policies (for example, cost recovery, recovery with an additional margin, notional charging), to decide the chargeable items, to establish how much customers will be charged (pricing), and to produce and present an invoice for services to a customer (billing).

3.3. Related work

Systematic literature reviews are research projects directed at uncovering all available material relevant to a topic of interest. Opposed to unmethodical reviews, systematic reviews have a predefined set of steps that guide the researcher to auditable, reproducible and unbiased study results. The use of guidelines of systematic reviews is intended to help them to be systematic and explicit (not mechanistic) regarding the

researcher posed questions and derived answers. Furthermore, the guidelines are not a substitute for good judgment [26].

The systematic reviews were carried out [27] based on the procedures proposed by [28]. This methodology was chosen because it is believed that it is adequate to uncover gaps in literature that justify this study, restrict (not necessarily reduce) the amount of literature readings necessary to validate the research and to produce unbiased results that are auditable by third parties.

Fig. 4 shows the flow diagram of the systematic reviews carried out. This diagram distinguishes in dotted lines the activity blocks for primary studies selection and information extraction. The first step of the systematic review is defining the research objective. The research objective has been defined in two ways: on the one hand, in terms of identifying currently proposed methods to assess IT service cost in very small or small companies (it is related to the IT financial management process); and on the other hand, in terms of identifying a standard taxonomy of IT services (it is related to the service catalog management process).

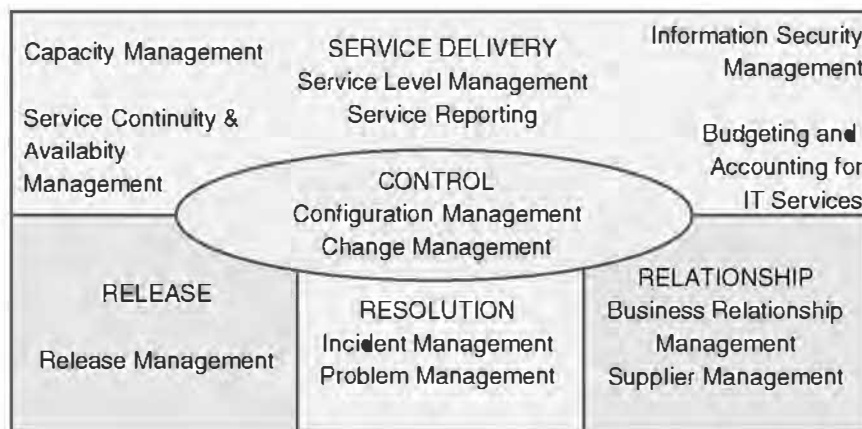


Fig. 3. Service management processes (from [20]).

The second step is to define the sources of information where the research will be carried out. In the following step, inclusion criteria (IC) and exclusion criteria of retrieved publications and selection procedures have been defined. So, primary studies are recorded. Finally, publications previously found are evaluated according to the information inclusion and exclusion criteria.

According to the research objective of identifying currently proposed methods to assess IT service cost in very small or small companies, Table 2 compares the studies uncovered by this systematic review. The table is rather self-explanatory, though a brief clarification on the use of "partially" is needed. "Partially" in this context means that some information is available, albeit not necessarily very detailed or comprehensive to be used exactly as presented. The first row of Table 2 indicates the criteria by which all the papers selected from the systematic review have been assessed. These criteria are the typical activities related to the processes of IT service catalog and IT financial management. And, according to the research objective of identifying a standard taxonomy of IT services, it can be said that no taxonomy related to IT services has been found.

3.4. Final considerations about IT service management

Conceptually, process models and standards describe "what" has to be done, but do not explicitly state "how" to achieve it. IT process models and standards provide guidance on how services can be managed effectively throughout their life cycles – from conception to retirement – in a repeatable manner. However, financial management

activities are left out of the main standard models to be implemented at the business manager's discretion; such a characteristic provides an opportunity for further research on how financial management can be refined to improve process models. In this direction, Table 3 compares the previous IT service management process models and/or standards from the previous sections and presents the gaps in knowledge that this research addresses. The criteria assessed are the typical activities related to the processes of IT service catalog and IT financial management that should be applied in companies (either very small, small, medium or large).

The study of process models and standards showed that no existing model/standard provides enough information on how to perform the service catalog and financial management activities, which leaves this task to be carried out solely at the practitioners' discretion. Financial principles explained in the models provided the theoretical basis for financial management in companies and also showed the need to account for the whole life costs of IT assets.

Taking into account the above information and given the importance of IT service catalog and IT financial management in the context of service management, the purpose of this research is to create a standard catalog of IT services for helping very small and small companies to define its own IT service catalog (that we have called in our proposal model the "defined catalog of IT services") as one of the main inputs for their IT financial management process (this process is outside of the scope of this article). It is not required to develop a detailed catalog, but it is important to get the list of services and their descriptions,

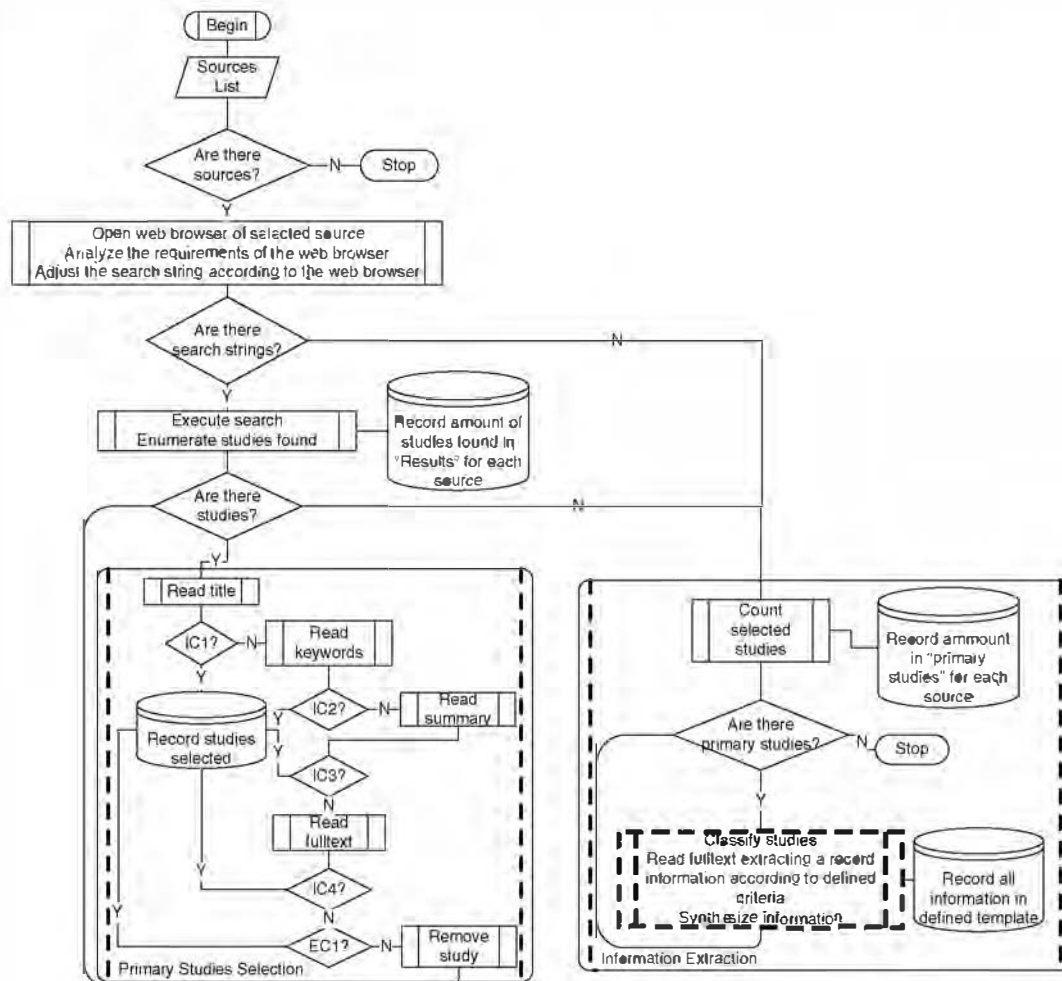


Fig. 4. Flow diagram of the systematic review.

Table 2
Comparison of papers in the systematic review.

Authors related to the systematic review	Provides guidance on assessing IT expenses?	Provides guidance on identifying the total cost of ownership of IT?	Suggests the use of techniques for budgeting?	Financial guidance can be used in SME?	Defines IT cost factors?
[29]	○	○	○	●	○
[30]	○	○	○	●	●
[31]	○	○	○	●	○
[32]	○	○	○	●	●
[33]	○	○	○	●	○
[34]	○	○	○	●	●
[35]	●	○	○	●	●
[36]	○	○	○	●	○
[37]	○	○	○	●	○
[38]	○	○	○	●	○
[39]	○	○	○	●	○
[40]	○	○	○	●	○
[41]	○	○	○	●	○
[42]	○	○	○	●	○
[43]	○	○	○	●	○
[44]	○	●	○	●	○
[45]	○	○	○	●	○
[46]	○	○	○	●	○
[47]	○	○	○	●	○
[48]	○	○	○	●	○
[49]	○	○	○	●	○
[50]	●	○	○	●	○
[51]	○	○	○	○	○

● yes; ○ no; ○ partially.

3.5. Process asset library

The concept of process asset was introduced first in the Software Capability Maturity Model, SW-CMM v1.1 [52], specifically in the key process area "Organization Process Definition". The purpose of this key process area is to develop and maintain a usable set of software process assets that improve process performance across the projects and provide a basis for cumulative long-term benefits to the organization. These process assets provide the foundation to institutionalize processes in an organization. CMMI defines a process asset as anything that the organization considers useful in attaining the goals of a process area [53].

Although the SW-CMM first introduces the concepts of assets, software process database and library of the documentation related to the process, this model does not include the term process asset library.

It was later when the successor of the SW-CMM, the Capability Maturity Model Integration (CMMI) took the concepts of its predecessor and defined the term "Process Asset Library" (PAL). A specific practice was defined for creating and maintaining the process asset library.

CMMI defines a process asset library as a set of process assets that are used in a project or organization. A process asset library provides the essential knowledge for obtaining, defining and disseminating the processes of an organization. It is also the key instrument to share this knowledge throughout the organization.

The development of a PAL is a critical activity for an organization, since all elements of a process that enable its execution are stored in the PAL. The PAL is more than a repository of things, it is the living component of the organization wherein lies the heritage of the processes [54]. If a PAL is not in place, experiences and the best practices of a process are likely to be lost over time, and not used again when implementing them for a new project [55,56].

Having well documented organizational policies, definition of processes, procedures, project plans, quality plans, process aids and, above all, the lessons learned, is the first step so that the organization knows what to do and how to do it, but it is also vital to have an electronic medium in which to save this information and make it available to the entire organization [57].

The PAL provides a key element that is required to support process improvement in an organization. A PAL allows to be made public within the organization the new rules and ways of working in software projects that the organization initiates. A PAL that is well defined and implemented reduces planning, implementation and training costs in the organization [58].

In summary, the main goal of a PAL is to provide an organized, indexed, searchable repository of process assets and make it easily accessible to anyone who needs process guidance information. The PAL is a collection of assets, maintained by an organization, for use by projects in developing, tailoring, maintaining, and implementing their software processes and is an important resource that helps to reduce the effort in using processes. In addition, the PAL should also

Table 3
Comparison related to IT service catalog and IT financial management among IT service management models.

Criteria assessed	ITIL	MOF	ISO 20000	CMMI-SVC
Does it define the standard service catalog related to a very small/small company with and IT department?	○	●	○	○
Does it define the IT cost factors?	○	○	○	○
Does it provide guidelines to classifying IT spending?	○	○	○	○
Does it provide guidelines to assess IT spending?	○	○	○	○
Does it provide guidelines on IT charging?	○	○	○	○
Does it provide guidelines about how to be applied to a very small/small company?	○	○	○	○
Does it indicate what to do?	●	●	●	●
Does it indicate how to do?	○	○	○	●

● yes; ○ no; ○ partially.

contain the lessons learned from those organizational projects that have been successful, in order to increase the knowledge database with each project's best practices (for more information about this PAL and its structure, refer to [59]).

4. Proposal model

The proposal solution defines, implements, and evaluates the IT service catalog and the IT financial management, through the use of a process asset library [59,60]. For this, the solution proposed has been divided into three phases, as shown in Fig. 5. In this article, the focus will be only on the IT service catalog (IT financial management is outside of the scope of the article as we have indicated previously).

1. The first phase (labeled as "1. Define standard model") will be the foundation from which very small and small companies will select their particular solution. This phase consist of defining a standard solution for the process of IT service catalog management. The result of this phase is a standard set of services (called standard catalog) that can be provided by the IT department of a very small or small company.
2. The second phase (labeled as "Defined model") will be the solution for a specific very small or small company. In this phase, IT departments that are going to implement their service catalog management process will select the services they are going to provide from the standard catalog. The result of this phase is the services (called defined catalog) each IT department provides.
3. The third phase (labeled as "Assessment") shows the process related to the assessment of the IT service catalog. In this phase, IT departments are going to be assessed through a questionnaire in order to know if their IT service catalog process is in place.

The standard and defined phases have similar activities and they are the ones related to the IT service catalog management process. Although the standard catalog is the same for all companies (it is

the standard solution that has been proposed), nevertheless the defined catalog will be different (each company will select each own services).

Next, the activities for defining the standard catalog and the defined catalog as well as the assessment are described.

4.1. Phase 1 – Define the standard model: create the standard IT service catalog

The service catalog is the cornerstone for defining IT business needs. The services of the catalog are grouped in a logical way according to the customer activity. So, a set of the services that the IT department provides to the business is established.

In this activity, the standard IT service catalog is defined (see Fig. 6). This catalog will be the foundation for defining (by selection) the catalog for each very small or small company.

The standard service catalog is based on a survey related to the most used services in most very small, small and medium enterprises, as well as on information provided by the small company where the model is going to be implemented. In particular, the inputs for the standard IT service catalog activity are:

1. Statistical data from the National (Spanish) Statistics Institute for very small, small and medium enterprises that have been obtained taking into account a survey related to the use of IT and electronic commerce [7].
2. Services required by the customers of the IT department of the small company where the model is going to be implemented (this is, the other departments of the company).

Table 4 shows the data from the survey conducted by the National (Spanish) Statistics Institute on the use of Information Technology and Communication (ICT) and Electronic Commerce in Spanish companies during 2009/2010. Its purpose is to know the implementation of IT and electronic commerce in all Spanish companies.

Next, each activity for this phase is detailed.

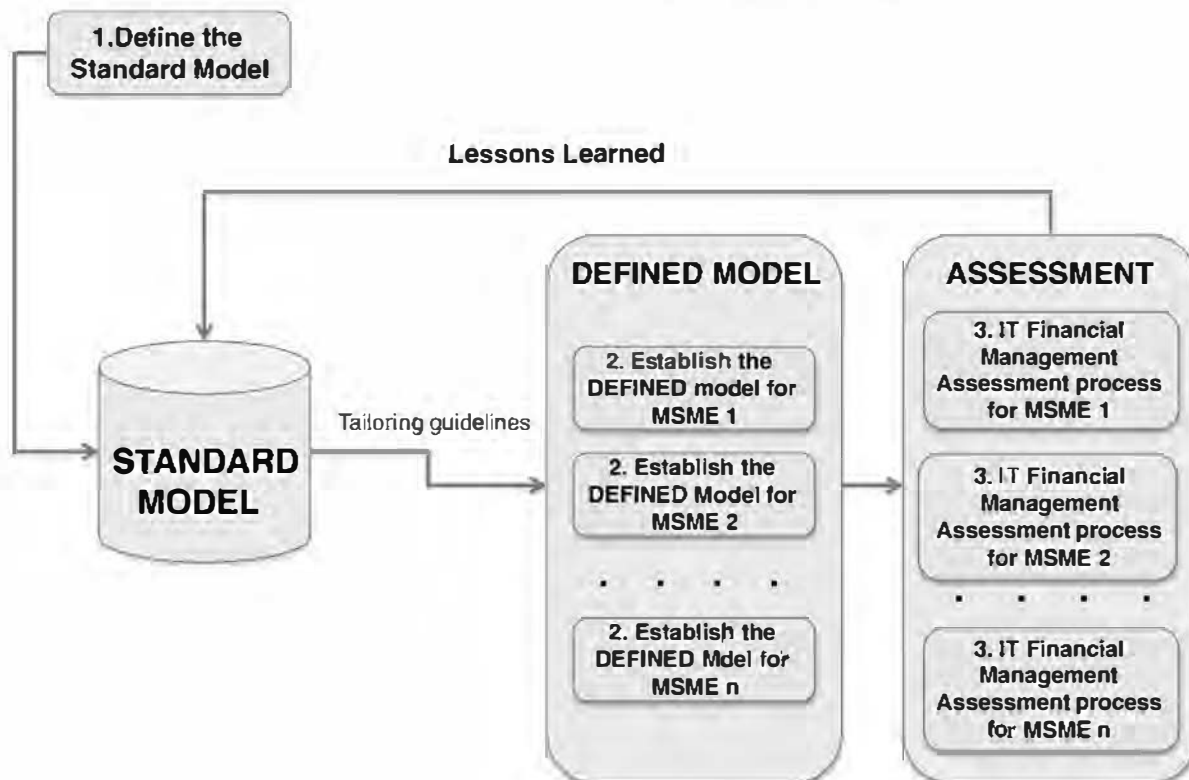


Fig. 5. Model for implementing the IT service catalog.

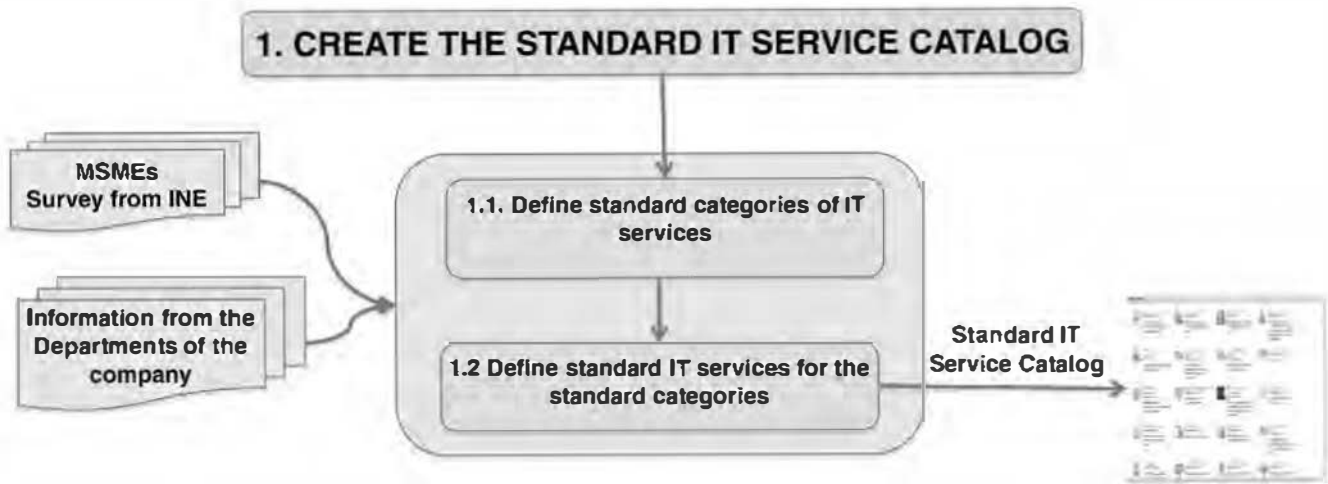


Fig. 6. Phase 1: create the standard IT service catalog.

4.1.1. Define the standard categories related to the IT services

The standard categories of services are shown in the top of Fig. 7. Taking into account that the initial amount of services could be greater than 15, a set of general (standard) services categories is defined. Then, the applicable standard services have been added for each standard category defined (see Fig. 7). Initially, there were more categories, for example maintaining and managing network, defining manuals and documentation, implementing and managing intranet services, but it has been decided to initially reduce the number of categories to the ones shown in Fig. 7 because they are the most commonly repeated in companies. As the research continues or more companies implement the proposed model, additional standard categories can be added.

Next, each standard IT service category is briefly defined:

- **Hardware.** In this category, new services and maintenance services for any hardware elements of a workplace are included here. Some examples are: computer, display, DVD.
- **E-mail.** It includes services related to installing, updating of versions, and maintaining the mail accounts (including changing password, auto-response configuration).
- **Internet.** It includes everything that relates to the software browsers (for example Internet Explorer, Firefox, Mozilla, Google Chrome), as well as any updates and configuration. In this category is also included the company site.
- **Software applications.** Services related to installing new applications, updating and any maintaining of the software applications for the different departments of the company are included here. For example, an accountability department will use a specific application related to accountability (for example, ContaPlus, ExtraSw). Also, base applications or operating systems are also included here (for example,

Adobe Acrobat, WinZip, ftp, Windows XP, Windows server).

- **Backup.** Services related to the backup of the company data for all departments, as well as backup of the company web site are included here.
- **Quality management.** It includes the review and updating related to the Quality Management System (ISO 9001) as well as the regulations related to the Spanish Organic Law of Data Protection (LOPD).
- **Telephony.** It includes the maintenance of the telephone switchboard company (PBX), revising the messages on the automatic answering in summer and winter timetable. It also includes the infrastructure and maintenance of the fixed phone sets and mobile telephony.

4.1.2. Define the standard IT services for each standard category

All the potential IT services to be considered in this research are defined for each standard category. Nevertheless, new standard service categories could be added, and also new standard services could be added for each category as research continues. In Fig. 7, the standard IT services are shown for each standard category defined in the model.

The main difference between the updating services and the maintenance services is that the updating services consist of installing new versions of the related service, while maintaining refers to solving an incident/problem related to the service.

Next, each service is briefly described:

- **Add hardware.** It includes adding any hardware element of a computer, server, displays, peripheral (e.g., printers, computer mice, keyboards), laptops, etc.
- **Hardware maintenance.** It includes any modification on the hardware due to an incident or a service interruption (e.g., if a power supplier is broken, the battery of a CPU does not work).
- **Installing a mail account.** It includes creating a new e-mail account, or adding an existent e-mail account in a new computer.
- **Updating/maintaining e-mail account.** It includes the updating or maintenance for an existent e-mail account, changing the user, removing users, changing password or any incident produced in an existent e-mail account.
- **Installing Internet browser.** It includes adding a new browser, different from the one that is installed (and configured) by defect.
- **Updating Internet browser.** It includes updating a new browser, different from the one that is installed by defect.
- **Maintaining Internet browser.** It includes reinstalling or revising a new browser different from the one that is installed by defect.
- **Maintaining web site.** It includes changing the web design (e.g., changing pictures).

Table 4
Use of IT infrastructure by company size and number of employees.

# of employees →	<10	10-49	50-250	+250
ICT infrastructure				
Computers		98.5	99.8	99.8
Local area network		83.8	96.7	98.3
Wireless local area network		36.5	55.1	68.4
Internet	58.1	96.9	98.8	99.7
Mobil	66.3	90.8	96.1	97.3
e-mail	55.3	96.2	98.5	99.7
% enterprises with internet and web site	25	60.8	81.3	91.1
Automatic data interchange		43	56.2	68

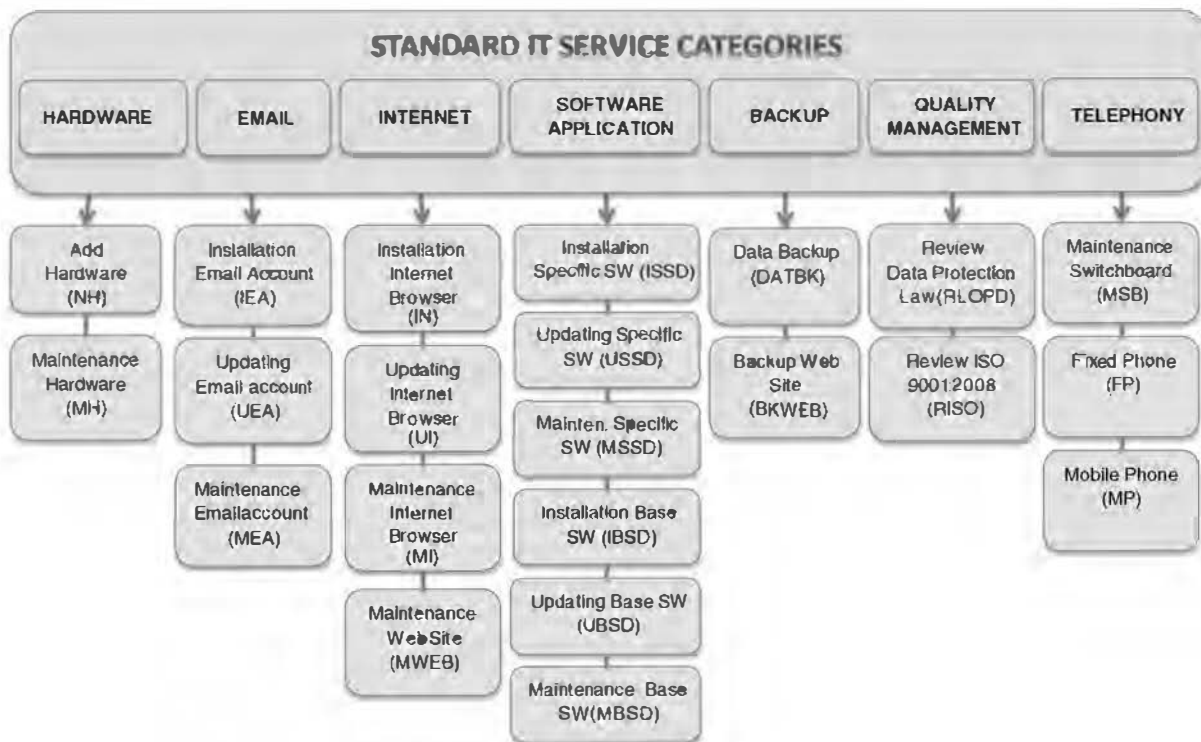


Fig. 7. Standard IT services for each standard service category.

- Installing specific software. It includes installing new specific applications.
- Updating specific software. It includes updating specific applications.
- Maintaining specific software. It includes modifying specific applications.
- Installing base software. It includes installing operating systems as well as base applications (e.g., Adobe Acrobat, WinZip, Windows XP).
- Updating base software. It includes updating operating systems as well as base applications.
- Maintaining base software. It includes reinstalling or modifying some base software due to an incident produced in the operating system or in the base applications.
- Data backup. It includes backup to data and applications.
- Web site backup. It includes backup to the code and the database of the web site.
- LOPD review. It includes the regular reviews for the compliance with LOPD regulations.
- ISO 9001 review. It includes the regular reviews for the compliance with the ISO 9001 standard.
- Maintaining switchboard (PBX). It includes any incident related to the switchboard, as well as changing messages related to the summer and winter timetable.
- Fixed phone sets. It includes the maintenance of fixed phone sets, as well as their configuration.
- Mobile phone. It includes the control and maintenance of the mobiles.

4.2. Phase 2 – defined model: create the defined IT service catalog

In this phase, the defined IT service catalog is defined from the standard services established in the standard model. The IT department related to the very small or small company that is going to implement the model selects the services that is going to provide to the other departments of the very small or small company. This catalog is called defined IT service catalog and owned by each very small or small company.

Next, the activities related to this phase will be detailed through the practical approach.

4.3. Phase 3 – assessment

In this phase companies are going to be assessed related to the IT service catalog management process. A questionnaire has been created taking into account the activities that are defined in the IT service catalog management process (standard process). A total of 8 questions have been defined. Initially the types of answers for the questions are “yes” or “no”, although a Likert scale could be used.

The questionnaire is going to be filled in by the IT department before and after implementing the IT service catalog management process in the company.

So, the IT department (manager) has to answer the questions before implementing the IT service catalog process. Then, according to the number of “yes”, the coverage of the process will be obtained. The coverage of the process will be calculated as the number of questions answered with “yes” divided by the total number of questions. In the case a Likert scale is used, a weighted formula can be used for calculating the coverage.

Then, the IT department implements the defined catalog. It only has to select the services from the standard set of services stored in the PAL and then, get it started.

Finally, the same questionnaire has to be filled in by the IT department after implementing the IT service catalog management process (called defined catalog in our proposal). In the same way, the coverage is calculated. Now, results are going to be compared in order to know if the process has a better coverage after implementing it or not.

5. Case study

The company that has experienced the model is called THE COMPANY for confidentiality reasons. It is a small company with 18 employees and 5 departments:

- Department of Accounting and Finance: is responsible for providing fiscal consultancy and the accounting of the company's clients, as well as its own accounting.
- Department of Labor: is responsible for carrying out payrolls, TCs (a specific document to be delivered to the Spanish Social Security), and updating the Spanish Social Security status of the company's clients, as well as all the activities related to its own human resources.
- Department of Mortgage Management; is responsible for everything related to the management of real estate certificates and processing of inheritances related to the company's clients.
- Department of Legal: is responsible for carrying out legal advices, issuing criminal certificates, wills, and any paperwork related to Department motor vehicles (as, for example, renewal of a driving license).
- Department of IT: is responsible for providing support to the rest of the departments. In addition it is also responsible for ensuring compliance to ISO Quality 9000 and LOPD (Organic Law of Personal Data Protection).

With respect to the infrastructure, THE COMPANY has a midrange server for hosting data and applications, 18 personal computers and 2 laser printers (all connected through a LAN). Each department only can have access (through licenses) to the applications needed for performing their daily work. These applications are installed on the server. There are 4 matrix printers needed for printing official forms. The company also maintains a web site that provides all the services of the company, through the web www.thecompany.com. The web site is hosted on a third-party ISP server, which also provides for storage and security needs. Next, activities for establishing the defined catalog of the company are shown, as well as the results obtained during the assessment before and after implementing the proposal.

- Initial assessment. The questionnaire was initially answered by the IT department previously to implement the IT service catalog. In this case, the coverage of the service catalog process was 37.5%.
- Establish the defined IT service categories. The categories the IT department is going to provide are selected from the standard IT

service categories. The standard categories related to quality management and telephony have not been selected.

- Establish the defined IT services for the defined categories selected. For each defined category of IT services, those services that are going to be provided by the IT department are selected from the standard IT services. In this case, all services have been selected except the ones with an "X" (see Fig. 8).
- Final assessment. The questionnaire was answered by the IT department after implementing the IT service catalog. In this case the coverage of the service catalog process was 50%.

6. Conclusions

IT is still considered by many managers as a representative part of the business expenses. Therefore, the service catalog is a very important component to make visible to the entire company the services that the IT department is providing. In this way, a picture of how IT is linked to the corporate strategy is shown.

A model for helping companies to implement their IT service catalog is proposed. The model is based on the concept of process asset library, where the standard process is defined. The IT services provided have been obtained taking into account the needs of the small company where the model has been implemented and a survey about the use of IT given.

Although the case study has obtained successful results, in the sense of improving the coverage of the service catalog process, however additional experimentations should be carried out for adding validity to the proposed model. Another weakness of the proposal is that the input to the model, that is, the first phase "defining the standard model" is based on the requirements of one enterprise and on a survey from the National (Spanish) Statistics Institute. It should be taken into account the requirements of more companies in order to ensure that the standard categories and services are a comprehensive model. In the case of the survey, new IT technologies like cloud computing are not present when gathering the information for the survey. This new IT technology will probably appear in the update of the survey.

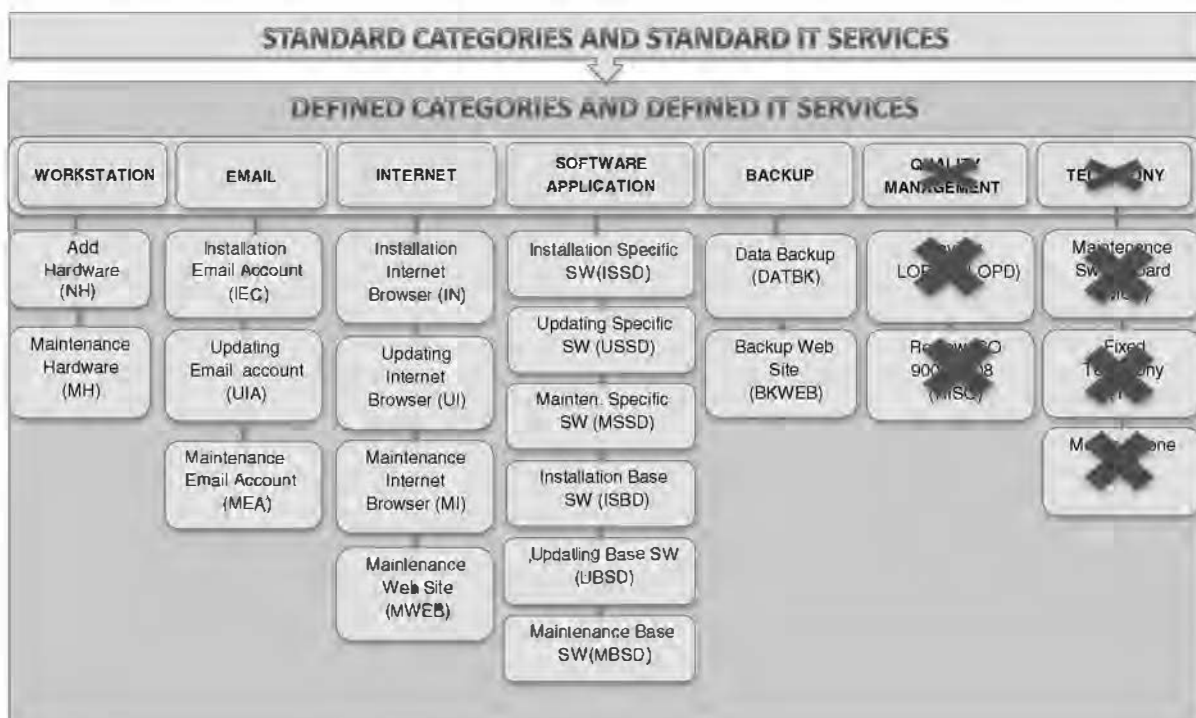


Fig. 8. Defined IT services for each defined service category.

The proposed solution is very flexible, in the sense that standard services could be used by many enterprises and the defined services are the ones related to each enterprise. Each enterprise could propose new categories and/or services to the standard model and, therefore, to the defined model.

The implementation of the service catalog has enabled the company under the case study understanding of the services provided by its IT department and the purposes for which they relate to the business. It is also the entry point for the implementation of the IT financial management process. After implementing the IT service categories and services, THE COMPANY is ready for developing budgets, controlling the money that is spent by department, this is, implementing the IT financial management process.

As a final conclusion, the CEO of the small company indicated that "it is possible to influence in the behavior of the staff, making visible to all the departments of the company, all the services that the IT department is providing them, and sensitizing them about their cost in order to make a good use of the IT".

One open future research line that can be accomplished is related to the automation of the model. It can be done at different levels; first the assessment phase, then the standard phase, and finally the defined phase.

Acknowledgments

This work is sponsored by everis Foundation and Universidad Politécnica de Madrid through the Research Chair in Software Process Improvement for Spain and Latin American Region.

References

- [1] R. Colomo-Palacios, E. Fernández, M. Sabbaghi, A. Amescua Seco, Human and intellectual capital management in the cloud: software vendor perspective, *Journal Universal and Computer Science* 19 (11) (2012) 1544–1557.
- [2] E. Brynjolfsson, L. Hitt, *Computing Productivity: Firm-level Evidence*, MIT Sloan School of Management, MA, Cambridge, 2000.
- [3] M. Garre-Rubín, E. García-Barriocanal, K. Sliński, M.-A. Sicilia, S. Tørling, R. Messnarz, A. Clarke, Analysing the corporate responsibility web pages of consumer electronics companies: implications for process improvement, *IET Software* 6 (5) (October 2012) 451–460.
- [4] L. Cosgrove, W. Worthen, Findings from CXO's IT spending and lesson learned survey, *CIO Magazine*. URL://www.cio.com/article/30479/Findings_from_CXO_s_IT_spending_and_lesson_learned_survey_2001.
- [5] C. Schneider, IT: hold on to your wallet!, *CFO Magazine*. URL://www.cfonet.com/article.cfm/2989074/c_2984312/?f=archives 2000.
- [6] S. Welch, 10–10–10: 10 Minutes, 10 Months, 10 Years – A Life-Transforming Idea, Scribner, 51st Scribner hardcover ed., New York, 2009.
- [7] Directorio Central de Empresas (DIRCE) Instituto Nacional de Estadística, http://www.ine.es/inebmenu/mnu_empresas.htm 2011.
- [8] M. Sottini, *IT Financial Management: Best Practice*, Van Nostrand Publishing, Zaltbommel, 2009.
- [9] T. DuMoulin, R. Flores, B. Fine, *Defining IT Success through the Service Catalogue*, Van Nostrand Publishing, Zaltbommel, 2007.
- [10] D. Trasiour, A. Christodoulou, Towards Robust IT Service Portfolio Management, *Integrated Management of Systems, Services, Processes and People in IT, ISOM 2009*, 2009, 152–163.
- [11] J. Esterlidi, Buenas y malas prácticas en TI, <http://www.deltaasesores.com/articulos/autores-invitados/iaap/>.
- [12] T. Lucio-Nieto, R. Colomo-Palacios, P. Soto-Acosta, S. Popa, A. Amescua-Seco, Implementing an IT service information management framework: the case of COTEMAR, *International Journal of Information Management* 32 (2012) 589–594.
- [13] C. Pardo, F.J. Piño, F. García, M. Plattini, M.T. Baldassare, An ontology for the harmonization of multiple standards and models, *Computer Standards and Interfaces* 34 (1) (2012) 48–59.
- [14] OGC, *ITIL® Service Strategy*, TSO, Norwich, 2011.
- [15] OGC, *ITIL® Service Design*, TSO, Norwich, 2011.
- [16] OGC, *ITIL® Service Transition*, TSO, Norwich, 2011.
- [17] OGC, *ITIL® Service Operation*, TSO, Norwich, 2011.
- [18] OGC, *ITIL® Continual Service Improvement*, TSO, Norwich, 2011.
- [19] Microsoft® Operations Framework, version 4.0, MOF overview, <http://ndcrosft.com/technet/Solution/accelerators>.
- [20] ISO/IEC 20000-1:2011 Information Technology – Service Management – Part 1: Service Management System Requirements, ISO, 2011.
- [21] ISO/IEC 20000-2:2012, Information technology – service management – part 2, Guidance on the Application of Service Management Systems, ISO, 2012.
- [22] ISO/IEC TR 20000-3:2012 Information Technology – Service Management – Part 3: Guidance on Scope Definition and Applicability of ISO/IEC 20000-1, ISO, 2012.
- [23] ISO/IEC TR 20000-4:2010 Information Technology – Service Management – Part 4: Process Reference Model, ISO, 2010.
- [24] ISO/IEC TR 20000-5:2010 Information Technology – Service Management – Part 5: Exemplar Implementation Plan for ISO/IEC 20000-1, ISO, 2010.
- [25] CMMI Product Team, *CMMI for Services, version 1.3*, CMU/SEI-2010-TR-034, Carnegie Mellon University, Pittsburgh, 2010.
- [26] S. Green, J. Higgins, *Cochrane Handbook for Systematic Reviews of Interventions 4.2.5*, John Wiley & Sons, Ltd, Chichester, 2005.
- [27] F. Alberó, Definition of a Model for IT Cost Assessment in Non-IT Small Enterprises, Master Thesis Universidad Politécnica de Madrid, Boadilla del Monte, 2010.
- [28] J. Biolchini, P.G. Mian, A.C.C. Natali, G.H. Trassasos, Systematic Review in Software Engineering, RT-F5679/05., Technical Report Universidad Federal Rio de Janeiro, Rio de Janeiro, 2005.
- [29] A.B.S. Electric, Determining total cost of ownership for data center and network room infrastructure, http://www.apcmec.com/salestools/CMRP-519PQC_R3_EN.pdf.
- [30] Z. Irani, J.N. Ezingard, R.J. Grieve, Integrating the costs of a manufacturing IT/IS infrastructure into the investment decision-making process, *Technovation* vol. 17 (no. 11–12) (1997/12) 695–706.
- [31] B.A. Aubert, M. Patry, S. Rivard, Assessing the risk of IT outsourcing, *Proceedings of Hawaii International Conference on System Sciences*, 1998, pp. 685–692.
- [32] C.S. Peebles, I. Antolovic, Cost (and quality and value) of information technology support in large research universities, *Educum Review* vol. 34 (no. 5) (1999).
- [33] P. Balasubramanian, N. Kulatilaka, J. Storck, Managing information technology investments using a real-options approach, *The Journal of Strategic Information Systems* 9 (1) (2000) 39–62.
- [34] A.L. Taylor, F.A. Schmittlein, Creating a Cost Framework for Instructional Technology, The Technology Source at University of North California, 2000.
- [35] J.S. David, D. Schluff, R.S. Louis, Managing your total IT cost of ownership, *Communications of the ACM* 45 (1) (2002) 101–106.
- [36] P. Hallikainen, H. Kivijarvi, K. Nurminen, Evaluating strategic IT investments: an assessment of investment alternatives for a web content management system, *Proceedings of the HICSS-35*, Hawaii, 2002, pp. 2977–2986.
- [37] D. Pröbitz, A proposal to use a balanced scorecard to evaluate information for health: an information strategy for the modern NHS (1998–2005), *Computers in Biology and Medicine* 32 (3) (2002) 221–236.
- [38] C. Verhoef, Quantitative IT portfolio management, *Science of Computer Programming* 45 (1) (2002) 1–96.
- [39] E.J. Grenchus, R.A. Keene, A technique used for estimating the processing cost of IT equipment received by an asset recovery center, *IEEE International Symposium on Electronics and the Environment*, 2003, pp. 205–208.
- [40] C. Verhoef, Managing multibillion dollar IT budgets using source code analysis, *Proceedings of the Third IEEE International Workshop on Source Code Analysis and Manipulation*, 2003, pp. 77–78.
- [41] P.E.D. Love, Z. Irani, An exploratory study of information technology evaluation and benefits management practices of SMEs in the construction industry, *Information Management* 42 (1) (2004) 227–242.
- [42] M. Keil, A. Tiwana, Beyond cost: the drivers of COTS application value, *IEEE Software* 22 (3) (2005) 64–69.
- [43] K.M. Chandy, T. Lu, M.Z. Daniel, Enterprise computing systems as information factories, *Proceedings EDOC'06, IEEE International Enterprise Distributed Objects Computing Conference*, 2006, pp. 427–432.
- [44] P.E.D. Love, Z. Irani, A. Ghoneim, et al., An exploratory study of indirect ICT costs using the structured case method, *International Journal of Information Management* 26 (2) (2006) 167–177.
- [45] Q.-s. Sheng, Z.-y. Shao, Y.-w. Zhang, An analysis of the efficiency of central costs in large-scale enterprises (groups), *International Conference on Management Science and Engineering*, 2006, pp. 1729–1732.
- [46] K. Huang, Towards An Information Technology Infrastructure Cost Model, Center for Technology, Policy, and Industrial Development, Massachusetts Institute of Technology, Cambridge, Massachusetts, 2007.
- [47] P. Neriotti, E. Paolucci, Assessing the strategic value of information technology: an analysis on the insurance sector, *Information Management* 44 (6) (2007) 568–582.
- [48] T. Chunhua, J. Shun, C. Rongzeng, et al., Business value assessment of packaged applications, *IEEE Congress on Services 2008*, 2008, pp. 67–70.
- [49] H.S. Cha, M.E. Pingry, M.E. Thatcher, What determines IT spending priorities? *Communications of the ACM* 52 (8) (2009) 105–110.
- [50] P. Narman, T. Sommerstad, S. Sandgren, A framework for assessing the cost of IT investments, *PICMET 2009 Proceedings*, 2009, pp. 3154–3166.
- [51] D. Trasiour, A. Christodoulou, Towards Robust IT Service Portfolio Management, *Processes and People in IT, Integrated Management of Systems, Services*, 2009, 152–163.
- [52] Mark C. Paulk, Charles V. Weber, Suzanne M. Garcia, Mary Beth Chrissis, Marilyn Bush, Key practices of the capability maturity model, version 1.1, Technical Report, CMU/SEI-93-TR-025, Pittsburgh, 1993.
- [53] C.M.M.I. Product Team, *CMMI® for development, version 1.3*, CMMI-DEV, V1.3, Technical Report, CMU/SEI-2010-TR-033, Pittsburgh, 2010.
- [54] A. Heredia, J. García-Guzmán, A. Amescua, M.I. Sánchez-Segura, Interactive knowledge asset management: acquiring and disseminating tacit knowledge, *Journal of Information Science and Engineering* 29 (2013) 133–147.
- [55] S. Fogle, C. Loulis, B. Neuendorf, The benchmarking process: one team's experience, *IEEE Software* vol. 18 (5) (2001) 40–47.
- [56] D. Martín, J. García Guzmán, J. Urbano, J. Llorens, Patterns as objects to manage knowledge in software development organizations, *Knowledge Management Research and Practice* 10 (2012) 252–274.

- [57] A. Aulescu, L. Bermón, J. García, M. Sánchez-Segura, Knowledge repository to improve agile development processes learning, *IET Software* 4 (6) (2010) 434–444.
- [58] B. Groarke, Web-based software process improvement repository, *CrossTalk, The Journal of Defense Software Engineering* 13 (5) (2000) 24–25, (Available from <http://www.stsc.hill.af.mil/crosstalk/2000/03/groarke.html>).
- [59] J.A. Calvo-Manzano, C. Cuevas, T. San Feliu, A. Serrano, A process asset library to support software process improvement in small settings, *Communications in Computer and Information Science: Software Process Improvement*, vol. 16, 2008, 25–35.
- [60] M. Arcilla, Metamodelo para la implantación de la gestión financiera de servicios TIC, en las medianas, pequeñas y micro empresas. PhD. Thesis Universidad Nacional de Educación a Distancia, Madrid, 2011.