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Special Issue on the Theme of Engineering and Management of IT-Based Service Systems: A Systems Approach

Guest Editorial Preface

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An Extensive Review of IT Service Design in Seven International ITSM Processes Frameworks: Part I

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ABSTRACT

An IT service design process is considered to be a fundamental piece of the seven key international IT Service Management (ITSM) processes frameworks (ITIL v2, ITIL v3 (and ITIL v2011), ISO 20000-4, CobIT 4.0, CMMI-SVC, MOF 4.0, and ITUP). Nevertheless the availability of IT service design processes, few –if any-descriptive-comparative studies among them have been reported. Thus, in this paper (Part I), we address this knowledge gap. An extensive descriptive-comparative review of seven IT service design processes in aforementioned frameworks is reported. Fundamental concepts (viz., design as noun, design as verb, service, service system, IT service, IT service system, and IT service architecture design) are analyzed by using a Systems Approach. Our findings indicate that the frameworks ITIL v2, ISO/IEC 20000 and Cobit 4.0 are using weak systemic concepts, while the frameworks ITIL v3, CMMI-SVC, ITUP and MOF 4.0 are more foundationally congruent with the new service systems view. Implications for ITSM theory and practice are discussed.

Keywords: *CMMI-SVC, Cobit 4.0, ISO/IEC 20000, IT Service Design, ITIL V2, ITIL V3, ITSM Processes Frameworks, ITUP, MOF 4.0, Systems Services*

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INTRODUCTION

IT Service Management (ITSM) can be defined as a management system of organizational resources and capabilities for providing value to organizational customers through IT services (van Bon et al., 2007). IT Service Management has become a relevant organizational theme for IT areas in large and mid-sized organizations because it is expected that its utilization, jointly with other IT schemes of processes, deliver a more efficient and effective IT management, and ultimately a better organizational value (Johnson et al., 2007; Gallup et al., 2009).

While studies on ITSM impacts are relatively scarce (Hochstein et al., 2005; Cater-Steel & Toleman, 2006; Potgetier et al., 2006; Cater-Steel et al., 2009), the few available studies share evidences of benefits. In Hochstein et al. (2005) the findings of six cases conducted in large European companies (5) and a governmental setting (1) are reported. In all of them, the overall assessment is of positive impacts categorized as follows: a better client/service orientation with positive impacts on the quality of IT services respectively, a better efficiency of IT processes, and a better visibility of IT processes (transparency and comparability documentary issues). Cater-Steel and Toleman (2006) also reports the following positive impacts of ITSM (found in 5 cases of Australian companies): a more consistent and documented service management process (less negative surprises or omissions), less conflictive SLAs negotiations (smoother), more precise predictions of IT infrastructure warranty issues, and a better manager of incidents, changes and testing tasks. Potgetier et al. (2006) also support the notion of ITSM implementation benefits from a single case. In Cater-Steel et al.'s (2009) survey of 65 Australian corporations identified the following key benefits: an improved customer satisfaction, an improved response and resolution time, an improved IT service continuity, a clear identification of roles/responsibilities, a reduction in cost/incident, and an improved IT employee productivity.

However, in order to be realized such benefits, IT practitioners – and organizations- must first select, learn, and deploy correctly an ITSM processes framework (Pollard & Cater-Steel, 2009). At present, the main seven ITMS processes frameworks are: ISO/IEC 20000 (ISO, 2005; 2010), ITIL v2 (van Bon et al., 2005), ITIL v3 (Cartlidge, 2007; van Von et al., 2007), CobIT 4.0 (ITGI, 2005), CMMI-SVC (SEI, 2010), ITUP® (EMA, 2006; Ganek & Kloeckner, 2007; IBM, 2010), and MOF® 4.0 (Microsoft, 2008). However, no single approach has achieved a generalized acceptance, which is not surprising, as there are a multitude of other contextual and situational factors that influence the choice of process and process management decisions (Clarke & O'Connor, 2012). Furthermore there have been attempts to develop a mechanism for relating process decisions and industrial contexts contexts (Jeners et al., 2013).

Given a similar aim of these ITSM processes frameworks, it could be expected that the selection of any of them is indifferent. Nevertheless, these ITSM processes frameworks use a particular nomenclature, a particular conceptual descriptive granularity level for their descriptions, and they are non-standardized (Dougmore, 2006). Thus, ITSM implementers need to identify the core structure and characteristics of such ITSM processes frameworks at first, in order to realize a correct selection of the most suitable framework for their organization.

In this research, we are interested in the specific process of IT service design. Few, if any, descriptive-comparative studies on IT service design processes have been reported in the literature. Furthermore, we consider that for ITSM practitioners, another usual ITSM phases (Strategy, Transition, Operation, and Continual Improvement) are most known in IT settings. IT strategic methods have been used for decades in organizations. IT transition and IT operations (with or without a service approach) are also a kind of strong expertise available from a practical perspective in IT areas, and continual improvement processes areas based on well-known quality approaches already available from decades. In contrast, an IT service design process implies a new discipline demanding the adaptation and enhancement of usual software systems or information system development methodologies. Furthermore, it is accepted that designing an IT service is a more complex process than designing a software system or an information system, because an IT service involves the interactions of several human and technology components (hardware, software, DBMS, networks, data, applications, IT environment, and internal and external teams). Consequently, IT service design processes, and their detailed study on how to systematically conduct it, emerges as a relevant current problem (Uebernickel, 2006; Ebert et al., 2007; Weist, 2009; Alter, 2011, 2012).

In this research, we consider that a system view is useful to review the IT service design processes in the seven ITSM processes frameworks. A system view is useful to organize and integrate diversified literature (Ackoff, 1971; Gelman et al., 2005; Mora et al., 2007). In particular, the emergent Service Science research stream (Spohrer et al., 2007) has developed updated foundations on what is a service and why must it be generated through a service system. Thus, in this paper (Part I of the overall study), we address such real and academic problems faced by ITSM practitioners and academicians, and develop a review of IT service design processes of the aforementioned seven relevant ITSM processes frameworks. Research questions can be established as follows: (i) *what are the foundational concepts of service, IT service, system and service system used in each ITSM processes framework ?; (ii) what is the used description for an IT service architecture design in each ITSM processes framework ? ; and (iii) what are the degree of compliance of the first two previous elements regarding the modern view of services and service systems?*

The remainder of this paper is as follows: in section 2, we review the foundations of IT Service Design concepts. In section 3, we report a substantial description of each one. Finally, in section 4, we use a systems view to report the scholarly and practical implications of findings. We end this paper with limitations and recommendations for further research.

FOUNDATIONS OF IT SERVICE DESIGN CONCEPTS

In this section, we identify and report the definitions used in the seven ITSM processes frameworks regarding to the foundational concepts of service, IT service, system, service system, and IT service architecture design. While the IT service concept per se is the most relevant concept for ITSM academicians and practitioners, it relies on the previous concept of IT service architecture model and service, for its realization. In turn, it has been accepted in modern literature that services are released through a service system (Spohrer et al., 2007; 2008). Consequently, the concepts of service system, and system per se become also relevant to be defined. We identify and report a set of brief but substantial insights regarding the notion of design. Relevant proposals in computer sciences, IT and engineering literature are analyzed.

On Service, IT Service, System and IT Service System Concepts

Service and IT service have been defined in different modes by the most recognized ITSM processes frameworks (see Table 1). ITIL v2 (OGC, 2004) defines service *as the deliverables of the IT services as perceived by the customers* and they do not consist merely of making computer resources available for customers to use. In turn, an IT service *is one or more IT systems, which enable a business process*. The concept of service system is not reported in ITIL v2 but a system is defined as: *an integrated composite that consists of one of more of the processes, hardware, software, facilities, and people, that provides a capability to satisfy a stated need or objective*.

In ITIL v3 (OGC, 2007), a service is defined *as a means of delivering value to customers by*

Table 1. On service, IT service, system and service system concepts

Source	Service	IT Service	System	Service System
ITIL V2	*… the deliverables of the IT services as perceived by the customers and they do not consist merely of making computer resources available for customers to use.*	*… one or more IT systems which enable a business process.*	*an integrated composite that consists of one or more of the processes, hardware, software, facilities and people, that provides a capability to satisfy a stated need or objective.*	Not explicitly defined. However, the definition for system corresponds rather to service system.
ITIL V3	*… a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks.*	*… as a service provided to one or more customers by an IT service provider, based on the use of IT and supports the customer's business processes, and is made up from a combination of people, processes and technology and defined in a Service Level Agreement.*	*… a group of interacting, interrelated, or interdependent components that form a unified whole, operating together for a common purpose.*	No explicitly defined.
ISO/ IEC20000	*… an intangible product of a process where there are interaction of supplier and customer activities* (derived, not implicitly defined).	*… an intangible product of the IT service management process* (derived, not implicitly defined).	*… a set of interrelated or interacting elements.*	No explicitly defined.
CobIT 4.0	a deliverable which is clearly valued for users (derived, not implicitly defined).	the deliverable by the enterprise IT architecture (derived, not explicitly defined)	No explicitly defined.	No explicitly defined
CMMI-SVC	*… a product that is intangible and no storable delivered through service systems designed to satisfy service requirements.*	No explicitly defined.	*… a regularly interacting or interdependent group of items forming a unified whole.*	*… as an integrated and interdependent combination of service component resources that satisfies service requirements.*
ITUP	It uses the ITIL V3 concept.	It uses the ITIL V3 concept.	No explicitly defined.	Not explicitly defined. ITUP uses the concept of solution: *the set of software, hardware, people, and other resources that work together to provide a service to IT customers service.*
MOF 4.0	*… a collection of features and functions that enable a business process.*	No explicitly defined.	No explicitly defined.	Not explicitly defined. MOF 4.0 uses the concept of solution: *a coordinated delivery of people, process and technologies to successfully respond to a unique customer's business problem.*

facilitating outcomes customers want to achieve without the ownership of specific costs and risks. An IT service is defined as *a service provided to one or more customers by an IT service provider, based on the use of IT and supports the customer's business processes, and is made up from a combination of people, processes and technology and defined in a Service Level Agreement*. A service system is not defined in ITIL v3 but a system is defined as: *a group of interacting, interrelated, or interdependent components that form a unified whole, operating together for a common purpose*. However, the concept of service systems is already used but concerned with value networks.

In ISO/IEC 20000 standard (ISO, 2005), the concepts of service and IT service are used implicitly. The concept of system is neither defined but it can be used the usual ISO standard concept of system. Similarly the concept of service system is not explicitly reported. In contrast, the concept of process is relevant. A process is *a set of interrelated or interacting activities, which transforms inputs into outputs*. A system is defined as *a set of interrelated or interacting elements*. In general a product is defined as the result of a process. In ISO 9000:2005 (ISO, 2006), there are four generic categories of products: software (any intangible product in form of transactions or procedures), hardware (any tangible product which is countable), processed materials (tangible but with a continuous characteristic), or services (intangible resultant from the interaction of activities between a supplier and a customer). In particular, the hardware and processed materials are called goods. In ISO 9000, services is about executing activities on customer-supplied tangible, delivering intangible products, or creating a particular ambience.

CobIT 4.0 (ITGI, 2005) does not explicitly define service, neither IT service and service system concepts. However, CobIT 4.0 is used for IT management team *to provide the IT services that the business requires to support the business strategy in a controlled and managed way* (ITGI, 2005, p. 25). Furthermore, in CobIT 4.0 is posed the need of a strong alignment between business needs and requirements and IT resources and processes (called the enterprise IT architecture). The IT processes in CobIT 4.0 are grouped in four categories: Plan and Organize, Acquire and Implement, Deliver and Support, and Monitor and Evaluate. The IT resources are applications, information, infrastructure and people. Applications are the automated user systems and manual procedures that process the information. Information is the data in all their forms input, processed and output by the information systems, in whatever form is used by the business. Infrastructure is the technology and facilities (hardware, operating systems, database management systems, networking, multimedia, etc., and the environment that houses and supports them) that enable the processing of the applications. People are the personnel required to plan, organize, acquire, implement, deliver, support, monitor and evaluate the information systems and services. They may be internal, outsourced or contracted as required (ITGI, 2005, p. 12). Based in these conceptualizations, an IT service can be defined *as the deliverable by the enterprise IT architecture, and a service as a deliverable which is clearly valued for users*.

In CMMI-SVC (SEI, 2010) the concepts of service, system, and service system are explicitly defined in the glossary. The particular concept of IT service is not reported. A service is *a product that is intangible and no storable delivered through service systems designed to satisfy service requirements.* A service system is defined as *an integrated and interdependent combination of service component resources that satisfies service requirements*. In CMMI-SVC a service system includes everything required for service delivery as such work products, processes, facilities, tools, consumable and human resources (employees and service customers during the service delivery occurrence). In CMMI-SVC a system should be interpreted in the broader sense of "*a regularly interacting or interdependent group of items forming a unified whole*".

In ITUP (IBM, 2010), the concepts of service and IT services are taken directly from ITIL v3. The concepts of service system and system are not explicitly defined. However, an additional concept called *solution* is reported as *the set of software, hardware, people, and other resources that work together to provide a service to IT customer's service* (IBM, 2010). This definition of solution fits the IT service system concept.

In MOF 4.0 (Microsoft, 2008), a service *is a collection of features and functions that enable a business process*. An IT service is not explicitly defined but MOF 4.0 pursues the goal "*to provide guidance to IT organizations to help them create, operate, and support IT services while ensuring that the investment* *in IT delivers expected business value at an acceptable level of risk*" (Microsoft, 2008, p. 1). From it, an IT service can be interpreted in MOF 4.0 as *a collection of IT features and functions that enable value at an acceptable level of risk to a business process*. Similarly to ITUP, in MOF 4.0 the concept of solution is reported: *a coordinated delivery of technologies, documentation, training, and support designed to successfully respond to a unique customer's business problem*. Solutions typically combine people, processes, and technology to solve problems. It can be interpreted that IT services are enabled by one or more solutions in MOF 4.0 (Microsoft, 2008).

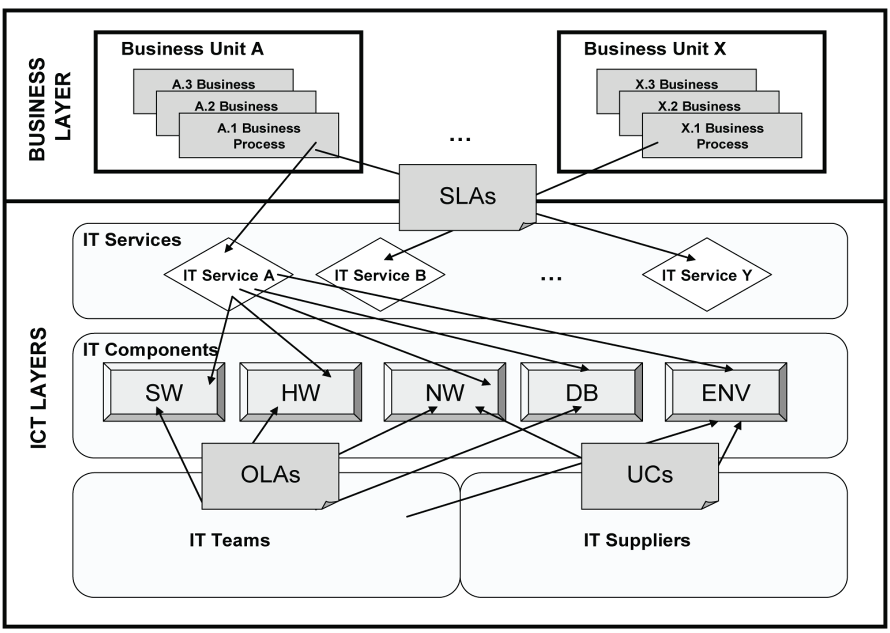
In Table 1, a summarization of these fundamental concepts is presented.

On IT Service Architecture Design Models

An IT service architecture design model can be defined as a conceptual representation of a service system which reports its essential components and interrelationships in an organized and hierarchical mode (Maier et al., 2004). Modeling IT service architectures can be pursued for several purposes: *facilitate human understanding of IT service systems, support IT service systems management, support IT service systems improvement, automate IT service systems guidance and enact automated IT service systems* (Curtis et al., 1992; Maier et al., 2004). In this research we focus on the study of IT service architecture design models for the first purpose. Given the novelty of IT service systems and the variety of IT service process frameworks, there are also a dispersion of IT service architecture design models. Consequently, IT service academics and practitioners face a fragmented and non-standardized view of what is an IT service architecture design model.

In ITIL v2 (Rudd & Hodgkiss, 2004; van Bon et al., 2005) a specific IT service architecture design model is not reported. However, there are several representations that can be mapped for an initial model. Figure 1 illustrates a suitable representation as a service model called the *ICT Infrastructure Model* in ITIL v2. The core identified elements present in this

Figure 1. ITIL v2 IT service architecture design model



model are the following: (i) business process, (ii) SLAs, (iii) IT services, (iv) IT components (SW, HW, NW, DB, ENV), (v) OLAs and UCs, (vi) internal teams, and (vii) IT suppliers. The interrelationships between such elements can be elaborated as follows: R1 business process are supported by IT services mediating SLAs; R2 IT services are released using IT components (SW, HW, NW, DB, ENV); R3 IT components are managed and operated by internal teams mediating OLAs and/or IT suppliers mediating UCs. Additional interrelationships are: R4 business process can use zero, one or several IT services; R5 IT service can be used in one or several business processes.

In ITIL v3 (Rudd & Lloyd, 2007), the concept of IT service architecture model is reported as a Service Composition Diagram and a Service Relationship-Dependence Model. In Figure 2 we report an adaptation of both diagrams. The core elements derived from both diagrams are the following: (i) business unit, (ii) business service, (iii) business process, (iv) IT service (service utility, service warranty (SLAs)), (v) assets/resources (infrastructure (HW, SW, DBMS, NW), environment, data, applications), and (vi) assets/capabilities (IT processes, support teams (OLAs), suppliers (UCs)). The derived interrelationships are the following: R1 a business unit delivers business services; R2 a business service is made up of business processes; R3 business processes (and lately business services) are supported by IT services; R4 an IT service is characterized by service utility and warranty parameters; R5 an IT service is made up of assets/resources and assets/capabilities; R6 assets/resources are infrastructure (HW, SW, DBMS, NW), environment, data, and applications; R7 assets/capabilities are IT processes, support teams and suppliers.

In ISO/IEC 20000 (ISO, 2005; 2010) there is no IT service architecture design model reported explicitly. However, it can be derived one from several insights. Figure 3 illustrates the derived IT service architecture model. In this model, the core identified entities are: (i) an organization, (ii) a customer, (iii) business units, (iv) IT services, (v) IT internal or external

Figure 2. ITIL v3 service composition model and service relationship-dependence model

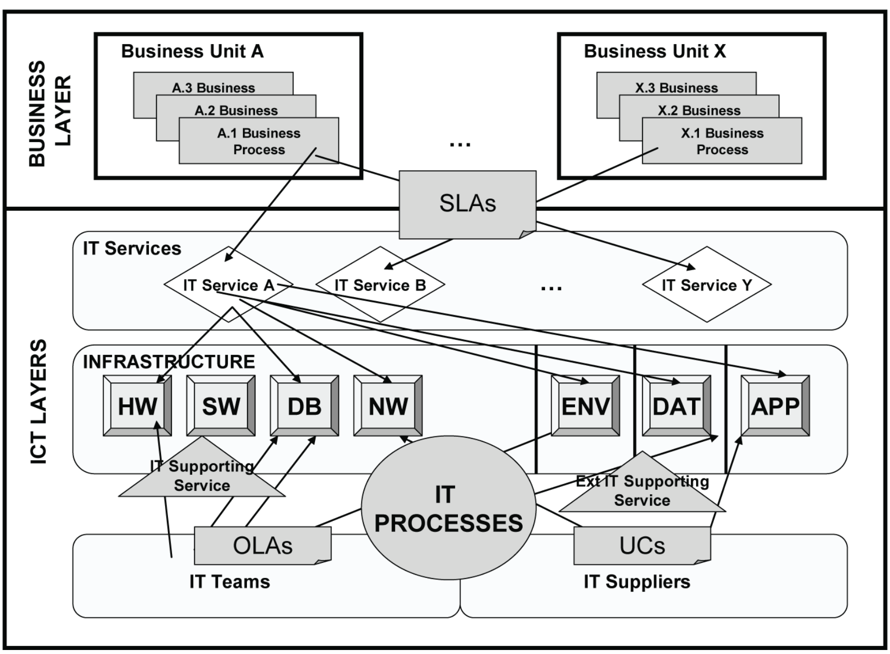
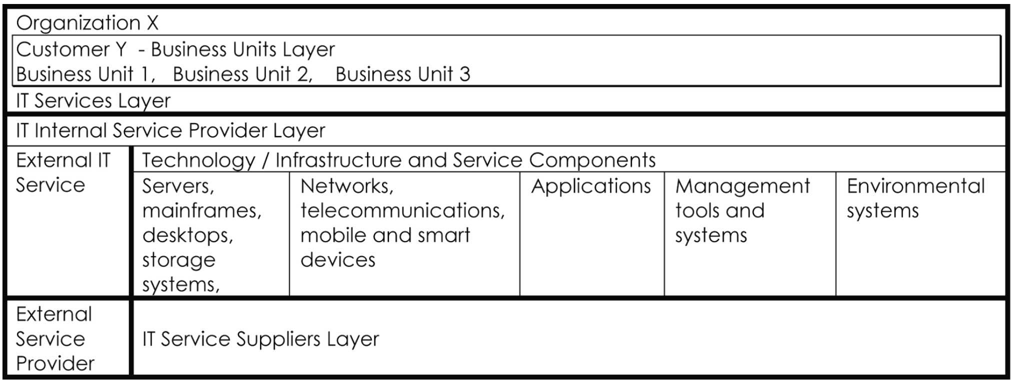


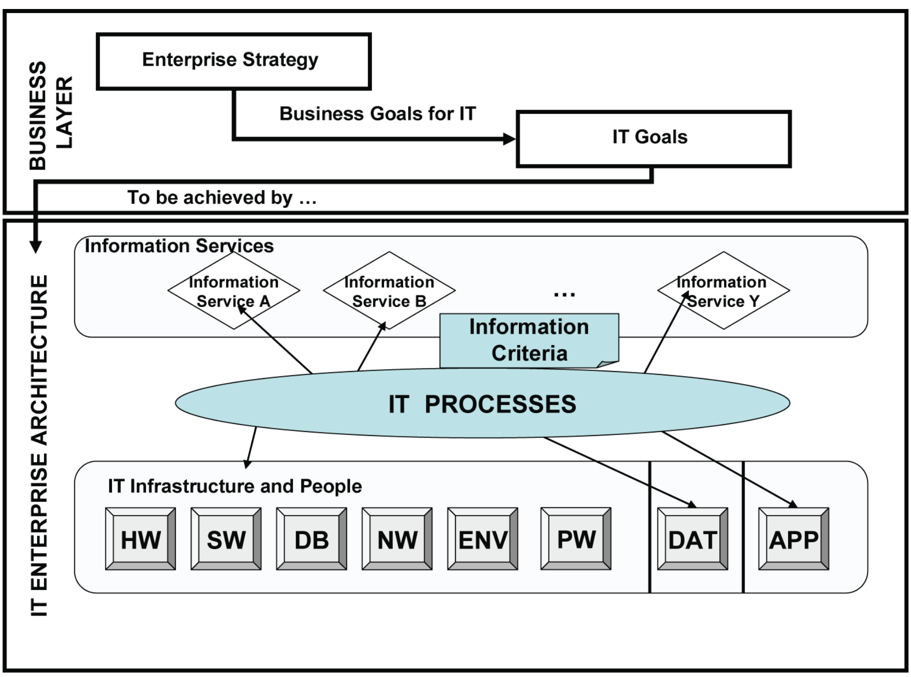
Figure 3. Derived ISO/IEC 20000 IT service architecture design model



service provider, (vi) technology (hardware, network, applications, systems, environmental systems), (vii) external service provider, and (viii) suppliers. The derived interrelationships are the following: R1 an organization has customers; R2 customers have one or several business units; R3 business units use IT services; R4 the IT services are delivered by IT internal or external service providers; R5 the IT internal service provider uses technology; R6 the technology is acquired from suppliers.

In CobIT 4.0 (ITGI, 2005) there is not an explicit IT service architecture design model. Most related model adapted from CobIT 4.0 is presented in Figure 4. From this representation the following core elements can be identified:

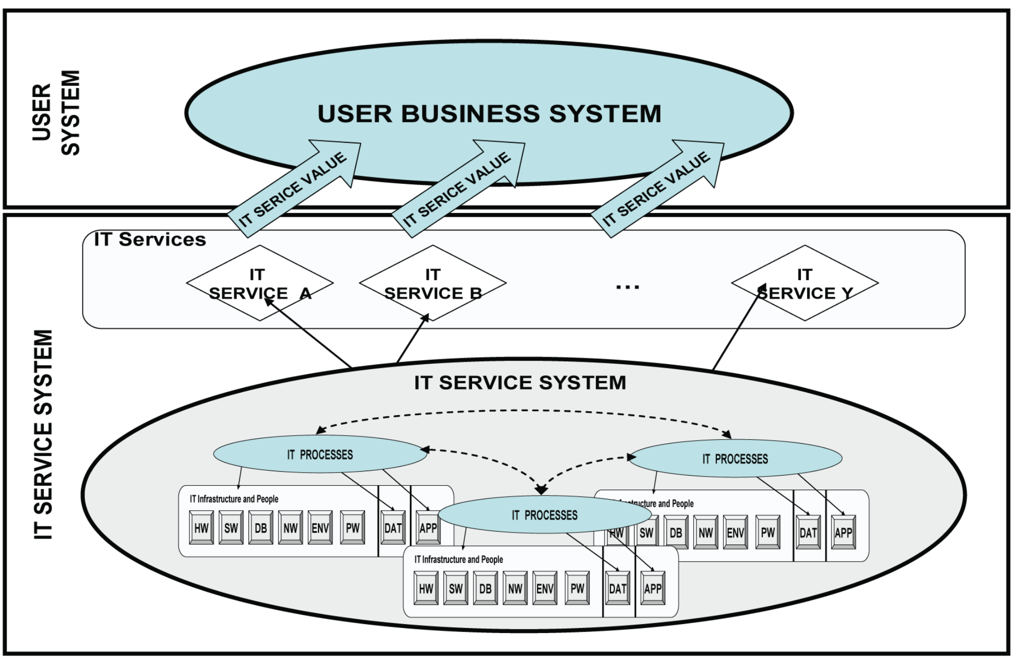
Figure 4. Derived CobIT IT service architecture design model



(i) enterprise strategy, (ii) business goals for IT (business requirements, IT/information services), (iii) IT goals, and (iv) enterprise architecture for IT (IT processes, IT infrastructure and people, applications, information). The derived interrelationships are the following: R1 the enterprise strategy defines the business goals for IT; R2 the business goals for IT define the IT goals; and R3 the IT goals are expected to be achieved through the IT enterprise architecture; R4 an IT enterprise architecture includes IT processes, information, applications, and infrastructure and people. In particular, in CobIT 4.0 the information services can be considered the whole IT services.

In CMMI-SVC (SEI, 2010) an explicit IT service architecture design model is also not reported. Similarly to ISO/IEC 20000, a high-level service model can be derived from several insights. Figure 5 reports an interpretation of it. From several diagrams reported in the full CMMI-SVC document, and the Figure 5 can be identified the following core entities: (i) customer/end user, (ii) IT service, (iii) IT service value, (iv) deployed IT service system, (v) establishing and delivering processes (STSM, SSD, SST, SD, and IRP), and (vi) managing services processes (REQM, CAM, SCON, WP, and WMC). The derived interrelationships are the following: R1 a customer/end user uses an IT service; R2 an IT service delivers IT service value; R3 an IT service is delivered through a deployed IT service system; R4 a deployed IT service system is established and delivered through a set of processes; R5 a deployed IT service system is managed through a set of processes; and R6 a set of processes use services components or resources for its execution. In particular, CMMI-SVC considers a service component as a resource required for a service system to successfully deliver services and includes transient resources (e.g. owned by users or third parties but used during the service occurrence). Infrastructure concept is also used for service component resources that are tangible and permanent in the service system. A

Figure 5. Interpreted CMMI-SVC IT service architecture design model



service system consumable is a resource whose capacity level is reduced or depleted during the service occurrence. For CMMI-SVC people is not a consumable but their labor time is.

In ITUP (EMA, 2006; Ganek & Kloeckner, 2007; IBM, 2010) there is not an explicit IT service architecture design model reported. However, a related IBM IT service value model can be linked to ITUP process framework. Figure 6 illustrates our interpretation of it. The core identified elements are: (i) IT customers, (ii) IT services, (iii) IT service provider, (iv) IT processes, (v) IT capabilities (IT organization, IT tools and technology (computing systems and storage, network, applications and data), and IT procured services), and (vi) finance and environment. The derived interrelationships are the following: R1 the IT customers uses IT services; R2 the IT services are delivered by IT service provider; R3 the IT service provider uses processes and capabilities for delivering IT services; R4 the capabilities are behind the service visibility line.

In MOF 4.0 (Microsoft, 2008) an IT service architecture design model is used through the concept of Service Map diagram (see Figure 7 interpreted from Microsoft, 2008). According to MOF 4.0 a Service Map diagram *represents a service from the perspective of the business and the user*. A service map diagram reports the critical component for a service. They are classified as: (i) service customers, (ii) hardware (the specific platform for delivering the service in the user setting rather the backbone IT infrastructure), (iii) applications (operating systems, middleware and end-user applications), (iv) settings, and (v) internal and external services (the additional hardware, network, and applications services required for delivering the service). The derived interrelationships are the following: R1 an IT service is used by service customers; R2 an IT service is enabled by using components of hardware, applications, internal/external services, and configuration settings; R3 internal services are generated by the organization; and R4 external services are generated by service suppliers.

Hence, this review of IT service architecture design models for each ITSM scheme reveals a general shared purpose (e.g. help to

Figure 6. Derived ITUP service architecture design model

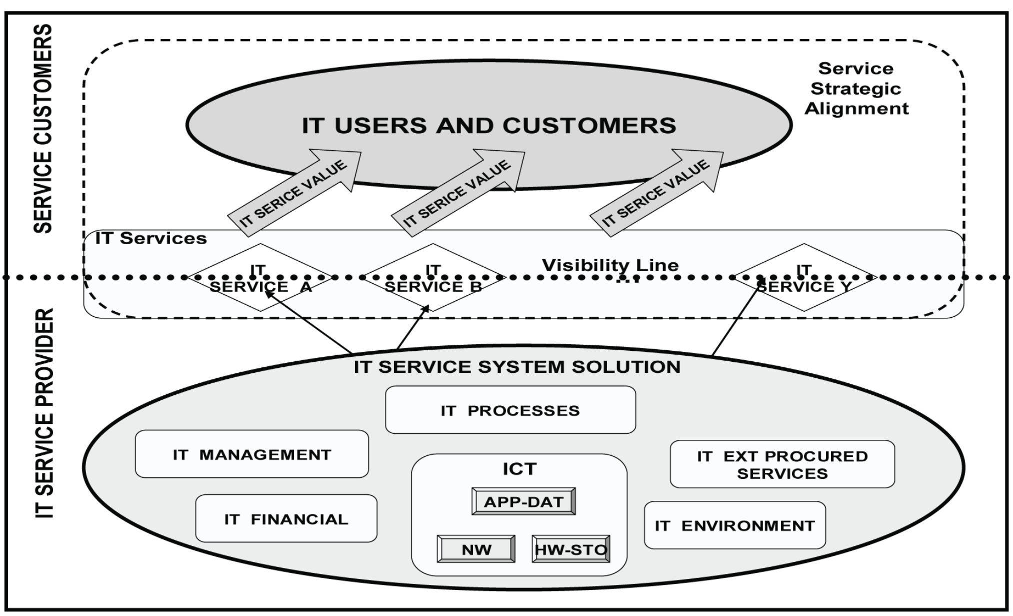
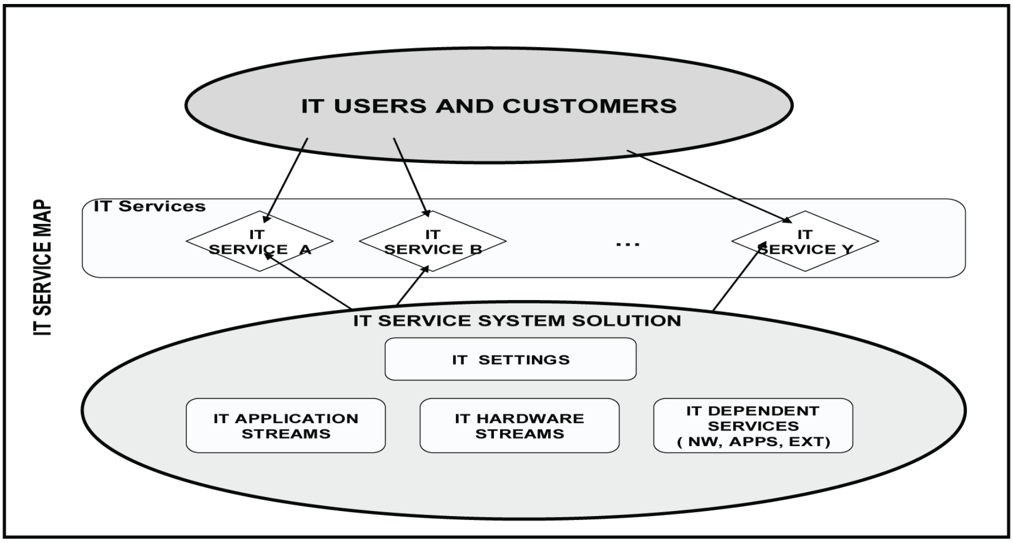


Figure 7. MOF 4.0 service map model



design an IT service) but describes it by using different notation and conceptual structure.

On Design and IT Service Design Concepts and Processes

According to Denning et al. (1989), design as a methodological paradigm for Computer Sciences, can be defined as an iterative process of: (i) state system requirements, (ii) transform (i) to system specifications (e.g. the design per se), (iii) implement (ii), and test (iii). It is an iterative process –under time and cost constraints- given that system tests can be not passed causing mandatory changes in some of the previous established statements.

In IT design literature (March & Smith, 1995), design – as a research paradigm- is a prescriptive mode for advancing the performance of systems. In contrast with a knowledge-producing descriptive mode –which pursues to understand the natural behavior of used systems-, design is a knowledge-using activity pursued for developing useful systems (IT systems in particular in studied context). Authors based on Simon's(1981) research, indicate that design is about "*devising artifacts for attain goals*". For these authors (idem, p. 253) "*design attempts to create things for human purposes*". Design products are assessed usually using utility or value criteria. Two core activities in design are build and evaluate. "*Building is the process of constructing an artifact for a specific purpose; evaluation is the process of determining how well the artifact performs*" (idem, p. 254). Design –as a noun- is the generated artifact from design activity. It can be classified either: construct, model, method or implementation.

In the engineering field, according to Suh (1998), system design is a common activity in engineering and other less cited fields like business (for instance design of organizational processes) and government (for instance design of policies). Suh (1998, p. 204) reports that: *Design involves an interplay between 'what we want to achieve' and 'how we choose to satisfy the need (i.e., the what)*. According to the same author (idem, p. 189) a system is designed –in a general sense- to perform a set of tasks to satisfy specified functional requirements and constraints.

For Suh (idem), a system design consists of transforming a set of customer needs (CAs) in a set of well-defined functional requirements (FRs) mapped to feasible design parameters (DPs) and processes (PVs). Feasible attribute means that the posed FRs, DPs and PVs satisfy the established constraints. Suh (1998; 2005) identifies three design approaches used in several fields: (i) heuristic/empirical, (ii) analytic/algorithmic, and (iii) axiomatic. Heuristic/empirical approach is used when none functional equations exists for describing the expected system, so the best empirical recommendations are iteratively tested –under the agreed time and cost constraints-. Analytic/algorithmic approach is used when analytic solutions exist for the system or well-tested algorithms (e.g. a finite set of steps which assures to obtain the expected design). Axiomatic approach is posed as an alternative theory general of design, which combines, strengthens of the first two approaches. It is based in a well-defined heuristic and analytic process, which assures an expected design when their axioms are committed. Suh (2005) indicates that while (ii) is the better approach; it can be used only isolated for very few design ad-hoc situations. Consequently, designers can use only a heuristic mode (i) or a hybrid mode (iii) in most faced design cases.

Hence, we can define design –as a verb- *as the intellectual activity to transform a set of system requirements in a set of system specifications, which satisfy a set of agreed goals, and constraints, which will enable the development, and building of the designed system*. Agreed goals are expected properties for system users (usually related with performance, security, and usability issues), while that agreed constraints are limits (minimums, maximums, or ranges) on characteristics of the design process per se (usually related with the consumption of time-based, financial, organizational, materials, and other related resources used for designing, building and operating the expected system). In turn, design – as a noun- is defined *as the conceptual artifact which conveys a set of system specifications which enable its further development and building with assumed extant design resources.*

In Table 2, a summarization of these fundamental concepts is presented for completing this review on design concepts.

A SYSTEMIC ANALYSIS OF FINDINGS

On Service, IT Service, System and IT Service System Concepts

In the emergent Service Science research stream, a service has been defined *as the application of competences for the benefit of another, meaning that service is a kind of action, performance, or promise that is exchanged for value between provider and client* (Spohrer et al. 2007, p. 72). A service system is defined as *a value-coproduction configuration of people, technology, other internal and external service systems, and shared information (such as language, processes, metrics, prices, policies, and laws)* (Spohrer et al. 2007, p. 72).

Further, Spohrer et al. (2008) re-established the following definitions: *service is the application of resources (including competences, skills, and knowledge) to make changes that have value for another (system)*. In this definition two dimensions are considered: interactions and attributes improvement. Value co-creation is considered an effect of the service realization but not part of the service per se. In turn, a *system is a configuration of resources, including at least one operant resource, in which the properties and behavior of the configuration is more than the properties and behavior of the individual resources*. In this definition is remarked one of the principles of a systems view: the whole has capabilities and properties not owned by any subset of their components (referred as resources in Spohrer et al's. (2008) definition).

Finally, authors (idem, 2008) define a service system *as an open system (1) capable of improving the state of another system through sharing or applying its resources (i.e., the other*

Table 2. On design concepts

Source	On Design and Service Design Concepts	On Design and Service Design Concept Remarks
Computer Sciences (Denning et al, 1989)	*Design is an iterative process of: (i) state system requirements, (ii) transform (i) to system specifications (e.g. the design per se), (iii) implement (ii), and test (iii).*	*It is an iterative process –under time and cost constrains- given that system tests can be not passed causing mandatory changes in some of the previous established statements.*
Design Research (March & Smith, 1995)	*Design is about "devising artifacts for attain goals".*	*Design is a knowledge-using activity pursued for developing useful systems. "Design attempts to create thing for human purposes. Design products are assessed usually using utility or value criteria. Design –as a substantive- can be classified either: construct, model, method or implementation.*
Engineering (Suh, 1998; 2005)	*Design is an interplay between 'what we want to achieve' and 'how we choose to satisfy the need (i.e. the what).*	*Design is about to transform a set of customer needs (CAs), in a set of well-defined functional requirements (FRs) mapped to feasible design parameters (DPs) and processes (PVs). Feasible means that the FRs, DPs and PVs posed satisfy established constrains. Design is about to attain a feasible system to perform a set of tasks to satisfy specified functional requirements and constraints.*
This research	*Design as substantive is the conceptual artifact which conveys a set of system specifications, which enable its further development and building with, assumed extant design resources. Design –as a verb- is the intellectual activity to transform a set of system requirements in a set of system specifications which satisfy a set of agreed goals and constraints which will enable the development and building of the designed system.*	*Design goals are expected properties for system users (usually related with performance, security, and usability issues).* *Design constraints are limits (minimums, maximums, or ranges) on characteristics of the design process per se (usually related with the consumption of time-based, financial, organizational, materials, and other related resources used for designing, building and operating the expected system).*

system sees the interaction as having value), and (2) capable of improving its own state by acquiring external resources (i.e., the system itself sees value in its interaction with other systems). In particular the concept of value *is defined as an improvement in a system, as judged by the system or by the system's ability to fit an environment*. In former definition, the essential characteristic of an open system (which affects to and is affected by its environment, where resides the service customer system) is accounted. In second definition, value is considered as both an effect on the acted customer system or on the self-system, but it does not explicitly report its co-generation principle. However, authors (2008, idem, p.1) support this strong principle as *a key condition is that service systems interact to co-create value.*

Additional definitions for service, IT service, and service systems have been also reported from a Systems Science stream (Mora et al., 2009a; 2009b; 2011) but including Service Science stream foundations. In particular, service has been defined as: *(i) an agreed integrated flux of actions delivered by a facilitator sub-system to an sub-appraiser sys-*

tem, complemented with a flux of actions of the latter, to co-create an expected value outcome, and affect positively the predetermined status properties in both systems (extended Spohrer et al's 2007 view), (ii) status properties in the facilitator and appraiser subsystems that are affected by the service interactions between both subsystems, and (iii) an value outcome (e.g. an emergent property, thus co-generated) that affects to the supra-system. This definition considers the three dimensions involved in core literature of services: interactions, attributes improvement, and valued outcomes. In turn, a service system has been defined (Mora et al., 2011) as *a system comprised of a facilitator and appraiser systems for generating value through the provision and consumption of services* (Mora et al., 2011).

Based on these definitions, Mora et al., (2011) established an IT service conceptual framework of four layers that we report here with updates: (L1) systems of IT components-resources, (L2) systems of IT processes, (L3) systems of business process, (L4) systems of business functions, and (L5) customer's organizational systems. Each one of the first higher four layers (L5 to L2) includes to the lower layer. We used here updated adaptations from this conceptual framework.

L1 layer accounts for the systems comprised of computing (hardware, software, network), data, infrastructure, and people components-resources used for generating IT services capabilities towards the L2 layer. IT services capabilities are the physical/cognitive interactions performed in L1 layer and towards L2 layer with the aim to co-generate IT services. L2 layer includes to L1 layer and accounts for the systems to manage the IT services capabilities from L1 layer to be interacted with L3 layer in order to lately jointly (L2 and L3) create IT services.

Similarly to the L1-L2 structure, there is a L3-L4 structure of interrelationships. L3 layer accounts for the systems of business processes, which generate business services capabilities among them and L2, layer, but additionally also to L4 layer. The business services capabilities are the physical/cognitive interactions performed in L3 and towards L4 (and L2) with the aim to co-generate business services (and IT services). Finally, L4 layer includes to L3 layer and represents the systems of business functions which are expected to co-generate business services through the interactions with the customer's organizational systems (e.g. L5 layer). These business services are lately realized when the business services capabilities interactions performed in L4 and the customer's organizational systems layer (L5) co-generate value for both sides.

Hence, in this framework, IT services are co-produced when the interactions of both L2 (IT service capabilities) and L3 (business services capabilities) create value for both sides. Similarly, business services are co-produced through the interactions (business services capabilities) of both L4 and the customer's organizational systems (L5) and value is obtained by both sides. In both cases, this value can be classified roughly in a performance increment or in a constraint reduction (OGC, 2007).

With these previous updated definitions, we consider that a service system can be more precisely defined as a *system comprised of a facilitator and appraiser systems which creates value (e.g. services) through the interactions of their respective service capabilities*. Similarly, we consider that a *service can be essentially defined as a valued outcome from a service system where there are interactions (e.g. application of service capabilities) and improvement of properties of interest (e.g. services attributes) in their co-participants*. In turn, an *IT Service can be also essentially defined as a valued outcome which is co-generated by the interactions (services capabilities) from a system of IT processes (L2) and a system of business processes (L3)*. Combining both previous definitions, L2 and L3 constitutes a service system (it can be called an IT service system). L2 represents the facilitator and L3 the appraiser side. Both L2 and L3 provide services capabilities. Similarly, the L4 layer and the customer's organizational systems constitute a service system (that could be called business service system).

We use these updated and more comprehensive conceptualizations – from a system view- of service, IT service, and service system, and the new concept of service capability to review the proposed in the seven ITSM models and standards. Our purpose is identifying the extent of inclusion of the modern view of services and system view considered in the seven ITSM models and standards. For it we use an ordinal scale with the following values (and color codes): NULL (gray), WEAK (red), MODERATE (yellow), and STRONG (green).

From the findings reported in the Table 3, we can identify that none of the seven ITSM

Table 3. Assessment of core concepts used in the seven ITSM schemes from a modern system and service view

Source	Service	Service Capability	Service System	IT Service
System View	A valued outcome from a service system where there are interactions and improvement of properties in their co-participants.	Services capabilities are the physical/cognitive interactions performed by the participants in a service system -with the aim to co-generate services (e.g. valued outcomes for both sides).	A system comprised of a facilitator and appraiser systems which creates value through the interactions of their respective service capabilities.	A valued outcome which is co-generated by the interactions (services capabilities) from a system of IT processes and a system of business processes.
ITIL V2 Analysis	*... the deliverables of the IT services as perceived by the customers and they do not consist merely of making computer resources available for customers to use.*		Not explicitly defined.	*... one or more IT systems which enable a business process.*
	WEAK	**WEAK**	**NULL**	**WEAK**
ITIL V3 Analysis	*... a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks.*		No explicitly defined.	*... a service based on the use of IT and supports the customer's business processes.*
	MODERATE	**MODERATE**	**NULL**	**MODERATE**
ISO/IEC 20000 Analysis	an intangible product of a process where there are interaction of supplier and customer activities (derived, not implicitly defined).		No explicitly defined.	an intangible product of the IT service management process (derived, not implicitly defined).
	MODERATE	**MODERATE**	**NULL**	**WEAK**
CobIT 4.0 Analysis	a deliverable which is clearly valued for users (derived, not implicitly defined).		No explicitly defined	the deliverable by the enterprise IT architecture (derived, not explicitly defined)
	STRONG	**NULL**	**NULL**	**MODERATE**
CMMI-SVC Analysis	*… a product that is intangible and no storable delivered through service systems designed to satisfy service requirements.*		*… an integrated and interdependent combination of service component resources that satisfies service requirements.*	No explicitly defined.
	MODERATE	**MODERATE**	**MODERATE**	**NULL**
ITUP Analysis	It uses the ITIL V3 concept.		ITUP uses the concept of solution: *the set of software, hardware, people, and other resources that work together to provide a service to IT customers service.*	It uses the ITIL V3 concept.
	MODERATE	**MODERATE**	**STRONG**	**MODERATE**
MOF 4.0 Analysis	*... a collection of features and functions that enable a business process.*		MOF 4.0 uses the concept of solution: *a coordinated delivery of people, process and technologies to successfully respond to a unique customer's business problem.*	No explicitly defined.
	MODERATE	**MODERATE**	**STRONG**	**NULL**

schemes can claim that are using modern and updated conceptualizations of service, service systems, and systems from a systems and service sciences view. However, some interesting findings emerge. ISO/IEC 20000 standard does not report definitions for these fundamental concepts: service, service system, and IT service. Derived definitions fit moderately the modern notions rooted in: value co-generations, interactions, systems of resources-components. ITIL v2 definitions were assessed with a weak fit. An IT service definition accounts only by the software-side view, and service as generic deliverables but perceived by customers (not users). The notion of value co-generation is missing. Cobit 4.0's definitions are not explicitly reported. Nevertheless, derived ones accounts strongly for the notion of value (for the case of service). Regarding its derived definition of IT service, it considers as a resultant from the IT architecture, and it fits moderately the systemic conceptualizations. ITIL v3 definitions are assessed with moderate appropriateness. While ITIL v3 endorses the notion of value (in service definition) it is reported as an effect (e.g. the service per se considers only the interactions). A positive highlight in this definition is the inclusion of two relevant mandatory attributes improvements for the customer side: lower risk and lower cost by no ownership of required resources for generating and receiving the expected service interactions. The IT service definition follows from the service definition and is assessed as moderate. Definitions in CMMI-SVC have been identified with moderate suitability regarding a modern systems and service view. It should be expected more comprehensive definitions, but CMMI-SVC reports traditional view of what is a service. ITUP definition of service and IT service are taken from ITIL v3. They have been assessed with moderate appropriateness. The concept of service system is not reported. However, ITUP uses the concept of IT solution, which can be considered the specific service system for releasing a particular IT service. Finally, MOF 4.0 definitions are assessed also as moderate given that value co-generation notion is omitted.

Hence, we can claim that while the seven ITSM schemes have provided a rich set of guidelines for conducting mainly the ITSM strategic, operational and improvement processes, all of them have used foundational concepts that are: (i) different between them addressing different notions of service, (ii) not theoretically rooted in systems theory, and (iii) moderately appropriate regarding the modern conceptualizations of services from services sciences stream. We do not claim that such used definitions are wrong but that they are conceptually no standardized and weakly to moderately founded in a Systems Approach. We believe that this disparate view of what are services, service systems and IT services can negatively affect to the integrated development of the field (e.g. ITSM research and practice) and confuse to ITSM practitioners (e.g. considers the case of two ITSM practitioners discussing on what is an IT service when some of them endorses CobiT 4.0 and the other ISO/IEC 20000 as instance). We recommend research and practical efforts for including the modern view of services, as well as the theoretical roots of systems approach, in forthcoming versions of these ITSM schemes.

On IT Service Architecture Design Models

The architecture of a system has been defined *as its fundamental organization embodied in its components, interrelationships to each other, and to the environment and the principles guiding its design and evolution* (Maier et al., 2004). For INCOSE (2004, p. 22) a system architecture *is the arrangement of elements and subsystems and the allocation of functions to them to meet system requirements*. According to Maier et al., (2004), any built system has an inherent architecture regardless of whether it is explicitly described. Authors (idem) also identify three essential assertions on system architecture descriptions: (i) they can permit varied descriptions regarding the description method used for it, (ii) their fundamental descriptions are guided for stakeholders interests on what is relevant for them, and (iii) as any system their descriptions must report their interrelationships with its environment. As it was reported in section 2.2, an IT service architecture design model (e.g. as a textual and diagrammatic description of a system architecture) can help to facilitate human understanding of IT service systems. However, we must agree the description method, the stakeholder's view of interest, and the inclusion of the system-environment interrelationships.

A review of updated literature reports scarce proposals specifically for helping on how to design IT service systems (Uebernickel et al., 2006; Ebert et al., 2007; Mora et al., 2011; Alter, 2011, 2012). Furthermore, all of them omit or use superficially the notion of system architecture. In Uebernickel et al. (2006) a single UML-based model is reported. It accounts for the following core entities: contract, customer, it services, and resources (classified in information, network, application, and hardware). The key implication derived from this model is that customers, through contracts, are enabled to use IT services which are supported by different types of resources. This model is essentially useful as an initial model but insufficient to accommodate present complex interrelations from a more varied set of entities in a service system.

Ebert et al. (2007) extends the previous model. Authors (idem) add the core entities of activity, process, IT product, access point, contractor (e.g. customer), and human resource. Consequently, more interrelationships can be modeled. Main implication of this updated model is the fact that IT services are considered actions performed from activities which use resources. Again, this model improves the previous one but uses a single dimension of the modern concept of IT service: interactions. Changes to attributes and value generation are not explicitly defined.

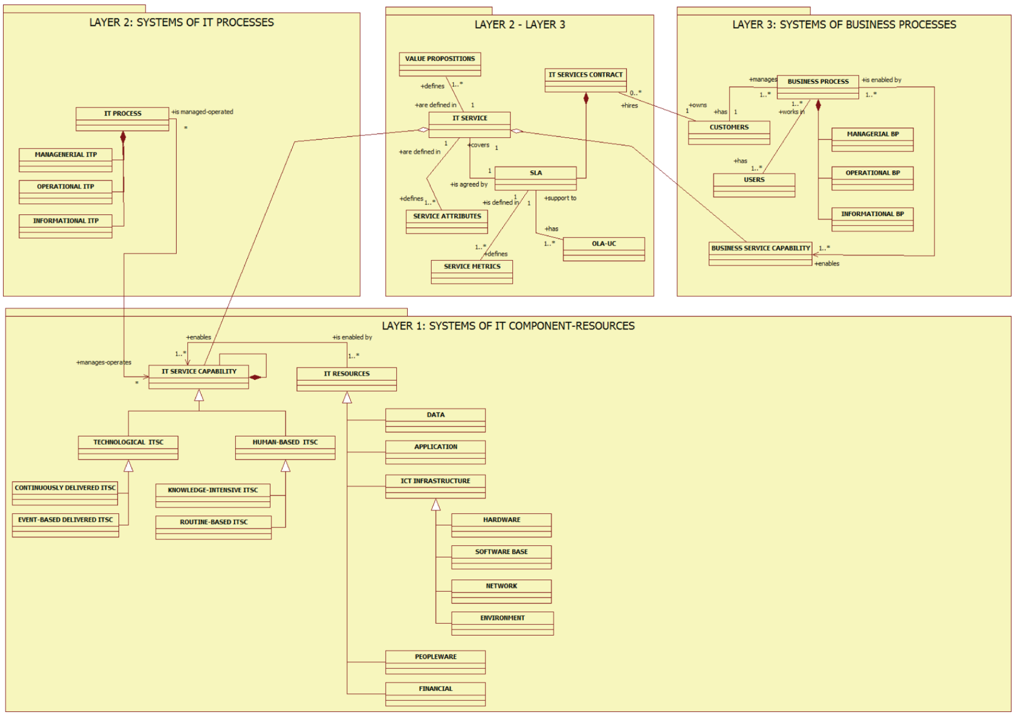
Models reported in Alter (2011, 2012) address general models of business service systems rather specific IT service design architecture modes. Both models are extensive by the inclusion of about 30+ entities, and 60+ interrelationships. Author (idem) calls these models meta-models which implies that they can be used (e.g. selected sections) as initial models for further detailed ones. In particular, author uses the concept of service as actions: *defined here as an activity performed for others* (idem, p. 231). Hence, while both models are thoroughly well-designed we consider that they are not focused in the particular purpose for a better technical and organizational design of an IT service, e.g., extensive further detail is required to be developed that conjointly with the initial entities will increment the complexity of the model.

Mora et al. (2011) presents an IT service operational framework where are reported essential implications for designing an IT service architecture (Mora et al., 2013). It has been already discussed and updated in section 4.1. Main implications from this framework to be considered in this research are the following ones: (i) services are valued outcomes co-generated by the interactions of facilitator and appraisal participant systems; (ii) interactions are service capabilities (e.g. enablers for co-create value); (iii) a service realization implies a change of attributes in both facilitator and appraisal participant systems. We consider this framework as the most adequate to be further detailed because it focuses on IT service design architecture and it is moderately complex (e.g., a few number of implied initial entities and interrelationships but sufficient ones for modeling relevant usual interrelationships). Thus, this framework is used here for generating an updated UML-based class diagram of a systemic IT service design architecture (e.g., a basic diagrammatic system architecture description). It is illustrated in Figure 8.

In Table 4, we report the analysis of each one of the explicit or implicit IT service design architecture models proposed in or derived from the seven ITSM schemes.

For it we use an ordinal scale with the following values: NULL, WEAK, MODERATE, and STRONG. The NULL value means that the standard or model does not consider the evaluated IT design issue. It can be considered a conceptual and practical weakness of such standard or model when an IT service design

Figure 8. A systemic IT service design architecture model



is designed using this scheme. Relevant design issues can be surely lost during the design process. WEAK value implies that the standard or model report explicitly or implicitly the design issue. However, this is roughly reported and applicants will be faced with scarce guidelines for a correct utilization and consideration of the design issue. Again, it is a no desired feature in an IT service architecture design model. A MODERATE value refers to the fact of the standard or model effectively includes the design issue but its information is incomplete. Finally, a STRONG value refers to a sufficient consideration of the design issue as well as to comprehensive information on it. We use an additional color scheme for a better holistic comprehension of the individual assessments realized for each design issue (e.g. in each cell). Green color in cell is used for STRONG value, yellow color for MODERATE value, red color for WEAK value and gray color for NULL value.

Table 4 reports very interesting findings. ITIL v3, CMMI-SVC, ITUP and MOF 4.0 provide the strongest IT service design architecture models from a modern systems and service view. This contrasts with the no compliance from them regarding the utilization of adequate systemic definitions of core concepts. Thus, despite such definitions can be considered as moderately appropriate, these three ITSM models compensate it provisioning clear insights on IT service architecture design models. With these descriptions, ITSM practitioners and academicians can advance adequately in the understanding of the technical, financial and organizational issues to be considered in the design of an IT service (or a specific IT service system called IT solution in ITUP and MOF 4.0). The main three layers (L1 to L3) posed in section 4.1 and realized in the UML class diagram reported in Figure 8, imply a modern system view of a service system. The four aforementioned schemes, according

Table 4. Assessment of IT service design architecture models used in the seven ITSM models and standards from a modern system and service view

Layer - Entity	ITIL V2	ITIL V3	ISO 20000	COBIT 4.0	CMMI-SVC	ITUP	MOF 4.0
L1: Systems Of It Resources-Components	Mod	Strong	Weak	Weak	Strong	Strong	Strong
It Service Capability	Null	Mod	Null	Null	Strong	Mod	Mod
It Resource	Mod	Strong	Weak	Weak	Strong	Strong	Strong
DATA	Mod	Strong	Weak	Weak	Strong	Strong	Strong
APPLICATION	Mod	Strong	Weak	Weak	Strong	Strong	Strong
ICT INFRASTRCT	Mod	Strong	Weak	Weak	Strong	Strong	Strong
Hw	Mod	Strong	Weak	Weak	Strong	Strong	Strong
Sw Base	Mod	Strong	Weak	Weak	Strong	Strong	Strong
Nw	Mod	Strong	Weak	Weak	Strong	Strong	Strong
Env	Mod	Strong	Weak	Weak	Strong	Strong	Strong
PEOPLEWARE	Mod	Strong	Mod	Mod	Strong	Strong	Strong
FINANCIAL	Mod	Strong	Mod	Mod	Strong	Strong	Strong
L2: Systems Of It Processes	Strong	Strong	Mod	Mod	Strong	Strong	Strong
It Process	Strong	Strong	Mod	Mod	Strong	Strong	Strong
MANAGERIAL ITP	Strong	Strong	Mod	Mod	Strong	Strong	Strong
OPERATIONAL ITP	Strong	Strong	Mod	Mod	Strong	Strong	Strong
INFORMATIONAL ITP	Strong	Strong	Mod	Mod	Strong	Strong	Strong
L2-L3 Layers	Mod	Strong	Mod	Mod	Strong	Strong	Strong
It Service	Strong	Strong	Mod	Mod	Strong	Strong	Strong
It Service Contract	Strong	Strong	Mod	Mod	Strong	Strong	Strong
Sla	Strong	Strong	Mod	Mod	Strong	Strong	Strong
Ola-Uc	Strong	Strong	Mod	Mod	Strong	Strong	Strong
Value Proposition	Null	Strong	Mod	Strong	Strong	Mod	Mod
Service Attribute	Null	Null	Null	Null	Null	Null	Null
Service Metric	Strong	Strong	Strong	Strong	Strong	Strong	Strong
L3: Systems Of Business Processes	Mod	Mod	Weak	Weak	Mod	Mod	Mod
Business Process	Mod	Mod	Weak	Weak	Mod	Mod	Mod
MANAGERIAL BP	Mod	Mod	Weak	Weak	Mod	Mod	Mod
OPERATIONAL BP	Mod	Mod	Weak	Weak	Mod	Mod	Mod
INFORMATIONAL BP	Mod	Mod	Weak	Weak	Mod	Mod	Mod
Business Service Capability	Null	Mod	Weak	Weak	Mod	Mod	Mod
Users	Mod	Strong	Weak	Strong	Strong	Strong	Strong
Customers	Strong	Strong	Weak	Strong	Strong	Strong	Strong
Overall Evaluation	Mod	Strong	Weak	Weak	Strong	Strong	Strong

to our analysis consider practically all of the design identified issues.

In contrast, the schemes of ITIL v2, CobIT 4.0 and ISO/IEC 20000 can be considered as moderate or weak regarding their methodological guidance on what is the structure of an IT service design architecture model. With this limitation, ITSM practitioners and academicians can generate multiples interpretations on what should be considered in the design of an IT service. In particular ITIL v2 provides useful diagrammatic insights but omits core descriptions on how the architectural elements can be specified.

Synthesis of Findings on the ITSM Models and Standards Regarding IT Service Design Purposes

We report the synthesis of the two systemic analyses realized in this research in Table 5. When we consider the two analyzed issues (foundational concepts and IT service design architecture layers), our systemic evaluation found the following facts:

1. All of the seven ITSM processes framework have not updated their fundamental concepts of service and service systems;
2. From the seven ITSM processes frameworks, ITIL v2 provides less compliance with modern view of service systems;
3. ISO/IEC 20000 and CobIT 4.0 are the weakest ITSM processes frameworks regarding the information provided on IT architecture design models, while that ITIL v2 presents a moderate status;
4. ITIL v3, CMMI-SVC, ITUP and MOF 4.0 provides strong descriptions on IT architecture design models;
5. Considering both issues (fundamental concepts and IT architecture design models), ITIL v2, ISO/IEC and CobIT 4.0 are assessed as weak-to-moderate, while that ITIL v3, CMMI-SVC, ITUP and MOF 4.0 are considered as moderate-to-strong.

From the qualitative results reported in Table 5 and all previous analyses, it is possible to identify useful insights for ITSM practitioners and academicians, as follows:

1. ITIL v3, CMMI-SVC, ITUP and MOF 4.0 ITSM processes frameworks provide a more detailed content on IT architecture design model issues;
2. The utilization of ITIL v2, CobIT 4.0 or even ISO/IEC 20000 ITSM processes frameworks will demand the complementation of additional knowledge when IT service design tasks be addressed;
3. ITUP and MOF 4.0 provides electronic process guidelines, which contains a variety of useful documents as templates, recommendations, and suggested tools;
4. While ITSM processes frameworks use the fundamental concepts of IT service and service systems, they are defined and structured with differences, and thus ITSM academicians and practitioners knowing and using different frameworks should be establish a common vocabulary of concepts

Table 5. Synthesis of findings on the seven ITSM schemes regarding their IT service design concepts

Analyzed Issue	ITIL V2	ITIL V3	ISO 20000	COBIT 4.0	CMMI-SVC	ITUP	MOF 4.0
Foundational concepts of service, IT service, system and service system.	Weak	Mod	Mod	Mod	Mod	Mod	Mod
IT service design architecture layers.	Mod	Strong	Weak	Weak	Strong	Strong	Strong
OVERALL EVALUATION	Weak	Mod / Strong	Weak	Weak	Mod / Strong	Mod / Strong	Mod / Strong

for using a shared vision of what is being addressed in the organization;

5. The differences between ITSM processes frameworks as ITIL v2, ISO/IEC 20000 and CobIT 4.0, versus ITIL v3, CMMI-SVC, ITUP and MOF 4.0 frameworks regarding the specific IT service design issues suggest that the ITSM practitioners and academicians will conduct different organizational efforts when an IT service design activity be conducted.

CONCLUSION

In this paper (Part I) we have conducted a systemic review of seven ITSM process frameworks on: (i) their foundational concepts of service, IT service, system and service system and (ii) their descriptions used for describing an IT service architecture design model.

This extensive endeavor has been pursued to advance our comprehension and understanding of the state of the art and science of what IT services are and how they should be designed. For this aim, we address the following research questions: (i) what are the foundational concepts of service, IT service, system and service system used in each ITSM processes framework?; (ii) what is the used description for an IT service design architecture model in each ITSM processes framework? and (iii) what are the degree of compliance of the first two previous elements regarding the modern view of services and service systems?

All of these three research questions have been answered after a thorough review of the available documentation of the seven ITSM frameworks. Some expected findings have been confirmed but other unexpected ones have been identified. One key conclusion is that ITSM academicians and practitioners interested in the design of IT services must be very careful in choosing an ITSM processes framework. For small companies where a systematic and rigorously design is not required, the ITIL v2 or ISO/IEC 20000 frameworks can be considered sufficient regarding the specification of the IT service architecture design model. For medium and large-sized companies, where a more formal design process and design specification is demanded, the other ITSM processes frameworks will be required: ITIL v3, MOF 4.0, CMMI-SVC or ITUP.

We must establish as an inherent methodological limitation that the assessment corresponding to the conceptual analysis by the research team was based on the available documents on the seven ITSM processes frameworks. The team's academic profile is as follows: (i) two researchers trained in Systems Engineering, one in Information Systems, and one in Computer Science, (ii) a joint general research experience of approximately 100+ years (10, 15, 15, 20, and 40 years respectively by order of authors), (iii) a joint research experience in ITSM topics since 2005, and (iv) strong experience in conceptual research (Mora et al., 2008). Nevertheless, we consider that other research team/s with a similar academic profile and by using the same set of ITSM service design documents will arrive at similar findings that are not drastically different. We encourage other researchers in the ITSM research stream to pursue this research effort.

Finally, we call for further research - both conceptual and empirical - in IT service design methodologies to improve our understanding and provide better guidelines to ITSM practitioners. Our next research step is the elaboration of an integrated IT Service Design process, based on these findings, for SMB organizations.

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