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Toward an Integrated Conceptualization of the Service and Service System Concepts:

A Systems Approach

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ABSTRACT

Service and service systems concepts are fundamental constructs for the development of the emergent SSME, ITSM, and Service Oriented Software (SOS) knowledge streams. A diversified literature has provided a richness of findings, but at the same time, the lack of standardized conceptualizations is a source of confusion to IT practitioners and academics. Given this problematic situation, we pose that a systems approach is useful to address it. In this article, we review and synthesize key studies in these knowledge streams to design: (i) a framework to characterize both concepts under a system view and, (ii) harmonized definitions (e.g. identification of shared and essential properties) for such fundamental concepts. Our main contribution is scholastic, but we are confident that the posed conceptual artifacts can be further used to elaborate standardized definition for the IT service and IT service system constructs, as well as analysis tools for describe real service systems. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *IT Service; IT Service System; Service; Service Systems; Systems Approach*

INTRODUCTION

Service Science, Management and Engineering (SSME) (Chesbrough & Spohrer, 2006, Spohrer et al.. 2007), IT Service Management (ITSM) (OGC, 2007; Beachboard et al.. 2007), and Service-oriented Architecture/Software Engineering (SOA/SOSE) (Bieberstein et al.. 2005; Kontogiannis et al.. 2007), are knowledge streams focused on developing an emergent service system engineering and management paradigm founded in the concepts of service, service system and by extension upon: IT services, IT service systems, and Service Oriented Software (SOS) concepts.

Such a focus on services has been largely influenced by core marketing[1] and business researchers (Levitt, 1972, 1976; Heskett, 1987; Schlesinger & Heskett, 1991; Quinn, 1992), who independently have envisioned a high-valued and semantically richer concept of service than the traditional simple and low-valued one. In particular Quinn (1992) conceives a new service-based economy, through his studies of strategic re-definitions of product-oriented manufacturing organizations to service-oriented business organizations. At present, this service view has permeated so strongly in business organizations, that the business organizations focused on delivering "*help, utility, experience, information or other intellectual content … account for more than 70% of total value added in the OECD"* (Sheehan, 2006). Thus the construct of service - as opposed to the product concept or the usual post-sale business activity - has experienced fundamental changes, and acquired a high business practical and theoretical relevance.

In particular since IT technology plays a critical role for the realization of such high-quality, cost-effective and trustworthy services provisioned by service systems (Zysman, 2006; Zhao et al.. 2007), we are motivated to provide practical assistance to help to IT stakeholders and to enlighten their understanding of such concepts. Academically we are interested in advancing our formal engineering and managerial knowledge on such systems. Such a diversified literature has provided a richness of findings on such concepts, however at the same time the lack of integrated and/or standardized conceptualizations has precluded a clear understanding to both IT practitioners and academics. For instance, the service concept has been used in the IT knowledge stream from the 1970's (Lewis, 1976; Olson & Chervany, 1980; Leitheiser & Wheteber, 1986) until today (Pitt et al.. 1997; Kettinger & Lee, 1997, 2005; OGC, 2007), but with different connotations.

Additionally, the current tight interrelationship of the ITSM and SOSE knowledge streams increases the conceptual variety and confusion on what are IT services and on how they can be engineered and managed efficiently and effectively. We consider that in the IT stream –and any knowledge stream- ambiguity and imprecision must be avoided by both IT stakeholders and academics. A vast literature of failed IT systems and the contrast of real user's needs versus the final capabilities implemented can be magnified for the multiple conceptualizations of what represents an IT service. For instance, an IT service can vary from a full ERP capability service priced in hundreds of dollars by hour to a single access to a laser printer priced at cents per sheet. Thus the available knowledge on services, service systems and IT services, is not harmonized: e.g. there are multiple definitions, with shared and unshared properties, and with different scope of referents, even though in the same knowledge stream as IT. Furthermore, no similar study on an integrated conceptualization of such concepts was located in the related business and SSME literatures.

We consider also that given the diverse nature of the above mentioned interrelated concepts, a system view (Ackoff, 1971; Gelman & Garcia, 1989) is useful to organize and integrate such diversified literature. Consequently, in this article, we use a systems approach to review and synthesize key studies on such knowledge streams to design: (i) an initial framework to characterize both concepts under a system view, and (ii) initial harmonized definitions (e.g. definitions based on the shared and essential properties of main sources) for such fundamental concepts.

The organization of our manuscript is as follows: we describe the systemic research method instanced as a conceptual design research (Mora et al.. 2008c; March & Smith, 1995). Next, we report the review of the set of selected studies - from business and SSME knowledge streams - and the design of the conceptual framework for service and service system constructs. We continue with an analysis of the conceptual evidences, and elaborate on an integrated definition for the constructs of service and service system. Finally, we conclude with a discussion on implications of such proposals for theory and practice, and on the limitations and cautions of our study.

DESCRIPTION OF THE CONCEPTUAL DESIGN RESEARCH METHOD UNDER A SYSTEMS APPROACH

The selection of the research method is based on two criteria: (i) adequacy to treat conceptual complex pieces to be analyzed and synthesized and (ii) method's familiarity to researchers. For the first case, we consider that the vast business and available SSME literature has provided a rich, but complex network of conceptual pieces for the constructs of service and service system. However, such a variety at the same time, adds a complexity dimension manifested for the lack of an agreement. Consequently, an adequate research method must provide tools for addressing and organizing such complex interrelationships. In this research, a systems approach (Ackoff, 1971; Gelman & Garcia, 1989) is used as a research meta-method[2] for such an aim. The specific instance is a conceptual design research method (Mora et al.. 2008c; March & Smith, 1995).

The systems approach assumes that the reality or conceptual situation under study can be mapped to a system comprised of interacting subsystems, and into a wider system, and environment, which affect it. Systems can be real or conceptual but all share the following properties: emergency, purposefulness, hierarchical organization, and control and communication information. A systems approach thus provides parsimonious but powerful concepts to organize disparate and complex elements as a hierarchical organization under a common purpose (Mora et al.., 2007).

The used specific conceptual design research method is reported in Mora et al. (2008c). Its five activities are[3]: CD.1 Knowledge Gap Identification, CD.2 Methodological Knowledge Selection, CD.3 Conceptual Design, CD.4 Design Data Collecting, and CD.5 Analysis and Synthesis. Activities CD.1 and CD.2 corresponds to first two sections of this article. Activities CD.3 and CD.5 are reported in forth one.

A conceptual design research method is used for designing a conceptual artifact through a systematic process. For March and Smith (1995) a design research approach is used to build and evaluate non-trivial, non-naturally created and non-existent artifacts needed for human-being purposes. Design research outcomes are constructs, models, methods, or instantiations. Build activity responses to the inquiry: is feasible to build X by using Y?, and evaluate activity to the inquiry: does the artifact X fulfill the design range of set M of expected metrics? March and Smith (1995) do not report guidelines for the build activity, but suggest strongly the development of metrics for the evaluation activity. Utility and value are the usual criteria suggested by March and Smith, in contrast to truthness for natural/behavioral sciences. Another core framework for research methods (Glass et al.. 2004) does not distinguish between natural and design research. However, from the reported three main research approaches (descriptive, formulative and evaluative), and 19 research methods, this research can be assessed as a formulative-framework/concept and evaluative-other approach, as well as an instance of conceptual research method. Under the Hevner et al.'s framework (2004), this research is a design research with two constructs and one model/framework as outputs. Seven design research guidelines are given by Hevner et al. (2004). Table A.4 in the appendix A, reports how these guidelines are addressed in this research.

CONCEPTUAL DESIGN OF THE SERVICE SYSTEM FRAMEWORK

SSME literature on services is new and limited, while the management science literature is vast. For our conceptual analysis with a design purpose we have identified five set of studies with theoretical sufficiency. This conceptual sampling procedure denominated theoretical sampling (Strauss & Corbin, 1990, p. 176) selects units of study by the relevance to build theory. This design research does not claim to elaborate on a theory of service systems, but we consider this criterion for selecting conceptual *ingredients* as highly adequate. The five set of studies are as follows: (i) Levitt (1972, 1976), (ii) Shostack (1984), Heskett (1987), and Schlesinger and Heskett (1991), (iii) Cook et. al (1999), (iv) Spohrer (2008) and Spohrer et al.. (2007), and (v) Mora et al.. (2008b).

Levitt (1972, 1976) is a pioneer in suggesting an engineering approach to design services process (e.g. a well-planned and industrialized process that reduces the employee's discretion, and assigns the adequate control level of employees on the service process). Shostack (1984), Heskett (1987), and Schlesinger and Heskett (1991) complement Levitt's industrialization approach to services with a focus on employee training, motivation and satisfaction features, but hold the premise that services can and must be engineered. Cook et al.'s study (1999) reviews 39 previous related studies on services published from 1964 to 1996 in the domain of business operations management. Spohrer (2008) and Spohrer' et al..'s (2007) studies are integrative studies on extensive service marketing and service business literature. These studies have also shaped the emergent SSME knowledge stream. Finally, Mora et al.'s study (2008b) poses concepts of service and service system by using the Theory of Systems (Ackoff, 1971; Gelman & Garcia, 1989). The main contribution of last study is the utilization of formal definitions of the concept system, in contrast to the typical but theoretically incomplete connotations widely used. A similar critique has been reported in the related domain of Information Systems (Alter, 2003; Mora et al.. 2003, 2008a; Gelman et al.. 2005).

For modeling a system (Gelman & Garcia, 1989; Mora et al.. 2003) it is necessary and sufficient to identify the following elements: (i) inner systems (subsystems), (ii) outer systems (suprasystem, environment), (iii) interrelationships with outer systems (inputs, outputs), (iv) interrelationships with inner systems, and (v) properties and actions.

Inner systems (called subsystems) are systems that compose the system under study, are mandatory for composing it and own their specific components. Outer systems (suprasystem, and environment) are the immediate wider system that contains the system under description (suprasystem), and the outer setting that contains the supra-system (environment). Both affect the system and both can be affected by it. Interrelationships with outer systems are the transference of materials, energy and information that the system needs to fulfill its purpose (a fundamental emergent property). The system's inputs are the flows of materials, energy and/or information that the system needs to have a useful purpose. The system's outputs are flows of materials, energy and/or information that the system generates to the supra-system for accomplishing its purpose. The interrelationships with inner systems can be considered inner inputs and outputs. Finally the system's properties are substantial features with the potential to exhibit an effect/product or cause/producer, while that the system's actions are acts performed by the exercise of properties, and these (actions) can be realized on itself (e.g. the system) or on other external systems.

Systems own some mandatory properties: emergency, purposefulness, hierarchical organization, control and communication information, and outcomes. Emergency is a generic name for any property owned by the whole system but not by a subset of parts. Purposefulness is the implicit general and long-term aim searching by the system. This can be self-defined or imposed by an external system. Hierarchical organization is a property that is manifested by the system per se through its composition by subsystems and its inner interrelationships. Control and communication information property is manifested through the exchange of information for controlling and/or communicating aims. The system's outcomes are properties that affect the wider system called supra-system. These effects are usually measured through system's effectiveness metrics. Additional system's metrics are of efficiency to evaluate the rate of outputs to inputs (including other resources), and of efficacy to evaluate the rightness of the real achieved outputs versus the expected ones. Of all these properties, emergency can be considered the root one, and the remainders as a subset. For instance, purposefulness is an emergent property as it is own by the whole entity, and not for a particular part. This view is exhibited in Table 1.

Consequently to design the service systems framework the following steps were undertaken: (I) we selected a previous theoretically valid conceptual framework of what is a system (Mora et al.. 2003) and it was updated with generic knowledge on services by two lead authors. (II) Each core study was reviewed by two lead authors for identifying conceptual pieces that fit in some of the five elements that comprise a system. Each time a new conceptual element was identified (and agreed to be included by at least two authors that acted as codifiers), previous studies were analyzed again to assess

Table 1. The essential system framework

ELEMENT 1: INNER SYSTEMS
1.1 Subsystem A
1.1.1 Process/activities
1.1.2 People (employees)
1.1.3 Resources
1.2 Subsystem B
1.2.1 Process/activities
1.2.2 People (employees)
1.2.3 Resources
1.X Subsystem …
ELEMENT 2: OUTER SYSTEMS
2.1 Suprasystem
2.1.1 Beneficiaries/Customers
2.1.2 Competitors
2.1.3 Suppliers
2.1.4 Regulators
2.1.5 Partnerships
2.2 Environment
2.2.1 Economic Influences
2.2.2 Legal Influences
2.2.3 Social Influences
2.2.4 Technological Influences
2.2.5 Physical Influences

ELEMENT 3: INTERRELATIONSHIPS WITH OUTER SYSTEMS
3.1 INPUTS
3.1.1 Customer's needs/wants
3.1.2 User's needs/wants
3.1.3 Extent of beneficiaries' contact (presence/participation)
3.2 OUTPUTS
3.2.1 Service actions' attributes
ELEMENT 4: INTERRELATIONSHIPS WITH INNER SYSTEMS
4.1 INNER INPUTS
4.1.1 Inner Customer's needs/wants
4.1.2 Inner User's needs/wants
4.1.3 Inner Extent of beneficiaries' contact (presence/participation)
4.2 INNER OUTPUTS
4.2.1 Inner Service actions' attributes
ELEMENT 5: PROPERTIES & ACTIONS
5.1 Emergency
5.1.1 Purposefulness
5.1.2 Hierarchical organization
5.1.3 Control and communication information
5.1.4 Outcomes
5.1.5 Other properties
5.2 Actions

the extent to which that element is: explicitly (●), implicitly (⦿) or not posed (○) in such studies. Thus, the assessment of elements exhibited in Table 2 was built iteratively. (III) Authors qualitatively assessed the elements identified in the five studies to pose the final non-redundant and essential ones to be included in the harmonized view of the construct: service system. The triple symbol (ΔΔΔ) stands by for an essential/mandatory element for the harmonized view of service system, two symbols (ΔΔ) stands by for a sub-item of a mandatory element, and a single symbol (Δ) for a sub-item of a mandatory element but few reported. Finally, (IV) the other three co-authors conduct a face validity test on the rationale of such element in the service system framework. Table 1 exhibits the essential system framework, and Table 2 the new designed service system framework.

The main insights from the set of five core studies are used to design and theoretically support the service system framework exhibited in Table 2. We remark the essential ones. From Levitt's studies (1972, 1976), suggests that we must avoid a discretionary and casual human-intensive approach for services and we must design, deploy and control services similar to the standards and quality of products that are manufactured. Thus, components (1.1.1, and 1.1.3) are remarked.

Subsequent studies (Shostack, 1984; Heskett, 1987; Schlesinger & Heskett, 1991) have complemented Levitt's view for services with employees' satisfaction and motivation. Schelesinger and Heskett (1991, p. 73), while defending the need of employee motivation and satisfaction, admit that implicitly these issues are insufficient when asserting that " … *service failures are not failures, they have been designed into the system by the choices senior management have done*". Thus from a systems view, service failures must be assigned to the overall system and trust only in highly motivated employees is insufficient to guarantee a stable and predictable quality of service. Thus from this set of studies, the systemic element (1.1.2) is justified as essential.

The next study (Cook et al. 1999) is one of the most complete in the business operations management literature. While the authors conclude that a service definition is not adequate, we believe that while an individual proposal for defining such a construct can be disparate, an integrative definition from shared and essential attributes can be helpful. Cook et al. (1999) identify marketing-oriented and operations-oriented service attributes. In the former case, these attributes are tangibility-intangibility, differentiation, object of service (people or people's possessions), type of customer (individual or institutional), and commitment. In the latter case, these attributes are customer contact, capital-people intensity, customer involvement, production process, and employee discretion. Additional attributes such as customization, quality and socio-economic environment issues are also identified. From this extensive study, as illustrated in Table 2, several elements can be remarked (1.1.1, 1.1.3, 3.1, 3.2, 2.2.1, and 2.2.3).

We review Spohrer's (2008) and Spohrer et al.'s (2007) studies by their comprehensiveness in the SSME knowledge stream. While several partial definitions for the construct service are elaborated, we consider that the following one (Spohrer, 2008): *"... the application of resources (including competences, skills, and knowledge) to make changes that have value for another (system)*", as well as the postulation of the service system construct 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*." (idem, p. 72), as the core two contributions related to this research. Spohrer et al. (2007, p. 76) indicates that " … *service systems are complex adaptive systems made up of people, and people are complex and adaptive themselves. Service systems are dynamic and open, rather than simple and optimized. And there are many different kinds of value, including financial, relationship, and reputation*." Spohrer's study (2008) is mainly built up on Lusch and Vargo's (2006) service-dominant

Table 2. The service system framework

	Levitt (1972, 1976)	Shostack (1984,), Heskett (1987), Schelesinger & Heskett (1991)	Cook et al. (1999)	Spohrer (2007), Spohrer et al. (2008)	Mora et al. (2008b)	**Level of Inclusion**
ELEMENT 1: INNER SYSTEMS	⦿	⦿	⦿	●	●	ΔΔΔ
1.1 Subsystem A	⦿	⦿	⦿	●	●	ΔΔΔ
1.1.1 Process/activities	●	●	●	●	●	ΔΔΔ
2.1.1 Well-defined/designed process	●	●	⦿	●	●	ΔΔΔ
2.1.2 Procedures (routinized, standardized)	●	●	⦿	●	●	ΔΔΔ
1.1.2 People (employees)	●	●	●	●	●	ΔΔΔ
2.2.1 Discretion-Divergence controllability	●	⦿	●	⦿	⦿	ΔΔ
2.2.2 Unskilled, skilled or professional	⦿	⦿	●	⦿	⦿	Δ
2.2.3 Motivation/ Satisfaction	○	●	○	○	○	ΔΔ
1.2.3 Resources	●	●	●	●	●	ΔΔΔ
2.3.1 Materials and Machines	●	●	●	●	●	ΔΔ
2.3.2 Information and knowledge	⦿	●	⦿	●	●	ΔΔ
2.3.3 Capital (hard, soft, hybrid)-people intensity levels	●	●	●	●	⦿	ΔΔ
1.2 Subsystem B …						Δ
ELEMENT 2: OUTER SYSTEMS	⦿	⦿	●	●	●	ΔΔΔ
2.1 Suprasystem	⦿	⦿	●	●	●	ΔΔΔ
2.1.1 Beneficiaries	⦿	⦿	●	●	●	ΔΔΔ
2.1.1.1 People (individual vs collective consumption)	⦿	⦿	●	●	⦿	ΔΔ
2.1.1.2 Things (people's possessions)	●	●	●	●	●	ΔΔ
2.1.1.3 Organizations (virtual people's possessions)	⦿	⦿	●	⦿	⦿	ΔΔ
2.1.2 Competitors	⦿	⦿	⦿	●	●	Δ
2.1.3 Suppliers	⦿	⦿	⦿	●	●	Δ
2.1.4 Regulators	⦿	⦿	⦿	●	●	Δ

continued on following page

Table 2. continued

2.1.5 Partnerships	⦿	⦿	⦿	●	●	Δ
2.2 Environment	⦿	⦿	●	●	●	ΔΔΔ
2.2.1 Economic Influences	⦿	⦿	●	●	●	ΔΔ
2.2.2 Legal Influences	⦿	⦿	●	●	●	ΔΔ
2.2.3 Social Influences	⦿	●	●	●	●	ΔΔ
2.2.4 Technological Influences	●	⦿	●	●	●	ΔΔ
2.2.5 Physical Influences	⦿	⦿	●	⦿	⦿	ΔΔ
ELEMENT 3: INTERRELATIONSHIPS WITH OUTER SYSTEMS	⦿	⦿	⦿	●	●	ΔΔΔ
3.1 Inputs	⦿	⦿	⦿	●	●	ΔΔΔ
3.1.1 Customer's needs/wants	●	●	●	●	⦿	ΔΔ
3.1.2 User's needs/wants	●	●	●	●	⦿	ΔΔ
3.1.3 Extent of beneficiaries' contact (presence/participation)	⦿	⦿	●	●	⦿	ΔΔ
3.2 Outputs	⦿	⦿	⦿	●	●	ΔΔΔ
3.2 Service actions' attributes	●	●	●	●	●	ΔΔΔ
3.2.1.1 Intangibility	●	●	●	●	●	ΔΔ
3.2.1.2 Quality features (ordered, uniform, predictable, reliable, standard, cost-effective)	●	●	●	●	●	ΔΔ
3.2.1.3 Simultaneous production -consumption time	⦿	●	●	●	●	ΔΔ
3.2.1.4 Co-manufacturing between customer-service system	●	●	⦿	●	●	ΔΔ
3.2.1.5 Perishability of effects	○	○	●	⦿	○	Δ
3.2.1.6 Reversibility of effects	○	○	●	⦿	○	Δ
3.2.1.7 Extent of customization, differentiation and specialization (unique/generic)	●	●	●	●	⦿	Δ
3.2.1.8 Financial evaluation (cost, economic value)	●	●	⦿	●	⦿	ΔΔ
ELEMENT 4: INTERRELATIONSHIPS WITH INNER SYSTEMS	○	○	○	⦿	⦿	ΔΔΔ
4.1 Inner Inputs	○	○	○	⦿	⦿	Δ
4.2 Inner Outputs	○	○	○	⦿	⦿	Δ
ELEMENT 5: PROPERTIES & ACTIONS	○	○	○	●	●	ΔΔΔ
5.1 Emergency	○	○	○	●	●	Δ
5.1.1 Purposefulness	○	○	○	●	●	Δ

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Table 2. continued

5.1.2 Hierarchical organization	○	○	○	●	●	Δ
5.1.3 Control and communication information	○	○	○	●	●	Δ
5.1.4 Outcomes	⦿	⦿	⦿	●	●	ΔΔΔ
5.1.4.1 Generic added value only assessed by beneficiaries	●	●	●	●	●	ΔΔΔ
5.1.4.2 Physical-Temporal added value (time, place, form) only assessed by beneficiaries	⦿	●	●	⦿	●	ΔΔ
5.1.4.3 Mental added value (psychological, cognitive) only assessed by beneficiaries	⦿	●	●	⦿	●	ΔΔ
5.1.4.4 Financial/economic added value only assessed by beneficiaries	●	●	⦿	●	⦿	ΔΔ
5.1.5 Other properties	⦿	⦿	⦿	●	●	ΔΔΔ
5.6.1 Complexity	●	⦿	●	●	●	Δ
5.6.2 Sustainability / Survivability	○	○	○	●	⦿	Δ
5.6.3 Efficiency/internal service system's metrics	⦿	⦿	●	●	●	ΔΔ
5.6.4 Efficacy, Ethical and Aesthetical metrics	⦿	⦿	⦿	⦿	●	Δ
5.7 Actions	⦿	⦿	⦿	●	●	Δ

logic, where each "*service system engages in three main activities that make up the service interaction: (1) proposing a value co-creation interaction to another service system (proposal), (2) agreeing to a proposal (agreement), and (3) realizing the proposal (realization)*". Spohrer (2008) study endorses Lusch and Vargo's (2006) core proposition that "*value is always uniquely and phenomenologically determined by the beneficiary*." Service system's efficiency (how well the system is performing its processes) and effectiveness (how much the system's outcomes are valuable to its supra-system) emerge as value-oriented natural attributes. The remaining systemic metrics, i.e., efficacy, ethical, and aesthetical measurements (Checkland, 2000) are implicitly addressed. Efficacy refers to how well the system is generating the expected outputs. The Ethical category assesses how well the system is acting in conformity with the legal, social and the cultural de facto and de jure norms in its supra-system. In turn, aesthetical issues measures how pleasant are the system's actions. Thus, the five elements are justified, and in particular the element 5.5 (outcome), emerges as an essential feature through the added-value premise that each service system must fulfill.

Finally, from Mora et al.'s (2008b) study, the concepts of business organization, business organizational subsystem, business process and sub-process, business activity, and product and service, are considered from a systems perspective. For Mora et al. (2008b) a service can be defined as an expected and intangible system's people-oriented and valued outcome from a system's outputs (acts), where a system can be a business activity, business process, business organizational subsystem or business organization. In contrast, a product (or good) is defined as an expected and tangible system's machine-oriented valued outcome from system's outputs (matter), where a system can be a business activity, business process, business organizational subsystem or business organization. Accordingly based on the Theory of Systems, generic system's outputs can be classified as a flux of matter, energy, and/or information. Mora et al. (2008b) extends such a classification to include a flux of acts and knowledge, where acts can be considered a special kind of energy, and knowledge a special kind of interpreted information about - how- and why-based information pieces. Such definitions are abstract. Specific attributes are responsibility of the system's modeler. Main distinction between the service and product concepts, is the type of element that can assess the value received (subjective or intra-subjective). In the former case, this can only be conducted by a single person or a group of people, and in the latter case, by automated machines (objective assessment). However, machine-oriented value metrics can be incorporated into an overall service valuation (e.g. for adding objective metrics).

Hence, from these last studies, the five main elements are justified. However, despite the definition a system as subsystems and inner interrelationships, no study reports such elements. For theoretical consistency these elements are kept in Table 2 and assessed with the single symbol (Δ) as few reported.

THE HARMONIZED DEFINITIONS FOR SERVICE AND SERVICE SYSTEMS CONSTRUCTS

The review of these five set of studies covers the most relevant conceptual pieces to assemble the service system framework (exhibited in Table 2). We consider this useful to elaborate on a harmonized view of the service and service system constructs. The main theoretical implication that contrasts with the previous disparate definitions for the service construct, is a holistic multidimensional conceptualization. From a systems view, a service can be initially mapped to: (i) an agreed integrated flux of actions (outputs' system) delivered by a provider system to a customer system to co-create value (Spohrer et al. 2007 view), and to (ii) a status property in the customer service that is affected by the delivered provider's system actions.

However, given the core characteristic on the co-responsibility of both parties (provider and customer systems) to generate the expected value, by applying a systems view again, this characteristic can be assessed as an emergent property. Thus, both the service provider and the service customer are co-producers (e.g. single necessary elements but not sufficient ones by separate) for this expected value realization. This last implication carries out to derive from a systems approach an innovative and challenger re-conceptualization for both service and service system constructs. Instead to consider the service system like uniquely the provider system, and the users being external to the system, we can re-conceptualize it with the following two core components: (i) a *service facilitator* sub-system (e.g. the original service provider), and (ii) a *service appraiser* subsystem (e.g. the initial user's system). This re-conceptualization implies that services failures can be caused by deviations on the agreed behaviors not only from the *service facilitator* subsystem -as at present is usually accepted-, but also from mistakes into the *service appraiser* subsystem. We pose denote this system as ***service-fa system*** to distinguish it from its current connotation, and for the *service facilitator and service appraiser* subsystems as ***service-f*** and ***service-a*** subsystems.

With this new view of system, the initial two-dimensional mappings for the concept service must be updated to be consistent with the systems approach. Thus, we pose the following mappings for the concept of service: (i) an agreed integrated flux of actions delivered by a *facilitator sub-system* to an *sub-appraiser system*, 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 suprasystem.

To distinguish these three dimensions of a service, we pose the following notation: (i) ***service-f(f1,f2,…)*** and ***service-α(α1, α2,…)*** stand by service as a flux of actions, (ii), ***service-f(sf)*** and ***service-α(sα)*** stand by service as properties, and (iii) ***service-fα**** stand by service as the system's outcome. Based in derived findings, we define:

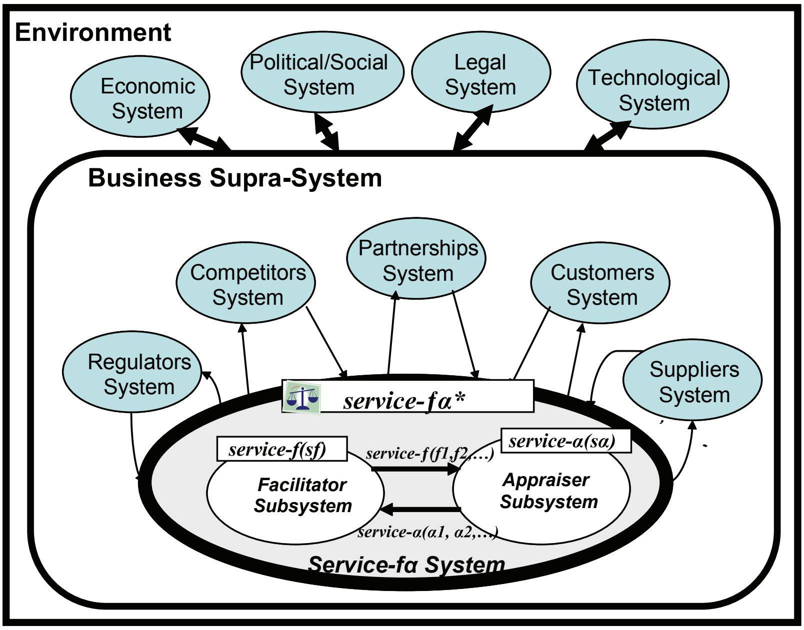
- **a *service-f system*** as a system designed for delivering ***service-f(f1,f2,…)*** actions toward, and receiving ***service-α(α1, α2,…)*** actions from, a *service-α system*, with the purpose to mutually generate an expected outcome called ***service-fα**** and affect positively two properties called ***service-f(sf)*** and ***service-α(sα)***.
- **a *service- α system*** as a system existent for receiving ***service-f(f1,f2,…)*** actions from, and delivering ***service-α(α1, α2,…)*** actions toward, a *service-f system*, with the purpose to mutually generate an expected outcome called ***service-fα**** and affect positively two properties called ***service-f(sf)*** and ***service-α(sα)***.
- **a *service-fα system*** is a system comprised of a *service-f sub-system* and a *service-α sub-system*, with the purpose to mutually generate an expected value outcome called *service-fα**, and which operates into a suprasystem and an environment.
- **a *service-fα**** is an expected people-oriented and valued outcome (which can be complemented by objective machines-oriented metrics), from a ***service-fα system,*** under an implicit or explicit agreement of its *service-f* and *service-α* sub-systems during a well-delimited period.
- **a *service-α(sα)*** is a *service-α system's* property expected to be positively affected by the ***service-f(f1,f2,…)*** and its ***service-α(α1, α2,…)*** actions, under an implicit or explicit agreement of such *service-f* and *service-α* sub-systems during a well-delimited period.
- **a *service-f(sf)*** is a *service-f system's* property expected to be positively affected by the ***service-α(α1, α2,…)*** and its ***service-f(f1,f2,…)*** actions, under an implicit or explicit agreement of such *service-f* and *service-α* sub-systems during a well-delimited period.

Figure 1 illustrates a diagram of such constructs. This definition incorporates the most relevant and shared properties from previous studies but introduces a new connotation on the service concept: by using Theory of Systems, the service is mapped to three systemic constructs: system's actions, properties, and outcomes (special emergent properties). In Figure 1, it is illustrated that the expected valued outcome (e.g. the ***service-fα****) is not experienced only by the *appraisal subsystem* (e.g. the traditional customer or user entities that receive the service) but for all systemic elements: the *facilitator system*, the provider supra-system and finally its environment by the co-creation of value that has interdependencies. The distinction between the appraisal and facilitator system is further elaborated in tables 3.1, 3.2 and 3.3 below.

Figure 1, also illustrates the systemic view of the remainders systems in the suprasystem: system of service regulators, system of service partnerships, system of appraiser's competitors, and the system of service facilitators. It is clear that from a service facilitator system's view, some elements change (e.g. competitors become customers for instance). However, Figure 1, exhibits these supra-system's elements from the ***service-fα*** system, that provides to it an expected outcome (***service-fα****) and which interacts and it is finally affected by the following suprasystem elements: regulators, partnerships, suppliers, competitors and customers.

Additionally by incorporating the fourth and fifth systemic metrics for any kind of systems (Checkland, 2000) of ethics and aesthetic, it is clear that a high quality and valued service

Figure 1. Diagram of the service system and service constructs



(e.g. the outcome) as well as its co-generative service system, must comply also the legal, environmental and social regulations toward its supra-system and environment. Aesthetic issues can be also incorporated by including comparative metrics on how pleasant are the actions experienced by the appraiser and facilitator subsystem in two competitive service systems. Thus, for instance, a high quality service is not more when employees are stressed for unpleasant acts, or when the service system is damaging its environment. With this innovative conceptualization of a service system, we support the Quinn's (1992) notion of a service as the building block for a new trading and business economy, which affects no only to customers, but to all involved systems. In addition, because a service is also an expected outcome, it lasts more, equal, or less than the service period of co-generation (e.g. application of actions).

An additional implication that can be derivable from both these harmonized connotations is an innovative initial taxonomy of three categories of service systems according to their intensity of responsibility of each sub-system. This is as follows:

i. Facilitator-oriented service systems - are service systems when the commitments asked to the service facilitators exceed relevantly to the ones asked to service appraisers.
ii. Appraiser-oriented service systems - are service systems when the commitments asked to the service appraisers exceed relevantly to the ones asked to service facilitators.
iii. Balance-oriented service systems - are service systems when the commitments from both parties are relatively of similar intensity.

We estimate that most service systems at present in business and governmental organizations belong to the categories (i) and (iii). Tables 3.1, 3.2 and 3.3 illustrate such a classification of service systems with three examples. In these tables the symbols (●,◒,⦿) indicate respectively a strong, similar and sufficient intensity of responsibility for the expected value co-generation. In the first case, an air transportation system seeks to serve through a reliable transportation by aircraft from one city to another one. In the second case, a tax declaration system seeks to serve through timely satisfied tax obligations. Finally, in the third case, a graduate educational system seeks to serve through the development of high-quality competences in a specific knowledge domain.

As illustrated in table 3a, an air transportation systems serves as a facilitator-oriented service system to provide a comprehensive service that meets and hopefully exceeds the needs, wants and expectations of the passenger from a service perspective. A strategic alliance with another airline allows code sharing so that passengers have a wider variety of routes (i.e., origins and destinations) to choose from and receive frequent flier miles from code-share partner airlines (e.g., the One World alliance among American Airlines, British Airways, Air Mexico, Cathay Pacific, and so forth). This s*ervice-fα system* is classified as facilitator-oriented, because the responsibilities of the passengers (e.g the appraiser subsystem), are simple and low cost when these are compared with the assigned ones to the facilitator subsystem (e.g. complex and high cost).

As illustrated in table 3b, an e-Tax citizen declaration service system serves as *an ap-*

Table 3a. Examples of the Service System Categorizations: a facilitator-oriented service system

Service-fα: service system name	Air transportation for passengers service system.
Service-fα*: expected value outcome	A trustworthy, cost-effective, and on-time transportation by aircraft from a planned origin to a destination.
service-f: service facilitator sub-system (●)	Airline company.
service-f(sf): service facilitator status properties	-Availability of schedule flights for most expected traveling cities. - Operational conditions of aircrafts. - Enjoyable/pleasant flight environment. - Competitive air tickets prices. - Availability of loyalty rewards programs. - Code-share with other airlines to offer more routes and destinations
service-f(f1,f2,…): service facilitator actions	- Ticket reservation. - Passenger check-ins and check-outs. - Luggage handling. - Flight operation. - Background pre-flight operations. - Background post-flight operations.
service-α: service appraiser sub-system (⦿)	A passenger.
service- α(sα): service appraiser status properties	- Pleasant (secure, enjoyable and on-time) arrival to planned destination by plane. - Pleasant check-out of flight (luggage is not missed)
service- α(α1, α2,…): service appraiser actions	- On time arrival to airport/airline offices - To respect and abide by the airline/federal aviation authority (FAA)/ Transportation Security Administration (TSA) rules & regulations.
Supra-System	International air transportation service system.
Environment	Air and legal space macro-system

Table 3b. Examples of the service system categorizations: an appraiser-oriented service system

Service-fα: service system name	e-Tax citizen declaration service system.
Service-fα*: expected value outcome	Timely satisfied fiscal obligations.
service-f: service facilitator sub-system (⦿)	Government tax office and online tax declaration system.
service-f(sf): service facilitator status properties	- Status of collected taxes. - Status of availability of e-offices
service-f(f1,f2,…): service facilitator actions	- To notify timely the tax payment obligations. - To make available office or e-systems to receive the tax declarations. - To processing tax declarations.
service-α: service appraiser sub-system (●)	A tax contributor.
service- α(sα): service appraiser status properties	- Correctness and timeliness of tax declaration (with potential assistance of other service systems).
service- α(α1, α2,…): service appraiser actions	- To be aware of the tax declarations deadlines. - To present timely the tax declaration, - To keep the fiscal records for further auditing procedures.
Supra-System	Governmental e-service system
Environment	A country tax regulation macro-system

praiser service-oriented system to provide a timely and cost effective service to the taxpayers and the government's treasury department/internal revenue service (IRS). The up-to-date tax code/rules/regulations can be implemented by this transaction system to facilitate the fair and accurate collection of taxes. Web 2.0 technologies (e.g., avatars in Second Life) can be used as supplementary services to assist the taxpayers with their queries and reduce human resources costs for the government. In this case, the s*ervice-fα system* is classified as appraisal-oriented, because while there are relevant responsibilities from the facilitator system, the taxpayers (citizens and business) (e.g the appraiser subsystem), are asked to provide and execute a series of actions ranging from simple to very complex actions, with high cost implicated by wrong actions. In this type of systems, the cost of involuntary mistakes done from the appraiser system is high compared with the first type.

As illustrated in table 3c, a graduate education service system serves as a balanced service-oriented system to provide a valuable service that contributes to the development of the students' lifelong learning activities and helps them earn a living in an ethical and responsible manner. The co-creation of value by the learning facilitator and the student not only enhances the learning experience but also contributes to the development of the individual, society and economy. This s*ervice-fα* system is classified as a balanced facilitator-appraisal system, because the non-accomplishment of responsibilities of any of the two systems will reduce the expected value outcome.

Hence, we can pose as three initial criteria for assessing a s*ervice-fα* system as facilitator, appraiser or balanced one, as follows: (i) the cost of mistakes, (ii) the complexity of actions,

Table 3c. Examples of the service system categorizations: a balance-oriented service system

Service-fα: service system name	Graduate education service system.
Service-fα*: expected value outcome	Development of high-quality competences in a specific knowledge domain.
service-f: service facilitator sub-system (◒)	Graduate system (faculty, curriculum, infrastructure)
service-f(sf): service facilitator status properties	- Innovative knowledge transference status - Relevance of knowledge generated
service-f(f1,f2,…): service facilitator actions	-To teach high-quality knowledge. -To assess students in an unbiased manner. -To encourage students for their maximum performance. -To instill a love/passion for lifelong learning
service-α: service appraiser sub-system (◒)	Graduate student (as a single human being system).
service- α(sα): service appraiser status properties	- Knowledge level - Stress level
service- α(α1, α2,…): service appraiser actions	- To achieve high grade-point-average (GPA). - To fulfill the academic regulations -To apply the learned knowledge in an ethical and responsible manner with sound judgment.
Supra-System	Regional educational service system (e.g., SACS)
Environment	A countrywide and worldwide educational macro-system

and (iii) the legal responsibility for achieving the expected outputs.

From these conceptual systemic designs, we can conclude that these new definitions: (i) include previous main shared properties from key/seminal studies in three knowledge streams, (ii) endorse and enhance two of the best and updated definitions for such constructs (from Spohrer (2008) and Spohrer et al. 2007)), and (iii) are build up on more elaborated concepts of Theory of Systems. Table 1 reports a generic framework of a system. Table 2 exhibits a framework based in Table 1's framework, populated with essential as well as few reported but important elements posed to be considered to characterize a service system and a service. From these findings, the definitions of such fundamental concepts have been reported. In particular, both definitions are highly innovative and challenger to the current ones, but are theoretically consistent with most important elements suggested. Additionally, given the innovative definition of a service system as a whole system comprised of the facilitator and the appraiser subsystems, an initial taxonomy of three types of service systems is reported in Table 3.

We finally argue that from these definitions, more detailed definitions can be generated if the interrelationships and properties of the system under study (e.g. the service system) are considered. These particularizations are suggested for further research.

CONCLUSION

In this conceptual design study, we have reviewed key/seminal studies on two highly related knowledge streams to design: (i) an initial framework to characterize the concepts of service system and service, under a system view, and (ii) initial harmonized definitions (e.g. identification of shared and essential properties) for such fundamental concepts. This article reports also an innovative concept of service as a multidimensional concept: service as actions, service as a property, and service as an expected. For instance, when a person is operated, the service acts are all medical and patient actions for achieving the "be operated" goal, service status properties for patient and doctor can be "health status" and "work satisfaction" respectively, and service as expected value outcome can be "efficient utilization of medical resources" and "recovering a productive person". It must be noted that expected value are strongly influenced during the application of service acts, but it can last after a long period..

We believe this is a challenger and innovative idea based in Theory of Systems. Furthermore, most service studies have used a limited conceptualization of what is a system or have omitted seminal references. For instance, Lovelock & Gummesson (2004) do not cite papers from Quinn (1992) and Levitt's (1972, 74). Furthermore, these authors (Lovelock & Gummesson, 2004, p. 38) suggest that "*in particular, we believe there is a need for systematic field research in services*" (pp. 38) but no seminal reference/s on Theory of Systems is/are cited.

Furthermore, despite there is a growing body of research on isolated aspects of operations services; still there is little research that is explicitly IT Service Management (ITSM) related. Consequently, while there is a significant growth of ITSM practice in industry, there is no academic work or community of scholars that shares a common mission to understand how to advance it. This article serves as a good foundation to build this stream of research using the systems theory as a theoretical foundation. Services are emerging in separate areas of academic, industry and government but few attempts have been made to integrate them. Since the early versions of ITIL lacked truly quantifiable business values, IT organizations are not interested in and supportive of ITSM processes. ITIL faces an uphill battle for acceptance and creditability that needs to be won across the entire organization.

The facilitator and the appraisal system are measurement-driven and outcome-based approach to continuous process improvement that focuses on reduction of variation, consistency and high service quality. Therefore, in terms of IT service oriented industry, combining the ideas from this article with established frameworks such as ITIL, ITSM, Capability Maturity Model Integrative (CMMI) can migrate current processes toward usable, measurable processes that can help enhance and sustain competitive advantage.

In terms of future research directions, more research needs to take place specifically relating to how measures from the framework described in this article contribute to organizational performance and service quality. Furthermore, what are the most appropriate and effective ways to measure the variables illustrated in Figure 1, and on the trade-offs between the various performance measures. Research should also be performed on ways to make the measure/s evolve to keep up with the dynamic changes in the system and needs of each field/industry taking into consideration various factors such as cost, scope, value and timeliness.

Hence, while the primary contribution of this article can be considered scholastic, we claim that these initial framework and definitions for service system can be useful to integrate the disparate current views of IT services, and to advance the knowledge demanded for IT service stakeholders for a better understanding on how to engineering and manage IT service and IT service systems. However, further research is encouraged for such aims.

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ENDNOTES

1. The studies considered in this article are theoretically different from classic marketing studies focused on the quality of services measurement (Parasuraman, Zeithaml, & Berry, 1988; 1994).
2. We define a research meta-method as a research generic process that can be particularized with multiple specific research methods, under a systemic philosophical stance and a multi-methodology research approach.
3. Appendix A presents complementary information on the research method employed. Face validation is based on Sargent (1999) recommendations.

APPENDIX A. THE CONCEPTUAL DESIGN RESEARCH METHOD

Table A.1 Research activities of conceptual design research

Research activity	Inputs	Process	Outputs
CD.1 Knowledge Gap Identification.	* Initial research goals. * Conceptual units of study.	1.1 Selection of studies by (i) recognition of authors; and (ii) comprehensibility of studies. 1.2 Identification of contributions and limitations in studies regarding the research goals. 1.3 Relevance validity assessment of the knowledge gaps.	* The confirmed and refined research goals. * The relevant knowledge gaps.
CD. 2 Methodological Knowledge Selection.	* Confirmed and refined research goals. * Relevant knowledge gaps. * Conceptual units of study.	2.1 Definition of the research purpose (conceptual exploratory or full design). 2.2 Assignation of unit of studies between researchers. 2.3 Selection of the design approach (heuristic or axiomatic).	* The research purpose. * The work plan.
CD. 3 Conceptual Design.	* Conceptual units of study.	3.1 Designing of the construct, framework/model/theory, method, or system/component (not instanced in a real object) by applying the selected design approach.	* The conceptual designed artifact.
CD. 4 Design Data Collecting.	* Conceptual designed artifact. .	4.1 Identification of conceptual units for testing. 4.2 Application of conceptual units for testing. 4.3 Face validity from a panel of experts (not involved in the design team).	* The conceptual designed and tested artifact (initially used with test data). 2. The face validity assessment.
CD. 5 Analysis and Synthesis.	* Conceptual designed artifact tested (initially used with test data). * Face validity assessment.	5.1 Analysis (direct insights) and synthesis (emergent insights) of findings derivable from the designed conceptual artifact.	* The contributions from the conceptual designed artifact.

Table A.2. Results from the model face validation 4.3 Activity (version 1.0)

CONCEPTUAL INSTRUMENT FOR MODEL FACE VALIDATION						PANEL OF EXPERTS						RESULTS	
	Total disagreement				Total agreement	Academic 01	Academic 02	Academic 03	Academic 04	Consultant 01	Consultant 02	Mean	Deviation Std.
I.1 The designed conceptual model is supported by core theoretical foundations regarding the topic under study.	1	2	3	4	5	4	5	4	5	4	4	4.3	0.52
I.2 The theoretical foundations used for developing the designed conceptual model are relevant to the topic under study.	1	2	3	4	5	4	5	4	5	4	4	4.3	0.52
I.3 There are no critical omissions in the literature used for developing the designed conceptual model.	1	2	3	4	5	*	*	4	5	4	5	4.0	0.58
I.4 The designed conceptual model is logically coherent to the purpose to the reality of study.	1	2	3	4	5	3	5	5	5	4	4	4.0	0.82
I.5 The designed conceptual model is adequate to the purpose of study.	1	2	3	4	5	4	*	5	5	4	*	4.0	0.58
I.6 The outcome (i.e. the designed conceptual model) is congruent with the underlying epistemological philosophy used for its development among positivist, interpretative, critical or critical realism.	1	2	3	4	5	*	4	5	5	4	4	4.0	0.55
I.7 The designed conceptual model reports strong innovative original findings.	1	2	3	4	5	2	4	4	4	4	5	3.5	0.98
I.8 The designed conceptual model reports findings that contribute to the knowledge discipline.	1	2	3	4	5	4	5	4	5	4	5	4.3	0.55
I.9 The designed conceptual model is reported using an appropriate scientific style of writing.	1	2	3	4	5	2	4	5	4	4	4	3.8	0.98
Mean						3.3	4.6	4.4	4.8	4.0	4.4	4.27	
Deviation Standard						0.95	0.53	0.53	0.44	0.29	0.52	0.70	

Table A.3. Demography of the panel of experts for the face validation 4.3 activity

Academic 01	Academic 02 (member of the research team)	Academic 03
• PhD in CSc • 15 years in graduate teaching and research activities in SwE • Assoc. Professor in a top European University • Expert in IT Standards • EiC of a Journal related with Standards	• PhD in CSc • 8 years in graduate teaching and research activities in Sw • Senior Lecture in a top European University	• PhD in Education • 5 years in graduate teaching and research activities in Sw • Expert in SwE standards • Assoc. Professor in a top ten state Mexican University
Academic 04	**Consultant 01**	**Consultant 02**
• PhD in MIS • 15 years in graduate teaching and research activities in MIS • Full Professor in a top three private Mexican University	• PhD in CSc • 5 years research activities in Service Science • Lead Principal Researcher in a worldwide USA Research Center focused in Service Science	• MSc in MIS • 5 years in graduate teaching and research activities in MIS • Assoc. Professor in a top ten state Mexican University

Table A.4. Compliance to Hevner's et al. design research guidelines

Id	Hevner's et al. Guideline	Addressing by this research
1	*"Design as an Artifact"*	A new framework and two integrative constructs are generated.
2	*"Problem Relevance"*	The need of having standardized/integrated definitions for the constructs of service and service system is reported. These concepts are fundamental for the development of three knowledge streams: SSME, ITSM and SOSE.
3	*"Design Evaluation"*	Given the scarcity of similar frameworks, the evaluation is realized through the descriptive category by using an informed argument from a panel of experts. This validation is usual in conceptual design of simulation models (e.g. face validation).
4	*"Research Contributions"*	Research contributions are satisfied by the (i) designed artifact itself, and (ii) the foundations for designing service systems. It is not claimed a contribution to category iii: design methodologies.
5	*"Research Rigor"*	Methodological rigor is satisfied through the utilization of the Systems Approach instanced in the design conceptual research method based in Mora et al. (2008c), March and Smith (1995), and Glass et al. (2004). It satisfies also Hevner's et al. (2004, p. 81) criterion for that a problem be considered for design research versus routine design: "*Design-science research in IS addresses what are considered to be wicked problems …That is, those problems characterized by … complex interactions among subcomponents of the problem and its solution*".

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Table A.4. continued

6	*"Design as a Search Process"*	Design as a process - based in Artificial Intelligence discipline- can be defined as the time-space-economical feasible localization/generation of a feasible node in the solution space under the satisfaction of the goal and related constrain set. For complex problems, this an iterative process guided by axioms –if exist them- or heuristics. This research, given the complexity of the conceptual pieces to be used required such a process.
7	*"Communication of Research"*	Design research is presented for engineering audience (the service system framework), and it is also explained its usefulness for managerial audience.

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Information Technology Service Management and Opportunities for Information Systems Curricula

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ABSTRACT

Historically, information systems (IS) programs have taught two of the three areas of information technology (IT) management: strategy and management, and applications development. Academic programs have ignored the third area, IT operations. IT operations management is becoming increasingly important as it is recognized as consuming as much as 90% of the IT budget and as acquisition of software becomes more prevalent than development of custom applications. Along with the shift of management focus to IT operations, standards such as the IT infrastructure library (ITIL) have been adopted by businesses to guide the development of processes for IT operations that facilitate evolution to IT service management. This shift to servitizing IT management, creates an opportunity for IS programs to align with business practices by innovating in the teaching of IT service management. Several methods of incorporating ITSM material into educational programs are explored. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: *Information Services Organization; IS/IT Curricula; IS Operations Activities; IS Policy; Process Improvement; Strategic Alignment*

INTRODUCTION

With increasing frequency, disruptive technology-related innovations cause a paradigm shift in IT practice and management. In the 1950s and 1960s, methodologies codified best practices in application development for analyzing and computerizing complex processes (De Marco, 1979; Yourdon, 1988). Subsequent generations of methodologies evolved to include data orientation, then object orientation, and most recently, event orientation. Relational database technology, introduced by Codd and Date, similarly disrupted data management in the 1970s (Codd, 1970; Date, 1999). The development of personal computers disrupted both industry and academia in the 1980s. Object orientation changed methods of teaching application development and programming in the 1990s (Jacobson et al., 1998). The Internet changed business conduct beginning with its privatization in 1993 but accelerating with technology maturity in the late 1990s and early 2000s. This decade is witnessing two disruptions relating to the servitizing of IT organizations, one technical in the form of service-oriented architecture (SOA) (Durvasula et al., 2008), and one process and management oriented in the form of IT Service Management (ITSM) (itSMF, 2007).

This article addresses the changes in the conduct of IT in business and the related need for academic programs to address those changes. Alternative approaches for developing academic programs are presented and discussed.

THE CONDUCT OF IT IN BUSINESS

In the last century, Information Technology (IT) and the Chief Information Office (CIO) often were separated from the business strategy-development team. Business strategy was developed and possibly discussed with the CIO, who developed an IT strategy, to the extent possible, that fit the business strategy. Enlightened organizations might allow the CIO to sit in the meetings so the later discussion was circumvented. Enlightened organizations might also conduct their critical decision making to prioritize and select projects for development or acquisition through an IT steering committee comprised of the CIO plus other executives who represented critical stakeholders to the decision process (cf. King, 1985). The outcome of a successful matching exercise should align the business and the IT strategy.

IT in Business: The Academic View

More recently, the need for more seamless integration of business and IT strategies has been described (Weill & Ross, 2004). Under the newer scheme, IT moves away from responding to single requests in a never-ending queue toward architecture-driven IT decisions that ensure improved organizational support and, eventually, improved organizational response to changing environmental conditions (Ross et al., 2006; Broadbent & Kitzis, 2005; Ross et al., 2006). Under these more recent schemes, the responsibility for alignment is shared between the C-level executives and the CIO, with successful organizations being those that most closely align IT with business strategy. However, alignment activities apply to matching applications to strategy and does not extend to operations, help desk, or other types of services.

One key issue in these writings and others like them is that the prescriptions give little guidance on how to actually conduct business within the IT department that mirrors and fulfills the alignment objectives decided. Frameworks, such as the IT Infrastructure Library (ITIL), Control Objectives for Information and related Technology (CobiT) or the Capability Maturity Model - Integrated (CMMI) might be alluded to with an implicit assumption that their application will provide the needed IT discipline for IT organizations to act as desired (SEI, 2006; ITGI, 2007; OGC, 2008).

These ways of thinking, rather than avoiding the issues of IT management, either assume that the important actions take place in the decision process or that day to day operation of the IT organization is not relevant to discussions of strategy. Further, books and academic programs that *do* address daily functioning of IT focus on applications development, such as object orientation, or technology, such as telecommunications with little regard to how they are configured and managed in a production environment.

IT in Business: Business Practice

Business organizations, whether public, private, profit, or non-profit, have realized that undisciplined, non-repeatable work can undermine the best governance architecture. To develop a process discipline along with a culture of service, organizations of all types are rapidly servitizing the IT organization and its offerings. Adoption of the IT Infrastructure Library (ITIL) has spread to about 70% of non-US organizations and about 60% of US organizations (Dubie, 2008). In the U.S., 87% of companies with more than 10,000 employees have adopted ITIL (All, 2008). ITIL is chosen over or in concert with Cobit, CMMI, and Six Sigma because as Evelyn Huber of Forrester Research says, “there is nothing else” (Anthes, 2008, pg 2.)

The adoption of service management tenets is idiosyncratic to each organization with significant contextualization of each adopted process and function (Conger & Schultze, 2008). In addition to the high global adoption rate for ITSM tenets and ITIL, in particular, the adopting companies generate a significant number of new jobs requiring service management and process understanding. One U.S. study of itSMF-USA (a practitioner organization) member companies found that about 15,000 jobs requiring ITIL knowledge and skills are created annually (Conger et al., 2008).

The combination of adoption rate and job growth has not gone completely unnoticed with about 15 programs in Australia, Europe, Africa, Mexico, and New Zealand (Cater-Steel & Toleman, 2007). By contrast there are two undergraduate and one graduate ITSM program in the U.S. These adopting universities are bucking established programs and courses to bridge the gap between business and academia. However, the gap is firmly institutionalized in academic program guidelines that hinder broad adoption. The divide between business practice and academic practice is an important one for it permeates IT education. The nature of the divide is explored in the next section.

IT IN EDUCATION

The Model Curriculum guidelines for undergraduate IS/IT education in the U.S. exemplify the business-IS/IT curriculum divide. U.S. curriculum is developed by the Joint Task Force on Computing Curricula, comprised of mostly academics through the Association for Computing Machinery (ACM), Association for Information Systems (AIS), and Institute for Electrical and Electronics Engineers (IEEE). While the 2005, currently official, version is discussed here, an update for 2008 was let for review recently. This discussion applies equally to the 2008 update which only uses the term ‘service’ in terms of student *service* projects, not mentioning IT management, IT operations, process, or service in any pedagogical discussion (The Joint Task Force, 2008).

The computing curriculum guidelines are summarized with weights applied to knowledge areas as shown in Table 1. Degree types and abbreviations include Computer Engineering (CE), Computer Science (CS), Information Systems (IS), Information Technology (IT), and Software Engineering (SE). The numbers ranges from zero to five and represent the relative emphasis at which program coverage is recommended (The Joint Task Force, 2005). Figure 1 shows the “organization” emphasis for information systems. These figures imply that there should be a preponderance of organizational information in IS programs. In fact, the Joint Task Force report says:

“The meaningful question is: ‘Has an IS program broadened its scope to include an integrated view of the enterprise with complex information needs and high-level dependency on IT-enabled business processes?’ ... IS students must learn how to assess and evaluate organizational information needs, specify information requirements, and design practical systems to satisfy these requirements” (ACM/AIS/IEEE The Joint Task Force on Computing Curricula, 2005, p. 32).

The lower half of Table 1 lists ‘business’ knowledge to be included in undergraduate curricula, including organization models, theory, structures, and functions along with system concepts and theories, skills in benchmarking, value chain analysis, quality concepts, valuation concepts, and evaluation of investment performance (ACM/AIS/AITP Joint Task Force on Computing Curricula, 2002, p. 14; The Joint Task Force, 2005). For graduate students,

Table 1. Comparative weights of program components

Knowledge Area	CE		CS		IS		IT		SE	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Programming Fundamentals	4	4	4	5	2	4	2	4	5	5
Integrative Programming	0	2	1	3	2	4	3	5	1	3
Algorithms and Complexity	2	4	4	5	1	2	1	2	3	4
Computer Architecture and Organization	5	5	2	4	1	2	1	2	2	4
Operating Systems Principles & Design	2	5	3	5	1	1	1	2	3	4
Operating Systems Configuration & Use	2	3	2	4	2	3	3	5	2	4
Net Centric Principles and Design	1	3	2	4	1	3	3	4	2	4
Net Centric Use and configuration	1	2	2	3	2	4	4	5	2	3
Platform technologies	0	1	0	2	1	3	2	4	0	3
Theory of Programming Languages	1	2	3	5	0	1	0	1	2	4
Human-Computer Interaction	2	5	2	4	2	5	4	5	3	5
Graphics and Visualization	1	3	1	5	1	1	0	1	1	3
Intelligent Systems (AI)	1	3	2	5	1	1	0	0	0	0
Information Management (DB) Theory	1	3	2	5	1	3	1	1	2	5
Information Management (DB) Practice	1	2	1	4	4	5	3	4	1	4
Scientific computer (Numerical methods)	0	2	0	5	0	0	0	0	0	0
Legal / Professional / Ethics / Society	2	5	2	4	2	5	2	4	2	5
Information Systems Development	0	2	0	2	5	5	1	3	2	4
Analysis of Business Requirements	0	1	0	1	5	5	1	2	1	3
E-business	0	0	0	0	4	5	1	2	0	3
Analysis of Technical Requirements	2	5	2	4	2	4	3	5	3	5
Engineering Foundations for SW	1	2	1	2	1	1	0	0	2	5
Engineering Economics for SW	1	3	0	1	1	2	0	1	2	3
Software Modeling and Analysis	1	3	2	3	3	3	1	3	4	5
Software Design	2	4	3	5	1	3	1	2	5	5
Software Verification and Validation	1	3	1	2	1	2	1	2	4	5
Software Evolution (maintenance)	1	3	1	1	1	2	1	2	2	4
Software Process	1	1	1	2	1	2	1	1	2	5
Software Quality	1	2	1	2	1	2	1	2	2	4
Comp Systems Engineering	5	5	1	2	0	0	0	0	2	3
Digital logic	5	5	2	3	1	1	1	1	0	3
Embedded Systems	2	5	0	3	0	0	0	1	0	4
Distributed Systems	3	5	1	3	2	4	1	3	2	4
Security: Issues and principles	2	3	1	4	2	3	1	3	1	3

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Table 1. continued

Security: implementation and mgt	1	2	1	3	1	3	3	5	1	3
Systems administration	1	2	1	1	1	3	3	5	1	2
Management of Info Systems org.	0	0	0	0	3	5	0	0	0	0
Systems integration	1	4	1	2	1	4	4	5	1	4
Digital media development	0	2	0	1	1	2	3	5	0	1
Technical support	0	1	0	1	1	3	5	5	0	1
Non-Computing Topics										
Organizational Theory	0	0	0	0	1	4	1	2	0	0
Decision Theory	0	0	0	0	3	3	0	1	0	0
Organizational Behavior	0	0	0	0	3	5	1	2	0	0
Organizational Change Management	0	0	0	0	2	2	1	2	0	0
General Systems Theory	0	0	0	0	2	2	1	2	0	0
Risk Management (Project, safety risk)	2	4	1	1	2	3	1	4	2	4
Project Management	2	4	1	2	3	5	2	3	4	5
Business Models	0	0	0	0	4	5	0	0	0	0
Functional Business Areas	0	0	0	0	4	5	0	0	0	0
Evaluation of Business performance	0	0	0	0	4	5	0	0	0	0
Circuits and Systems	5	5	0	2	0	0	0	1	0	0
Electronics	5	5	0	0	0	0	0	1	0	0
Digital Signal Processing	3	5	0	2	0	0	0	0	0	2
VLSI design	2	5	0	1	0	0	0	0	0	1
HW testing and fault tolerance	3	5	0	0	0	0	0	2	0	0
Mathematical foundations	4	5	4	5	2	4	2	4	3	5
Interpersonal communication	3	4	1	4	3	5	3	4	3	4

(ACM/AIS/IEEE The Joint Task Force on Computing Curricula, 2005, p. 24-25)

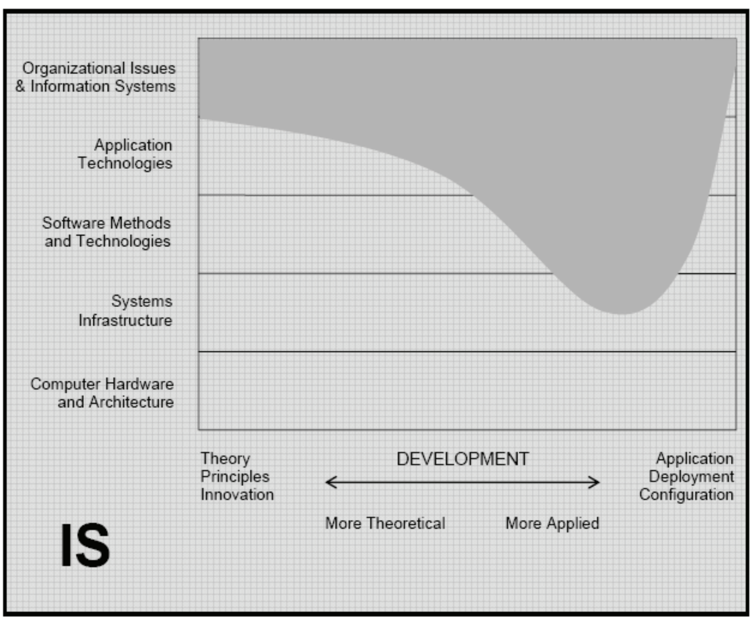
recommended 'business' knowledge includes financial accounting, organizational behavior, and marketing (ACM/IEEE The Joint Task Force on Computing Curricula, 2000, p. 18) in courses with no ties to or even discussion of information technology or its relationship to the topic area. That is, the emphasis, even in programs with a focus on organizational issues does not actually attend to the daily operation of an IT organization.

Neither undergraduates nor graduates in IS programs are required to learn basic information such as how to define, recognize, or analyze a process, let alone how to determine whether or not a process can be improved through automation. Process modeling is confined to creation of data flow diagrams, not process maps that include non-automated activities. Further, the specific management processes applied to the management of IS/IT organizations are missing.

There is nothing in IS/IT curricula about IT Operations or how this function delivers IT resources to organizational customers. This gap is depicted in Figure 2 in which the three key aspects of IT academic program gaps are depicted. On the one hand, IT management, discussing topics recommended in the curriculum guidelines, describes business functions (e.g., Marketing), information levels, and how information is used in organizations. From a service perspective, this discussion is lacking in discussion of the non-functional requirements that must come from business users, for instance, criticality of an application to the organization, and requirements for security, privacy, and recoverability. On the other side of the divide is the application development function for which academic programs discuss programming, requirements modeling, and use case development.

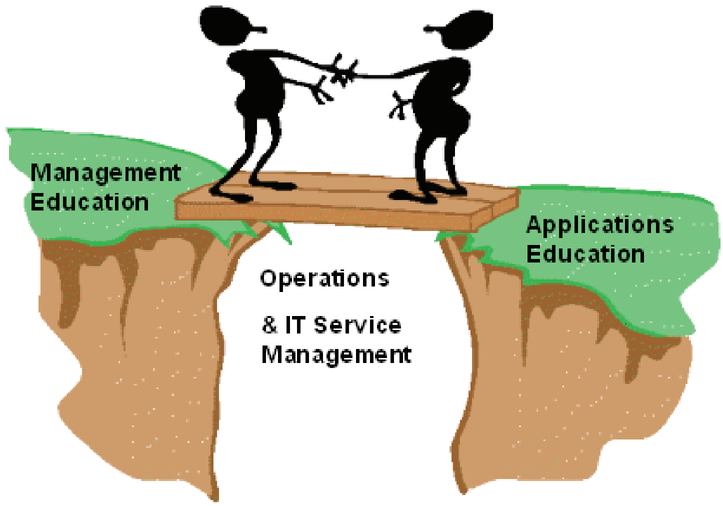
In the gap are Operations, which manages the organization's IT infrastructure and IT Service Management, the discipline that provides process maturity to the entire IT organization. Scant infrastructure organization knowledge or its tasks are recommended in any programs (see Table 1). Further, what infrastructure topics are discussed tend to be 'silo' technology topics such as telecommunications or operating systems. There is no discussion of how the product an applications group delivers actually is placed into production or how it is managed in a production environment. There is no discussion of how to size an application, let alone capacity modeling or planning for a data center. There is no discussion of any of the processes involved in running a data center such as availability management, finance management, incident management, change management, continuity management, and so on. These areas of knowledge are the focus for IT Service Management, the emerging, disruptive IT-related set of management best practices that promises to bridge the gaps between applications and management. ITSM is the first step to servitizing an IT organization and thus, facilitating alignment of IT with its related business strategy.

Figure 1. Information systems profile of topic coverage



(ACM/AIS/IEEE The Joint Task Force on Computing Curricula, 2005, p. 19)

Figure 2. IT in education with operations and ITSM as the missing links



IT SERVICE MANAGEMENT EDUCATION OPPORTUNITIES

Since infrastructure represents a significant gap in all computing education programs, and since management of IT is articulated within the IS academic discipline, IS curricula are the most likely place for ITSM programs. In this section, ITSM is briefly explained and linked to IT strategy. Then, three options for incorporating ITSM concepts into IS curricula are described.

IT Service Management

IT Service Management is generally used to refer to the management of processes within IT Operations so that, through efficient and effective execution of the processes, value accrues to the organization. Thus, companies can create value through application of best practices to IT Operations (Nieves & Iqbal, 2007). IT operations are critical to organizational effectiveness since as much as 90% of IT budgets is used to manage operations (Fleming, 2005).

The term "service" has no single definition and ranges from a change in condition or state of an entity caused by another to a set of deeds, processes, and resulting performances (Zeithaml & Bitner, 1996). From the ITIL perspective, a service is "a means of delivering value to customers by facilitating outcomes customers want to achieve without the ownership of specific costs and risks" (TSO, 2007, p. 45).

IT service management begins with business strategy, which when new or changed, causes reflection on the existing IT service offerings in the form of applications, computing resources and user services. The heart of service management is a series of processes and functions (e.g., service/help desk) where a "process is the set of activities (repeated steps or tasks) that accomplishes some business function" (Conger & Schultze, 2008, pg. 4). Thus, students of ITSM need to understand how business strategy is reciprocally created with IT strategy, and how the development of strategy can cause changes in any IT resources – human, financial, or capital (e.g., hardware), and how the changes are embodied in processes that ensure repeatability and quality.

The processes in ITIL relate to keeping an operations organization functional. The main ITIL processes relate to management of incidents, problems, changes, releases, configuration, availability, capacity planning, financial planning, continuity, and service levels. While the processes apply to any size organization, the benefits of scale are best attained in global organizations, such as Unilever or Proctor and Gamble. One important body of knowledge relates to the scaling of process management from small to large organizations.

ITIL tends to be implemented in the infrastructure organization first. However, many ITIL processes, for instance, incident and change management, though initiated within operations, are actually remedied or executed within another organization usually within IT, such as applications maintenance. Thus, service management processes have tendrils that permeate other organizational processes and coordination of activities throughout an organization is needed to ensure successful and encompassing ITIL implementation. This integration of operations with all other IT organizational activities includes a need for operational process understanding for applications, database, security, and all technology areas.

While ITIL is the only best practice framework that principally addresses IT Operations, there are many valuable alternatives to ITIL that a company might adopt. For instance, the Control Objectives for Information and Technology (CobiT©), the framework most closely related to financial reporting compliance (e.g., Sarbanes-Oxley in the U.S.), was initiated in the auditing world but has crossed over to management of the IT organization (ITGI, 2007). Another often-used framework is the Capability Maturity Model – Integrated (CMMI©), which was originally developed to support application development management has crossed over to use by operations organizations for such areas as project management (SEI, 2006).

Similarly, there are customized versions of ITIL by Microsoft – the Microsoft Operations Framework (MOF©), Hewlett-Packard, IBM, and others. These frameworks adopt ITIL as their base and build on them by customizing for a suite of support software that imbeds the process within the operational framework of software for help desk, network monitoring and the like.

For all of these frameworks, and for service management in general, the goal is creation of value to the organization through its IT operations function. A secondary goal and outcome of successful service management implementation is alignment with the strategy of the business since strategy is the starting point for the development of all service offerings.

Curricular Alternatives Incorporating IT Service Management

The three alternatives for incorporating ITSM into IS academic programs include the following:

- Part of an existing course(s)
- A single course
- A concentration or major set of courses (Beachboard et al., 2007).

Each of these alternatives is briefly discussed.

ITSM as Part of Existing Course(s)

If ITSM were incorporated into a single existing course, one likely course would be an IS Foundations course because it serves the broadest audience. A module on ITSM could discuss concepts of process and service, providing definitions and examples of each. In addition, a brief overview of IT Operations and its criticality to organizational functioning could be provided. Finally, a high level discussion defining various operational processes, such as capacity management, and describing their relationship to other operational processes could be included.

Other existing courses into which ITSM concepts could be interjected include any applications development, database, or telecommunications courses. For instance, during systems analysis and design (SAD), risk analysis and related security mitigations should be discussed.

Also in an SAD class, the need for early capacity planning to ensure adequacy of testing and production facilities for hardware, data storage, and telecommunications could be included. A partial list of non-functional requirements and the need for their articulation and sharing with IT Operations would include, for example, transaction volumes and peaks, number of users and locations, security and privacy, compliance requirements, data integrity, organizational criticality, recoverability, help desk, and access requirements (Conger, 2008). Also in SAD, change management, both for users in terms of using a new application and for the developers in terms of moving the application from testing into a production environment and the work that such a move entails could be included.

Single Course in ITSM

A single course could address Fundamentals of ITSM. This course could discuss alignment of business strategy and IT strategy with the need for demand management driving the creation and presentation of services to the organization. If ITIL were the basis for the course, the five main areas of the framework, relating to strategy, planning, transition, operations, and continuous improvement could be structured into one to three sessions each with case studies and practical exercises for students to apply the concepts.

Concentration or Major in ITSM

A concentration in ITSM requires decisions on content and purpose of the major. If the goal of the program is to obtain the highest possible certifications for students, then alignment with ISO/IEC 20000 would allow students to obtain master's level certification (EXIN, 2008). The ITIL v3 certification scheme now requires over 10 courses and takes more than five years to obtain and is thus beyond the scope of most academic programs (Taylor, 2007). Under the EXIN scheme, the courses relate to ITIL version 2 (the basis for the international standard ISO/IEC 20000) and include Foundations of Service Management, Advanced Services Support and Advanced Service Delivery. One or two other courses could be electives, for instance, Systems Analysis and Design, Process Management, and/or Managing the IT Function.

One issue with a program based on the ITIL framework is that ITIL, per se, does not guarantee 'service management' (Conger & Schultze, 2008). Ultimately, servitizing requires proactive demand management. As in manufacturing operations, IT demand management is used to plan and deploy resources (i.e., applications, computing resources and user services). Once deployed, demand management concentrates on delivering a product that meets a contracted level of service. Under this more 'service management' approach, courses might include some combination of Foundations of Service Management, IT Service Management, Process and Service Design, Service Delivery, Demand Management, and IT Governance.

CONCLUSION

This article argues that IS academic programs are incomplete because of the absence of any content dealing with servitizing the IT function. This absence has caused a widening gap between business conduct and IT academic programs. Servitization includes not only the management of IT Operations but also courses on the processes required to actually manage an IT function. IT Service Management, in the form of ITIL, has become a significant activity in many organizations, and its body of knowledge directly addresses both the gap between IT academic programs and business practice and provides the 'how' to aligning business strategy with IT service delivery. Therefore, ITSM provides an opportunity to move toward explaining *how* to align IT with business strategy, provide students with an understanding of process and service orientations, and move toward developing courseware that comprehends the servitizing of IT.

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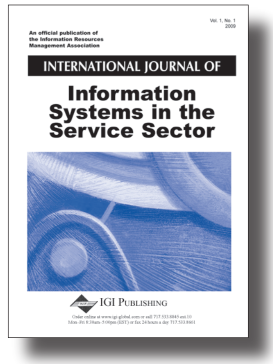

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