Editorial

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Abstract: The papers included in this Special Issue are drawn from the Decision Technologies and Service Science Track of the Hawaii International Conference on System Sciences. These papers highlight an important new direction for services-based business transformation. In this paper, I discuss our underlying assumptions, describe the service-oriented IT paradigm and suggest an integrated service culture. I conclude our thoughts on the emerging trans-disciplinary field of service science that is substantively grounded in the cross-functional issues of business, engineering, technology and the social sciences.

Keywords: SOE; service-oriented enterprise; IT services; service science; SLAs; service level agreements; commoditisation; flexibility; servitisation of processes; architectures and technologies; servitised enterprise.

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Biographical notes: Haluk Demirkan is an Assistant Professor of Information Systems in the W. P. Carey School of Business at Arizona State University. His main research interests and expertise are in services-centric computing and the management of outsourcing relationships. His research leverages his multidisciplinary educational background and extensive professional industry experience in the fields of information logistics and strategic business engineering. He is becoming increasingly well-known for his leadership in the emerging service science, management and engineering discipline. He received a PhD in Decision and Information Sciences, an ME in Industrial and Systems Engineering from the University of Florida.

1 Introduction

As globalisation continues to effect substantial the business world is changing very quickly and with boundless uncertainty. Increasing competition, heightened customer expectations, dynamically changing markets and technologies, mergers and acquisitions and fragmented regulatory environments imply that organisations must become more responsive to changing demands, that is, become more flexible. Patten et al. (2005) define flexibility as a combination of three organisational characteristics: anticipation, agility and adaptability. It has been shown that to achieve flexibility, companies must break down stovepipes into modular services that can be reused dynamically in multiple business processes (Dubray, 2004). Furthermore, the linkages between business

processes and those services need to be aligned and streamlined in a manner that facilitates taking advantage of the cost savings associated with the emerging commoditisation of business processes, software and hardware (Davenport, 2005; Mani et al., 2006). This move to flexibility through innovation has been referred to as the services-based business transformation (Burton-Jones, 1999).

The services-based business transformation has also been driving emerging conceptualisations of the Service-Oriented Enterprise (SOE) and its orientation towards on-demand, proactive computing to reduce the complexities and costs of current information architectures, infrastructures and distributed software. Some scholars have even predicted the demise of enterprise computing as we know it today given anticipated SOE capabilities (Carr, 2005). The foundations for SOE are rooted in current applications of Service-Oriented Architecture (SOA), Service-Oriented Infrastructure (SOI), business process and workflow, computing resource virtualisation, business semantics, Service Level Agreements (SLAs), increasing standardisation, end-to-end enterprise integration, enterprise modelling and other areas of applied and theoretical research.

This Special Issue on the servitisation of processes, architectures and technologies is the culmination of the 'SOE' mini-track in the Decision Technologies and Service Science Track of the Hawaii International Conference on System Sciences (Demirkan et al., 2007). The topic of the mini-track led to a wide variety of submissions representing the growth of the service-oriented IT paradigm. This Special Issue focuses on this paradigm, reviews the impact of servitisation on enterprise systems that are called SOE, investigates its tenets and evaluates relevant management and technical approaches to architecture, infrastructure, business processes, workflows and strategy. The seven papers accepted for the Special Issue investigate these issues in different ways.

In the following section, I provide an overview of the service-oriented IT paradigm with the conceptualisation of SOE. The papers that comprise this Special Issue are introduced in Section 3. In the last section, I discuss some of the major research questions and conclusions of these papers.

2 Service-oriented IT paradigm

The servitisation of processes, architectures and technologies have evolved as a new paradigm in which organisations can define activities (those are collection of tasks) as services in processes, and then source them through service-oriented IT architecture, virtualised infrastructure and technology. The evolution and increasing adoption of the internet, web services, SOA and grid computing have generated great interest in information technology services (Papazoglou and Georgakopoulos, 2003; Spohrer and Riecken, 2006). However, it is becoming increasingly clear that this service-oriented IT paradigm is also part of a larger cross-disciplinary transition from a goods-based economy to a services-based economy (Rai and Sambamurthy, 2006). To understand this paradigm, it is helpful to begin by discussing the goods versus services-based economy.

Lead by the USA, the world economy is currently transitioning from a goods-based economy to an economy in which value creation, employment and economic wealth depend on the service sector (Lusch and Vargo, 2006; Vargo and Lusch, 2004). Services account for 75% of the US Gross Domestic Product (GDP) (Pal and Zimmerie, 2005) and 80% of private sector employment in the USA (Karmakar, 2004), and they play a

similarly important role in all other Organisation for Economic Cooperation and Development (OECD) countries.[1] Industries that deliver consulting, experience, information or other intellectual content now account for more than 70% of total value added in these countries. Market-based services (excluding those provided by the public sector, such as education, healthcare and government) account for 50% of the total and have become the main driver of productivity and economic growth, especially as the use of IT services has grown.[2] Information services and business services are two of the fastest growing segments of the service economy (Spohrer, 2005). According to Babaie et al. (2006), worldwide end-user spending on IT services will grow at a 6.4% compound annual growth rate through 2010 to reach $855.6 billion, with positive growth in nearly all market segments.

All services – from knowledge-intensive services (e.g. business consultant, physician, software engineer, legal council, financial advisor, university professor) to labour-intensive services in the hospitality, personal services and transportation industries – have shared characteristics (Bitner and Brown, 2006; IBM Research, 2004):

- intangible primary products (health, business data, education, etc.) that cannot be easily transported and stored
- value creation with an external, customer-supplied production factor (brain to be educated, body to be cured, etc.), which is non-standardised
- simultaneity of production and consumption (e.g. key airline service is produced while customer is on board) in highly complex service ecosystems.

In the following, implications of this paradigm to IT and transformation are discussed briefly (Table 1). There are significant amount of implications to IT from the services paradigm.

Table 1 Service-oriented IT transformation agenda

From	*To*
Standardisation	Customisation
Transactions	Relationships
Focus on goods	Focus on services
Function oriented	Coordination oriented
Build to last	Build to change
Application silos	Enterprise solutions
Tightly coupled	Loosely coupled
Centralised governance model	Distributed federated model
Cost reduction through manufacturing efficiency	Revenue expansion through services
Limited ability to communicate, store and process information	Improved ability to communicate, store and process information

For example, transforming from ‘Focus on goods’ to ‘Focus on services’ will have huge implications to both IT processes and personnel. Similarly, traditional ‘application

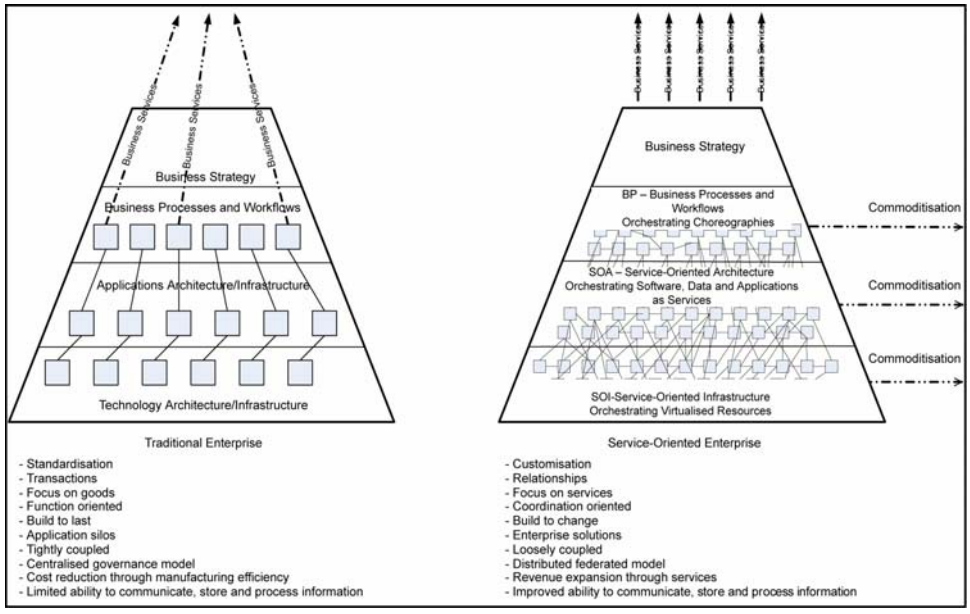
software' is being transitioned to a loosely coupled services model with huge implications to virtually all enterprises (Knorr, 2006).

OASIS (2006) defines service-orientation as,

> "A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations" (2006).

Figure 1 provides an architectural view of the layers that typically exist in a SOE, ranging from low-level infrastructure layers to middle-level application services layers SOA to top-level business processes and enterprise strategies. These top-level processes represent the knowledge-intensive business strategy that drives the ultimate purpose of the enterprise system, adding value to the organisations involved in the collaborative activity. Moving downward, an enterprise strategy is linked to business processes, then a business process is linked to architecture (application) services that support the process and those services are sourced through infrastructure for IT service execution. Horizontal and vertical layers are linked in meaningful ways, so as to support the examining of impacts of changes made in one vertical layer as they ripple through to others. One goal of this architecture is to facilitate the acquisition and integration of the best enterprise services that can be obtained from the market with maximum flexibility. For example, process, software services and even virtualised infrastructure services can be swapped in and out of the architecture when there are viable business reasons. Another goal is to deliver enterprise services to support business strategy from throughout the extended organisation, that is, a view that the IT architecture is itself a provider of enterprise services (Demirkan and Goul, 2006).

Figure 1 Building blocks of SOE (see online version for colours)



Source: Adapted from Demirkan and Goul (2006).

Currently, the information technology researchers and industry professionals are aligned with the horizontal layers in Figure 1 (SOE). Service-oriented IT and the prevailing global shift to a services-based economy, however, have together altered the delicate equilibrium between enterprise computing infrastructures and the support they provide for business processes. In the services model, the infrastructure for provisioning collaborative enterprise services is characterised by market-driven volatility. This volatility has major implications for dynamic sourcing strategies, requiring a deeper knowledge of how volatility affects interoperability within the horizontal layers and through vertical cross-sections of the layers – a concept that IBM refers to as component business modelling. These dynamic sourcing strategies also imply a need for intelligent and autonomic behaviour with respect to participation in collaborative activities (Martin-Flatin et al., 2006), supporting self-monitoring, self-healing and self-management of the service environment in response to the dynamics of the Business-to-Business (B2B) context as well as the Business-to-Customer (B2C) concept of self-service (Kephart and Chess, 2003). The concomitant consumption, coproduction and delivery of services require new scientific foundations, research methodologies and trained scholars to investigate emerging equilibrium issues and to realise self-alignment principles.

3 Papers in this Special Issue and research agenda

In adopting the service-oriented paradigm, enterprises will change their business and IT strategies, operational policies and execution processes in order to receive the most benefits from servitisation. Overall, a 'service culture' is now becoming pervasive in the management philosophies of many modern organisations – including those units typically assigned responsibility for elements of enterprise services.

Even while many organisations are moving towards services computing, the definition of a service and methods for service design are still not very clear. In this paper titled, 'Business application design and enterprise service design: a comparison', Schelp and Winter outline a research programme on the design of enterprise services by analysing different layers of enterprise architecture. They compare software design guidelines established in business application modelling with empirical evidence of enterprise IT service design. They propose that enterprise services are designed similarly to traditional applications with a limited amount of adjusted design guidelines.

In today's collaborative business world, highly complex enterprise service projects require an up-front configuration phase to assess the needed level of engagement from each unit to produce a robust and effective solution (Cameron, 2002). This configuration phase results in an 'engagement model' that involves some or all of those service units. Unfortunately, there is limited research on modelling engagement decision processes, contracting and negotiation processes, assessing the risks (e.g. disaster, security) and examining the service quality associated with outsourcing options. In the second paper, which is entitled, 'Value-at-Risk (VaR) in service-oriented systems: a framework for managing a vendor's portfolio uncertainties', Kauffman and Sougstad provide a solid introduction to the new VaR methodology in the domain of IT portfolio management. Departing from the traditional real options approach which focuses on decision-making prior to making the investments, the VaR methodology assists IT managers in evaluating the worst case expected loss associated with a portfolio of IT investments after the initial

decision has been made. Their research model uniquely applies the VaR portfolio analysis technique to leverage existing capabilities and risk exposures to inform the IT sourcing decision and IT services risk management. This paper represents an original and robust application of VaR methods for evaluating the changing value of IT services investments and portfolios.

The third paper 'Evaluating the benefits of service-oriented computing for risk/return management' authored by Hackenbroch and Henneberger demonstrates that how the value derived from risk/return management calculations can be measured. The paper presents a model to determine the computing capacity in a grid environment that should be allocated to services that are required for risk management tasks depending on current market parameters such as the volatility of asset prices. This paper complements emerging market-oriented resource allocation research.

In the fourth paper, Soper et al. focus on implementation issues and the use of Negotiation Support Systems (NSS) and collaborative technologies. They explain the role of social factors in IT SLA negotiations and the importance of incorporating up-front guidance regarding the construction of IT SLAs into NSSs. Their work confirms the necessity for a systematic and rigorous system analysis and design approach to building effective NSS. This paper recognises the key and potential contribution of NSS in improving both the outcomes and processes of the negotiation.

When each service unit ascribes to its discipline-based focus, the resulting engagement model requires significant integration overhead due to lack of common vocabulary, alternative perspectives of the problem domain and lack of a common understanding of each discipline's toolsets being brought to bear in the analysis of that problem domain. The personnel who are typically self-taught to become effective interservice unit integrators often come to be in such high demand that they bottleneck the efficient and cost-effective delivery of a portfolio of ongoing projects. Lamparter et al. analyses the operational side of these collaborative service execution processes and aims to provide solutions for vocabulary issues. They propose an ontology framework for semi-automated management of web service contracts for automated contracting and monitoring, which relies on existing internet standards to facilitate interoperability in a web environment. Intra and interorganisational service management requires automatic contract mechanisms between parties. In their opinion, full automation is not feasible across organisational boundaries. Their approach integrates static aspects with a formalised description of clauses that are dynamically negotiated and monitored.

In the sixth paper, 'iDesign: intelligent design for service innovation underlying symbiosis', Tung and Yuan propose a roadmap to fulfil valued service innovation using an ecological perspective – the ecological mutualisms theory. Based on this theory, a two dimensional classification schema for services is developed and described using several examples. This framework is based on the notion of partners interacting with each other such that the value of coproduction is driven by adaptability associated with the behaviours of customers and producers. The value that coproduction and service innovation create has a significant impact on strategic partnerships.

In the last paper, 'Legacy to web migration: Service-Oriented Software Reengineering (SOSR) methodology', Chung et al. propose a framework to combine existing software design tools and techniques for service-enabling legacy applications SOSR. The contribution is specifically in the organisation of existing software design methodologies for the purposes of componentising legacy applications and architecting a viable service platform from them. The motivating argument for a manuscript such as

this is the idea that, while service-oriented design methodologies are growing in number and maturity, little has been done to provide assistance in porting legacy (non-component-based) applications into a service context. Organisations are likely to seek ways to reengineer existing applications rather than rebuild them from scratch, necessitating a methodology such as SOSR for supporting this process.

Taken together, the seven exemplar papers selected in this Special Issue highlight the increasing need for research on servitisation of processes, architectures and technologies and seek answers to some of the important questions for the SOE transition.

4 Conclusion

The services-based business transformation has had a substantial impact on our world. This impact will intensify because of our increasing ability to process more information more efficiently while providing access to more people in different parts of the world. An IT/IS services research agenda requires addressing a service science, management and engineering strategy that can integrate the heuristic nature of designing, modelling, representing and warehousing best practice business processes that are sourced by IT services. This research agenda also requires extending traditional services science semantic approaches, development life cycles, tools and standards for the context of business process execution, intraecosystem stability/self-organisation and interenterprise collaboration.

The intent should be to build on the core foundation of an integrated service culture. Such a culture is characterised by a cross-disciplinary attitude that recognises that fulfilling clients' needs is the primary objective. A secondary attitude within that culture must be an awareness of the complexities associated with what I refer to as service trade-off decision making that considers value, risk and cost. The emerging trans-disciplinary field of service science is substantively grounded in the cross-functional issues of business, engineering, technology and the social sciences and its theoretical roots lie in the business disciplines, engineering, technology and the social sciences: for example the theory of transformation (stated in terms of value deficiencies, work processes, decision making and social networks); sociotechnical systems theory (stated as self-regulation for interactions of physical and institutional structures); service ecosystem complexity theory (expressed as a function of the number and variety of people, technologies and organisations linked in the value creation networks); systems theory (stated as the arrangement of and relations between the parts which connect them into a whole (e.g. particles, cells, transistors, people, etc.)) and consumer behaviour theories (stated in terms of customer decision making, experience, satisfaction and perceived quality).

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Notes

[1]The OECD has 30 member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, UK and USA (www.oecd.org).

[2]Business services include the renting of machinery and equipment, computer and related activities, R&D and other business services. Market services include wholesale and retail trade, hotels and restaurants, transport and communications, financial intermediation and real estate, rentals and business services. Total services include market services plus public administration, health, education and other community, social and personal services.