Enterprise Systems in a Service Science Context

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Abstract By enterprise systems we here refer to large integrated standard application packages that fully cover the provision of information required in a company. They are made up of extensive administrative solutions for management accounting, human resource management, production, logistics and sales control. Most of the enterprise systems on the market have traditionally been designed with a focus on manufacturing companies, but during the past years the supply of various enterprise systems for service-oriented business organizations has gradually increased. This fact raises the issue to study enterprise systems from a service management perspective. Service science is an emerging discipline that studies value creation through services from technical, behavioural and social perspectives. Within service science it is therefore possible to use and apply a wide spectrum of engineering tools for development of business services in organizations. In this sense, enterprise systems represent an efficient tool for service innovations. The research interest in this chapter is focussed on how we can study enterprise systems in a service science context.

Keywords Enterprise systems · Service science · IT artefacts · Business reshaping · Life cycles · Method support · Levels of change

1 Enterprise Systems

A current trend since the middle of 1990s is that a growing number of business software packages are classified as enterprise systems [9, 21]. Enterprise systems have been used as advanced tools to increase the business capacity in companies and organizations [2]. By enterprise systems we here refer to large integrated standard application packages that fully cover the provision of information required in a company. Enterprise systems are made up of extensive administrative solutions for

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management accounting, human resource management, production, logistics and sales control. An important criterion is that the included parts are closely integrated with each other through a central database [8]. From that standpoint we can conclude that enterprise systems are all-embracing IT supports for the whole business in companies and organizations [17].

An advantage of enterprise systems is that the vendor guarantees that different functions in the business software package are connected, with thoroughly tested interfaces. A disadvantage is that the different parts in the vendor's enterprise system are often of varying quality. For this reason it may be wise to combine an enterprise system with one or more niche packages. Because of their extensiveness, enterprise systems usually are called enterprise resource planning (ERP) systems [17, 29].

Nowadays many organizations are facing a complex existence, with mixed system environments (platforms) and multiple IT solutions for the same applications in the business. It is not unusual in large companies to find perhaps five different material resource planning (MRP) packages running parallel – often operating on different platforms – as a result of previous organizational mergers. It is therefore tempting to start afresh, replacing existing IT solutions by a new, fresh enterprise system. Most of the enterprise systems on the market have traditionally been designed with a focus on manufacturing companies, but during the past years the supply of various enterprise systems for service-oriented business organizations has gradually increased [23]. This fact raises the issue to study enterprise systems from a service science perspective.

2 Service Science

The service sector dominates the global economy of today. Services have come to represent more than 75% of the gross domestic product of developed nations [16]. In most countries, services add more economic value than agriculture, raw materials and manufacturing combined. In developed economies, employment is dominated by service jobs and most new job growth comes from services. Jobs range from high-paid professionals and technicians to minimum-wage positions. Most activities by government agencies and non-profit organizations involve services [28].

Service science is an emerging discipline that studies value creation through services from technical, behavioural and social perspectives [12]. This new discipline is the application of services management and engineering sciences to work tasks that one organization beneficially performs for and with their customers. Service science is truly multidisciplinary and builds on knowledge and experience developed from marketing, operations management, sociology, psychology, working life science, computer science and information systems [18]. According to one of the pioneers, Jim Spohrer, the new discipline of service science (from around 2005) could be described as follows [5]:

> Service Science is the short term for Services Sciences, Management, and Engineering (SSME). This new discipline is the application of scientific, management and engineering disciplines to tasks that one organization beneficially performs for and with another ('services'). Science is a way to create knowledge. Engineering is a way to apply knowledge

> and create new value. Management improves the process of creating and capturing value. Service Science is truly multidisciplinary! (Jim Spohrer, Director of Services Research, IBM Almaden Research Center, San Jose, California)

Service science as a discipline focusses on fundamental science, models, theories and applications to drive innovation, competition and quality of life through services [4]. This definition suggests a focus on substantive outcomes (innovation, competition and quality of life), grounded in rigorous research (science, models, theories and applications). The definition does not preclude any relevant discipline from participating, nor does it prescribe a particular type of research methodology.

Service science has a potential to stimulate a new and fruitful cooperation between scholars within different academic disciplines to develop concepts, models, theories and not least relevant empirical studies on value creation through service. Service science should open up for and invite scholars in areas such as software metrics and software development, service-oriented architecture (SOA), open source frameworks, service simulation, system interaction and integration, service management control and business strategy [27]. The focus should be on how value is co-produced or co-created with customers and thus add value for other stakeholders such as shareholders, employees and society in general. Both strategic and operational issues must be focussed on [19].

Within service science it is therefore possible to use and apply a wide spectrum of engineering tools for development of business services in organizations [7]. In this sense, enterprise systems represent an efficient tool for service innovations. Enterprise systems and service science do have intersections today which will widen due to the fact that more and more IT vendors are trying to take up the SOA (service-oriented architecture) paradigm [11]. We will now look closer to possible connections between enterprise systems and service science in a business environment.

3 Connections Between Enterprise Systems and Service Science

For gaining a deeper understanding of the practical use of IT systems in service-based organization it is essential to highlight the relationships between enterprise systems and service science from a business environment standpoint (see Fig. 1). Enterprise systems and service science depend on each other. Particularly, they both influence each other for various connections.

The relationships can also be regarded from a Venn diagram perspective with joint and separate parts. Enterprise systems are general or universal IT solutions for all kinds of organizations, e.g. for traditional manufacturing companies as well as for professional service-oriented organizations. On the other hand, service science as a discipline can propose many kinds of engineering tools where, e.g., enterprise systems could give good potentials for supporting service management in organizations.

The research interest is here focussed on how we can study enterprise systems in a service science context. We have approached this issue from investigating some

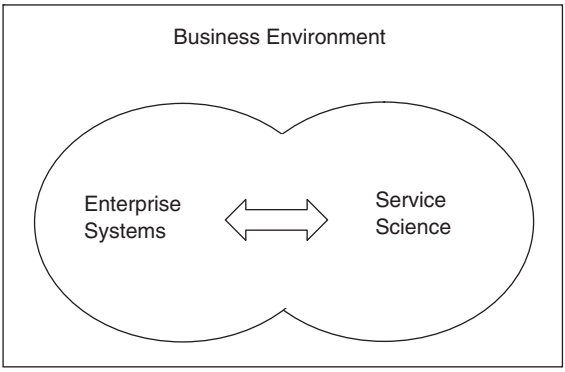

Fig. 1 The relationship between enterprise systems and service science

possible connections [20–22] or significant conditions between enterprise systems and service science related to

- IT artefacts
- Business reshaping
- Life cycles
- Method support
- Levels of change

We will describe each possible connection in a separate section below. These connections have been found when analyzing the literature of enterprise systems and service science as well as using practical experiences from business projects.

4 Enterprise Systems and Service Science – IT Artefacts

Enterprise systems could be regarded as useful IT artefacts to support some kind of business in organizations. By IT artefacts we mean the use of hardware and software solutions to improve the business activities and service processes within and between organizations [24]. The IT artefacts can be of a varied character, for example, we can create IT solutions in organizations by using software metrics, service-oriented architecture (SOA), open source frameworks, service simulation and system integration (see Section 2). We are here focussing on enterprise systems as IT artefacts for developing and changing the situation in concrete business service cases. In the service science literature you will find IT outsourcing service systems [28] and offshore outsourcing [4] as other examples of IT artefacts for service innovations.

Enterprise systems are examples of IT systems for the collection, processing, storage, retrieval, distribution, presentation and use of information in organizations.

An enterprise system is an integrated part of the business operations that it is supposed to serve or in other words an embedded system with the business services in companies [1]. It is not an end in itself, but intentionally arranged for organizing the message exchange or communication between people for supporting their work tasks in service organizations [7]. Enterprise systems could also have a more offensive or aggressive target for enabling or creating new business opportunities in service companies, e.g. Internet Banking and Electronic Commerce. In the new service economy, enterprise systems will play an essential role for promoting a more proactive service management [13].

The ISD subject has a tradition to be multidisciplinary in character trying to study the phenomenon of "information systems" such as enterprise systems from, e.g. technical, economical and pedagogical aspects. Therefore, there is a need to integrate knowledge from different disciplines, such as computer science, business administration and behavioural science [6], when studying the phenomenon of enterprise systems in organizations. Therefore, the disciplines of information systems and service science have much in common as multidisciplinary subjects [27].

A significant condition is that organizations live with enterprise systems in an increasingly changing world. There are a number of trends or driving forces in the business world around us that will have a growing impact on investments in enterprise systems [22], for example:

- The structure of companies is becoming more virtual, horizontal and network-based.
- Enterprise systems are to a greater extent used as inter-organizational or business-to-business (B2B) solutions between service companies.
- Actors are increasingly operating on electronic or digitized markets using the Internet technology and E-business framework for service organizations.

In this light, the fields of information systems and service science will play an increasingly important part in the future. We need to invest in enterprise systems for the professional service organizations of tomorrow. This is a position statement on service science from an information systems perspective where the IT artefact is represented by an enterprise system.

5 Enterprise Systems and Service Science – Business Reshaping

From earlier experience we have noticed that enterprise systems are going through different stages or phases in business reshaping of service operations in companies and organizations [22, 30]:

1. Automation and Efficiency
2. Integration and Cooperation
3. Transformation and Networking

In the *first stage* the focus is on automating certain service operations, to do things right, faster and cheaper with support of enterprise systems. The primary use of enterprise systems has been to increase the efficiency of different functions or activities in organizations, e.g. by automating service jobs that earlier was carried out manually. This approach could lead to "information islands" in service organizations more or less isolated from each other.

In the *second stage* the focus is on cooperation between business processes and service operations inside companies – from these viewpoint, efficient functions or activities are important but not sufficient. Business people often think more in terms of workflows or service processes for achieving expected results. Enterprise systems as an integrated support to service operations become a key issue on the top management agenda. This approach promotes that bridges are being built between "information islands" in service organizations.

In the *third stage* the focus is on transforming service operations in the market place for creating competitive power of the enterprise systems. The value constellation or networks of business actors comprise our focal company, customers, clients, suppliers and partners. Enterprise systems from different business actors are linked to each other and shared databases or e-portals are used. This approach supports inter-organizational solutions and connects "information islands" over company boundaries for service organizations.

An interesting condition is that all three stages, automation, integration and transformation, are interdependent, which means that we must work with them simultaneously. The "field of play" is to go through the three stages of business reshaping over and over again to make an improved use of enterprise systems in service organizations. The value creation of a company is performed by the business services [12, 19] in interaction with the enterprise systems in use. In this sense, enterprise systems must be considered in a service science context.

6 Enterprise Systems and Service Science – Life Cycles

Change work in organizations goes through a life cycle with sequential, parallel and/or iterative phases. It is the same way with change processes as with, e.g., product and market development processes. We will here focus on life cycles for investments in enterprise systems and for development of business services in organizations.

A life cycle can be partitioned in a number of phases or areas. On a crude level a development life cycle can consist of phases for change analysis (with enterprise models), formulation (of requirements specification), implementation (of business solution) and after some time assessment (review of business operations). These phases or areas focus on different kinds of problems and therefore demand various bodies of knowledge and professional competence [20].

What pattern lies behind a life cycle philosophy? Development work can be seen as a form of decision-making activity. The Nobel Prize winner Herbert Simon (in

1978) states that all kinds of decision making go through three phases: intelligence (I), design (D) and choice (C) [26]. When we come to the situation to carry out or execute a decision it is according to Simon again a decision-making activity (with its own IDC triplet). A general model for change processes (based on IDC) comprises of three recurrent and overlapping phases: planning (goals), operation (activities) and evaluation (evidence).

What we have learnt as a lesson from the ISD area is that it is fruitful to consider a system's life cycle consisting of phases for acquisition, use, maintenance and phasing-out of enterprise systems [20]. Strictly speaking, by information systems development (ISD) we mean the acquisition phase including steps for analysis, design and implementation of IT artefacts.

From an *enterprise systems perspective* we can identify three different types of life cycle models [15]. From the beginning there has been a customized development of an in-house system for a specific company (original development model). Further on an IT vendor has performed a generalized and packaged solution in the shape of a newborn enterprise system for sale on an open market (vendor development model). Thereafter every customer or user organization has to perform an acquisition and implementation of a selected enterprise system among the IT vendors (customer development model). This last life cycle model is what we normally think of when adopting and deploying enterprise systems in service organizations [3].

From a *service science point of view* there are several life cycle models launched in the literature for service innovation and development. In a work system life cycle model for business services we can identify four different phases: initiation, new development, implementation and operation/maintenance of service systems for organizations [1]. In a discipline life cycle model for service science we can identify three comprehensive phases: strategic planning, innovative design and operation/evolution of business services [14]. In a service research life cycle model we can identify four overall phases for service development and innovation: service idea generation, the service strategy and culture gate, service design and service policy deployment and implementation [13].

It is now an interesting task to try to compare and contrast life cycle models from general information systems development (ISD), acquisition and use of enterprise systems in customer organizations as well as present experiences from the service science area (see Table 1). It is here an attempt to sketch a four-phase model for each of the three areas based on the presentation of different life cycle approaches above.

Table 1 Life cycles from an ISD, enterprise systems and service science perspective

ISD life cycle	Enterprise systems	Service science
1. Analysis	1. Selection	1. Planning
2. Design	2. Customization	2. Innovation
3. Construction	3. Adoption	3. Evolution
4. Assessment	4. Management	4. Operation

There is a need for life cycle models for development and use of enterprise systems as well as for service development and innovation of professional organizations. When studying different life cycle models for enterprise systems and business service development (from service science) they seem to have more similarities than discrepancies. This is an interesting observation which facilitates a desirable integration and interaction between enterprise systems and business services. Earlier research and practice from our ISD area could here be of valuable support for elaboration and extension of future life cycle models.

7 Enterprise Systems and Service Science – Method Support

Reliable experience shows that issues concerning the design and use of enterprise systems in organizations need to be addressed systematically [21]. Nevertheless, quite often the investments in enterprise systems are performed following ad hoc strategies. Enterprise systems or ERP systems are implemented into more or less chaotic company environments, where too much happens at once. Business people tend to select enterprise systems by instinct behaviour (using their "heart") rather than by rational thinking (using their "brain"). Some of the effects of this could be as follows:

- The enterprise systems are underused, or even disrupt the business services of the company.
- An increased IT vendor dependency, which leads to extensive extra work for the service providers in the organization.
- Constant adaptations are made, both in the business services and the enterprise systems.

Earlier research has to some degree been focussing on systematic ways of working or method support for acquiring, implementing and maintaining enterprise systems in organizations. The traditional approach in the ISD discipline is to support with general guidelines and checklists for managing enterprise systems in companies [20]. From services research we have recognized a complementary approach with different supporting methods for service idea generation, service strategy and culture, service design and service policy deployment [12, 13]. From IS research we have recently developed method support for characterizing business services as work practices and communication patterns [7] which will make the use of enterprise systems more transparent in service organizations.

A good working principle is to be able to combine systematics with inspiration in a sensible manner when implementing enterprise systems in our service organizations. We need appropriate "doses" of both methodology and creativity to achieve successful results when designing new business services in an effective interplay with applied enterprise systems. In this regard, enterprise systems have to be understood within a service science discipline.

8 Enterprise Systems and Service Science – Levels of Change

Enterprise systems should be viewed in a wider organizational context. Business performance of service management generally consists of different tasks which can be collected into some appropriate levels [1, 10, 11, 13]. We can recognize three levels of change for work practices in companies, each level with a distinct scope and focus [22]:

- **Business market level**
  Focussing on strategies for improving the business relationships between our company and the cooperating actors in the market environment.
- **Service operation level**
  Focussing on strategies for making service operations more efficient within our company; the workflow or processes are improved.
- **Enterprise systems level**
  Focussing on strategies for how enterprise systems can be more useful resources for running the service operations more professionally and competitively.

In today's business world, information support by enterprise systems has become a more integrated part of service operations and, in many cases, a vital part of the business mission itself. In fact, the enterprise systems could also create new service opportunities for companies to reinforce their competitive edge in the market place. In many cases development of business markets, service operations and enterprise systems are often carried out as separate change measures and as independent projects in organizations.

The business challenge is to have a proper organizational coordination and timing between the three levels of work practices in companies. Strategic congruence and integrated control between organizational levels are essential issues on the top management agenda in companies. Therefore, investments in enterprise systems should be in harmony with the efforts taken on business market and service operations levels in organizations. In other words, enterprise systems should be regarded from a service science perspective.

9 Summing Up

The research interest in this chapter is focussed on how we can study enterprise systems in a service science context. We have identified and described five possible connections between enterprise systems and service science as follows:

- Investments in enterprise systems as *IT artefacts* represent a valuable engineering tool for making service organizations more effective in the business world.
- Investments in enterprise systems could strengthen the stages of *business reshaping* in service organizations (i.e. automation, integration, transformation).

- Investments in enterprise systems follow a *life cycle* model which should be coordinated with the corresponding life cycle model for service development.
- Investments in enterprise systems for service organizations should be guided by a systematic way of working with a solid *method support* for change work.
- Investments in enterprise systems should be in harmony with different *levels of change* in service organizations (i.e. market, operation and systems levels).

These possible connections between enterprise systems and service science are grounded from a series of theoretical and empirical studies based on a scientific design method called consumable research [25]. Most of the enterprise systems on the market have traditionally been designed with a focus on manufacturing companies, but during the past years the supply of various enterprise systems for service-oriented business organizations has gradually increased. Therefore, it is important to study and investigate enterprise systems in a service science context.

In conclusion I would like to give our ISD discipline a challenge for the future. In this respect I will refer to a well-known formula for performing success in business services by applying it to the area of information systems development:

$$\text{Degree of success in ISD} = f\ (\text{Quality} \times \text{Acceptance} \times \text{Value})$$

The success formula states that to attain a successful result for information systems development (ISD) in organizations, we must have a sufficient quality in the designed IT solutions and a good acceptance among the users or people to give them a motivation for using the enterprise systems as well as that the designed IT solutions should create a business value to the ultimate beneficiaries or customers to the company. A low figure in quality, acceptance or value will lead to an unsuccessful result – hence, the multiplication sign in the success formula. There is a strong interplay between computers, people and work tasks in organizations – a lesson learnt from the history of the ISD discipline! As a final point we would like to give service organizations a real business challenge for the future:

> Be open to the new and interesting opportunities that modern enterprise systems offer. Winners are those who make the best use of the enterprise systems in their business services!

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