Service Science as a Transdisciplinary Model for Information Science

Hans-Christoph Hobohm

Potsdam University of Applied Sciences
Friedrich-Ebert-Str. 4, 14467 Potsdam, Germany
hobohm@fh-potsdam.de

Abstract

Service science is a relatively new concept that wants to educate future "service experts" in as comprehensive a way as possible. The nature of services means that this concept must take as transdisciplinary an approach as possible. The nature of information science means that the concept seems to have something to do with that discipline. The following paper will demonstrate how information science can contribute to a service science. It will present relevant study content and programmes on offer in Germany and abroad and will use this as a basis from which to call for a transdisciplinary positioning of information-science disciplines in the future. The "new" discipline of service science has also experienced a boom that resembles, albeit in a shorter timeframe, information science.

Keywords: Service science, Information science, Transdisciplinarity, Curriculum, Competencies

1   Starting point

Fundamental to the changes happening in society today is the transition to an information and service economy that is no longer defined solely by products and material goods but also, and above all, by services. "Service economy"

has long been the widely accepted term for describing our current economic system. For a long time, however, implementation of this concept was limited to a fundamental principle of a general customer focus and respective changes to product portfolios. The "new" possibilities presented by e-commerce and the corresponding advances in web technologies, combined with new "management-science" approaches, are increasingly producing a new understanding of the term "service" – one that accounts for the soft aspects of customer communication on the one hand, and for the aspects of technical communication between information systems on the other.

The transition to a service economy is fundamentally changing the needs of companies and their academic discipline, business administration. While traditional economics programmes were primarily concerned with value chains in industrial production, the focus is now increasingly shifting to the need for research into service management and innovation, and for academic education that can produce service specialists rather than mathematically focused business administrators. For a long time now, social and personal competencies have been central to management discussions and recruitment efforts. In addition, greater attention is being paid to topics that concern information technology and information science. As early as 1996, Picot, Reichwald and Wigand, writing in what is now a standard business administration textbook, pointed to the potential that the information sciences had for modern company management in a global environment.

Important impetus for arriving at a concrete description of what constitutes a service came from Parasuraman, Zeithaml and Berry (1984) when they developed their gap model, or rather the SERVQUAL method for measuring customer satisfaction.[1] The method has also, as is well known, found its way into the library world as LibQUAL+[2]. The survey findings showed that soft factors (or intangibles, e.g. empathy and appearance) play an important role in the success of service transactions in all industries. This put the emphasis on the personal/social components of services marketing and made it possible to describe what business practitioners had learned long ago: that social relationships are always the most important form of capital. In early 2000, other areas of the economics discussion that were seeking knowledge resources as capital also began emphasising the social aspect of business organisation. The economy discovered information science at the peak of the

---

1 Spohrer et al. (2015) are rigorously pursuing this model from the perspective of value.

2 LibQUAL+. Charting Library Service Quality: http://www.libqual.org/.

knowledge management hype cycle – though without the situation really being reciprocated to the same degree. Information science (and economics, too) was still paying too little attention to the "social life of information" (Brown & Duguid 2000).

On the other hand, the term "service" has experienced a veritable boom in computer science in particular – so much so that some began talking of misuse. Gartner Consulting, Inc. has been including the concept of *service-oriented architecture (SOA)* in its technology hype cycles since the mid-1990s. Services have started playing an increasingly important role in the IT industry, with service-oriented architectures offering numerous new possibilities. Examples of these include web services, software as a service (SaaS), infrastructure (IaaS) or platforms as a service (PaaS) – i.e. everything as a service (XaaS), or cloud computing.

On his way to developing an interdisciplinary, academic discourse on how to describe service, information scientist Robert Glushko (2008) defined the following seven service types (2010):
1. Person-to-person
2. Technology-enhanced person-to-person
3. Self-service
4. Multi-channel
5. Service on multiple devices or platforms
6. Backstage or computational
7. Location-based and context-aware services

In doing so, he drew a continuum between "experience-intensive" and "information-intensive" services (Glushko 2011) and thereby essentially reflects the two paradigms of information science that Ingwersen and Järvelin (2005) identified in *The Turn.*

2   The emergence of a service(s) science

The term "service science" was established, under the leadership of IBM, as a concept and stand-alone term in 2004. The development was based on the Innovate America report that was published by the Council on Competitiveness and counted the president of IBM among its participants. The report

resulted in the National Innovation Act being introduced in Congress in 2006.[3]

(10) SERVICE SCIENCE. – The term 'service science' means curriculums, research programs, and training regimens, including service sciences, management, and engineering (SSME) programs, that exist or that are being developed to teach individuals to apply technology, organizational process management, and industry-specific knowledge to solve complex problems.

(13) SSME. – The term 'SSME' means the discipline known as service sciences, management, and engineering that -

(A) applies scientific, engineering and management disciplines to tasks that one organization performs beneficially for others, generally as part of the services sector of the economy; and

(B) integrates computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in

1 how organizations create value for customers

2 and shareholders that could not be achieved

3 through such disciplines working in isolation.

(H.R. 4654, sec. 3 definitions).

Although the bill was never adopted, the work that produced it had a major impact on the academic world. It sparked a wide variety of activities connected to the new concepts of "service science" and "service science, management and engineering (SSME)". The SSME section of the IBM Academic Initiative website provides an even clearer explanation of the concept and refers in more concrete terms to disciplines and learning goals (Murphy 2012):

Service Science or Service Science, Management and Engineering (SSME) is a growing multi-disciplinary research and academic effort that integrates aspects of established fields like computer science, operations research, engineering, management sciences, business strategy, social and cognitive sciences, and legal sciences. [...] Practitioners need depth and breadth in combinations of technology, business, and organizational studies, even at the undergraduate level. The goal of Service Science is to nourish productivity, quality, and learning and innovation rates across the service sector.

The call for new skills, competencies and insights grew out of the desire to find ways of surviving in an increasingly complex global society: "knowledge and skills needed to succeed in the information and service economy."

---

3 However, it was not enacted: H.R. 4654 [109th]: National Innovation Act of 2006. https://www.govtrack.us/congress/bills/109/hr4654/text <10.1.2015>.

A new discipline emerged at the concrete intersection of the service-oriented economy and the IT-driven economy, and although the information sciences were repeatedly mentioned in connection with its basic ideas, they never really picked up the ball and ran with it.

Jim Spohrer (2008a) observed the development of the most-affected (sub-) disciplines – e.g. Business Administration (MBA), Organization Theory, Computer and Information Sciences – over the past 100 years using three dimensions: Business, Social-organizational and Technology. The result showed an astounding convergence at the mid-point of the three axes. Information Sci & Sys was located right in the centre and overlapped slightly with Performance Support Systems, Service Ops & Mgmt, Service Marketing, CSCW, and Agent-based Computational Economics (fig. 1). The topics and approaches of the last few decades have increasingly incorporated the three dimensions of technology, organisation, and business. Spohrer's interesting theory is that this trend towards interdisciplinarity initially requires generalists who then, thanks to the new "discipline", become specialists themselves.
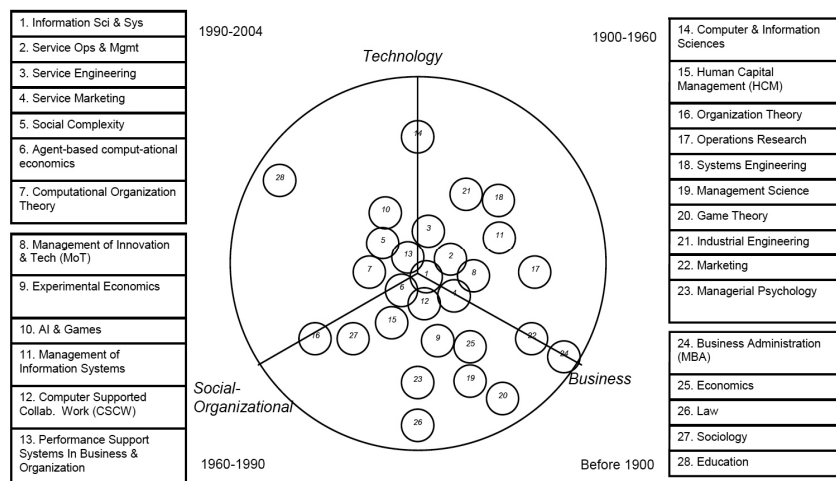

1. Information Sci & Sys	14. Computer & Information Sciences
2. Service Ops & Mgmt	15. Human Capital Management (HCM)
3. Service Engineering	16. Organization Theory
4. Service Marketing	17. Operations Research
5. Social Complexity	18. Systems Engineering
6. Agent-based comput-ational economics	19. Management Science
7. Computational Organization Theory	20. Game Theory
8. Management of Innovation & Tech (MoT)	21. Industrial Engineering
9. Experimental Economics	22. Marketing
10. AI & Games	23. Managerial Psychology
11. Management of Information Systems	24. Business Administration (MBA)
12. Computer Supported Collab. Work (CSCW)	25. Economics
13. Performance Support Systems In Business & Organization	26. Law
	27. Sociology
	28. Education

Figure 1. Convergence of disciplines contributing to „Service Science" –
in the centre: "Information Science" (Spohrer 2008a: fig. 4)

Spohrer's list (2008b: 18) of the ten key areas for a general theory of service science also casts an interesting light on the interdisciplinary embedding of information science in a transdisciplinary service science:

- Economics and Law
- Operations Research
- Industrial Engineering
- Computer Science
- Information Science
- MBA and Management Consulting
- Management Information Systems and Knowledge Management
- Organizational Studies and Organizational Learning
- Urban Planning, Ecosystem Services, and Nature's Services
- Complexity Science and Complex Adaptive Systems for Social Systems Research

Here, Spohrer makes a clear distinction between Computer and Information Science, but also allocates Knowledge Management and Organizational Learning to separate fields. Unfortunately, in his explanation of the Information Science field, he quotes almost exclusively from the Wikipedia entry of the time, in which information science was already clearly described as being interdisciplinary. Spohrer believes that the significance of information science primarily lies in the fact that "a rapidly growing portion of the service sector deals with information services," and concludes that "a general theory of service will need to borrow from and align with information science" (2008b: 24).

3   A new discipline as a study programme?

A variety of academic programmes were drafted in the wake of IBM coining the term "SSME". The University of Maryland and the Arizona State University were among the pioneers. These days, the programmes differ depending on the faculty to which they belong and generally have a specific focus that reveals the connection to the original discipline. Since 2006, the I-School at UC Berkeley has also been offering courses that address the need for service science. It was even initially planning to create an entire degree programme. The idea was that the course, entitled Information and Service Economy, would provide the foundation for a master's in 'Information Systems and Service Design' (Glushko 2011).

A variety of courses (in the US) were examined as part of the process of developing the curriculum. In doing so, Robert Glushko (2008) found that

most of the programmes were mainly located in the area of business admini-stration and focused on the socio-organisational aspect of service science. Other programmes that focused more on the engineering sciences paid greater attention to the technological side but, with content such as queuing theory and discrete-event simulation, seemed at times too abstract and there-fore unsuited to the human components of service science. Programmes that were more concerned with questions of user interfaces and human-computer interaction made it almost impossible to incorporate the economic context of strategic service management. North Carolina State University was the only one to have a genuine service science curriculum that, according to Glushko, covered key content but was nevertheless lacking in its coverage of econom-ics topics.

A cooperative initiative for a new curriculum was thus launched at the University of California, Berkeley. A diverse mix of partners were involved and it had the support of IBM (Glushko 2011: 24). Little is now left of this concerted initiative. The University of California at Merced is the only one that explicitly offers services science as a minor subject for its bachelor's programmes. Most of the other universities have integrated the topic into other subjects and appear to have moved away from the idea of developing a separate field of study. In their 2014 study, Martín Peña, María Luz and Marcos Martínez[4] come to the conclusion that, in the few countries where the subject has developed, a positive correlation to a high gross national product exists. They call for more study and training programmes to be set up, pri-marily because of the developmental benefits they will bring. In this sense, service science becomes the lead science in the service economy and the great white hope on the road to an information economy. Nevertheless, the study only lists four bachelor's and six master's programmes around the world. What is more, the programmes cover a relatively large area with their specific titles, which include Service Management, Human Services/Manage-ment, Service Design and Engineering, and a concentration in Services Man-agement on one of the MBA programmes (308 ff.)

The situation in Germany is similar. A few examples of individual ap-proaches are as follows: Furtwangen University (FH) offers a Bachelor of Science in Service Management. Course content includes service innovation, media in service and usability, electronic components and applications, and marketing and services. The programme clearly lacks, among other things,

---

4 Motta et al. did not identify many more in their 2011 paper.

the socio-organisational perspective (see Spohrer's diagram in fig. 1). In addition, the list of possible future careers includes – alongside the classic business engineer – technical writer, usability engineer, and training manager / concept developer. The MBA in Customer and Service Management at Aachen University of Applied Sciences (FH) initially had a stronger focus on service science, but has recently been repositioned towards international markets. In addition to business models in service, the course content now includes cross-cultural competencies and business intelligence. Trier University runs a business administration Masters in Service Management. The basic module in service economics addresses decision and game theory, and its service marketing module looks at, among other things, competition-oriented information management and innovations in ICT. It does not, however, explicitly address service in the Spohrer and Parasuraman sense of the term. The Harz University of Applied Sciences (FH) also offers (and has done for a long time) a BA in Business Administration / Service Management, which, at least from the outside and on the basis of its module structure, appears to differ from a traditional business administration programme only in that it allows students to take a specialisation in either consulting or location and event management.

Genuine information science courses in Germany often use the term information service(s), but it is, again, impossible to detect any kind of service-science orientation in these programmes. They naturally lack the "hard" economics components that we find in the business administration courses. Stuttgart Media University (HDM) is the only one to have ever dared make an attempt in the direction of service science – though it evidently no longer offers the programme. The Information Systems and Services master's did actually combine information science, information technology, business administration and service management. The university's bachelor in Business Informatics has also started to look very "traditional" again. The International Master in Service Engineering, which is based in the Business Informatics department at the University of Stuttgart and run in collaboration with the universities of Tilburg and Crete, appears to be alone in corresponding to the topic of service science. Even the *Karlsruhe Service Research Institute*, which was founded by IBM and the University of Karlsruhe in 2006, has not developed its own degree programme as was originally hoped. Instead, it is continuing – in much the same way as Tilburg's European Research Institute in Service Science – to focus on research. It seems, therefore, that a trend is developing in which service science approaches are being removed from

economics courses at the same time as the business administration aspects of information science programmes are shrinking.

4 Transdisciplinarity as a model

Irrespective of whether or not it is established in genuine degree programmes, a discipline can also be measured by publication output. A similar discussion on establishing discipline status is currently being held in the digital humanities (Hobohm 2015). For a long time now, they, too, have had large handbooks and dedicated journals and conferences but have seldomly managed to give form to a specific programme of study. The service(s) science(s) also have a comprehensive handbook (Maglio/Kieliszewski/Spohrer 2010) and a series of specialised conferences and journals.[5] At times these provide very explicitly inductive descriptions of the content of the possible discipline. What is striking is that, even from this perspective, the information sciences, or rather their practical application, still play an important role, as some of the terms used are also mentioned explicitly in the curricula of information science programmes. A look at the scope of the *Journal of Service Science and Management* might help clarify the point. The journal lists the following as relevant topics (among others):

- Information System Management
- Data Mining and Knowledge Discovery
- Web Based Services and Applications
- Software Engineering Management
- Knowledge Management and Semantic Web
- Business Intelligence
- Computational Economics
- Decision Support System
- Innovation and Entrepreneurship
- Human Resources Management

---

5 In addition to the *Journal of Service Science* and the *Journal of Service Science and Management*, these include the *International Journal of Information Systems in the Service Sector*, the *Journal of Systems Science and Systems Engineering*, and *Managing Service Quality.*

- Customer Capital Management
- Psychological Services
- Service Science
- Quality Management
- Project Management
- Public Administration
- Urban Economics and Planning.

Over time, the scope has become larger and larger. It now includes a variety of fields of application, such as Food Services, Health Services, Children and Youth Services, Building Services, and Tourism. Within the context of the service economy, customer orientation and service are a meta-topic that concerns all disciplines and practical fields. Information science also went through a period where attempts were made to establish specialisations in specific domains as stand-alone degree courses (chemistry, media, medicine, etc.).

   As part of a large-scale Delphi study in 2007, Rahul Choudaha developed a competency-based curriculum model for a service scientist (cf. also Motta et al. 2011). It was built on, or rather referred to the T-shaped-people model that is often used by IBM (e.g. Dueck 2011) and describes the type of people that will be needed in the society of the future (fig. 2).

   The centre of the model is occupied by a meta-competence, which has also been described as playing a central role for careers in information (Hobohm et al. 2015). Above all, it is clear that service science is also a transdiscipline (as Mittelstrass (2012) describes it) that, rather than just involving ad-hoc interdisciplinary collaboration, systematically addresses an overarching social (global) phenomenon (problem). Typical transdisciplinary questions include (according to Mittelstrass) climate change, nanotechnology and technology assessment. In this age of digitisation and the information and knowledge economy, information science could also see itself as a transdiscipline because of its addressing the overarching global problem of the information glut (Ibekwe-SanJuan 2014, Hobohm 2014).
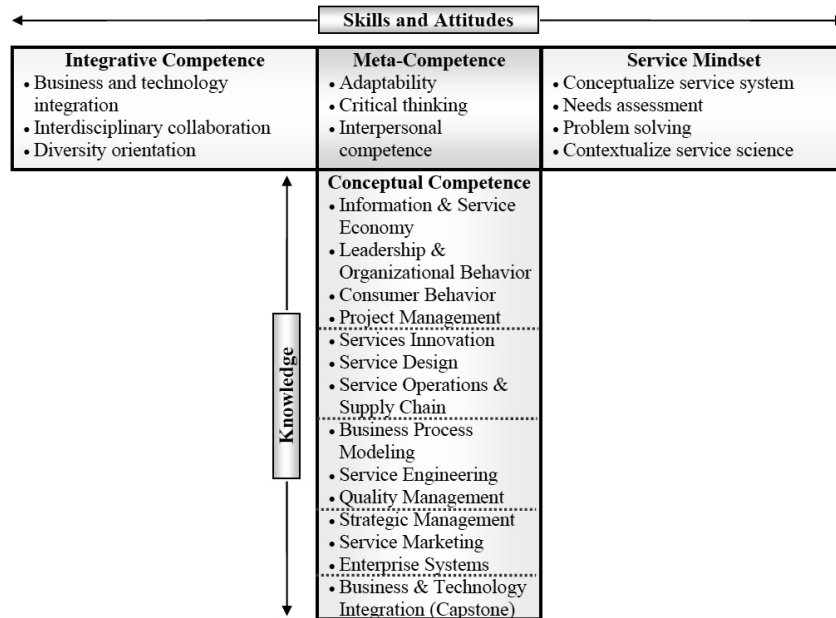
Figure 2. T-shaped people: Competency model for a service scientist
(Choudaha 2008, fig. 7)

In light of all this, Robert Glushko (2008) suggests a "discipline lifecycle matrix" as a way of taking a structured approach to positioning information science. The matrix can be used to establish which sub-disciplines should participate to what degree in the lifecycle of a service. The service lifecycle he proposes essentially corresponds to the PDCA[6] cycle of quality management, or rather to the general cycle of strategic management that, via a feedback loop of target-setting and analyses of target achievement, assigns managers the task of making continual improvements. Services are strategically drafted, planned, designed and eventually put into practice, developed, evaluated and optimised. At each of these stages, different subject areas are involved to different degrees. However, it is only the sum of them together that produces the "life" of a service at the management level. If information science says that information service is one of its main objects, then the matrix actually also describes the components of the information science curriculum.

---

6 „Plan – Do – Check – Act"

Table 1: The discipline-by-lifecycle matrix (R. J. Glushko, 2008)

		D1	D2	D3	...
Strategy	Planning				
Design	Innovation				
	Specification				
	Composition				
	Realization				
Operation	Deployment				
	Management				
	Evaluation				
	Optimization				
	Evolution				

Disciplines (D1, D2, etc.) in the matrix might be "computer science, engineering, management, business strategy, law, and organizational sociology". However, they could also doubtlessly be sub-disciplines of the kind addressed in the *Journal of Service Science and Management* or of the kind that already exist in traditional information science curricula and competency profiles. Somewhat like a recipe book, the table makes it possible to put together a relevant service-oriented curriculum. In many places here it becomes clear that an information science curriculum must not hesitate to draw on external subject areas – as is already implicitly happening with subjects such as library management and information technology. Conversely, individual fields such as indexing or retrieval – to name just the classics – can also be put to the test with this analysis in order to re-adjust their weighting.

The ideal transdisciplinary revision of the curriculum will doubtless initially fail when it comes up against the practical realities of the academic world – as appears to have been the case with service science. It could, however, also be the case that the intensive efforts undertaken from 2004 to establish a service science curriculum were merely the peak of inflated expectations on the hype cycle, and that we are currently in the trough of disillusionment – after which comes, often unnoticed as we know, the slope of enlightenment and then the mainstream.

One could think in terms of longer cycles for information science, and this raises the question of whether the slope of enlightenment will actually follow. Nevertheless, and in addition, information science as a discipline should take its cue from service science and reposition itself. It should also demonstrate, on the one hand and in line with Spohrer's analysis, that it does indeed

occupy the centre and can make its big contribution to all stages of the service lifecycle and, on the other, that it is capable of reinventing itself against the backdrop of this new paradigm. Spohrer himself recently pointed out that service science is also an important aspect for the administration of universities themselves (Spohrer, Fodell & Murphy 2012). This coincided with, and came at almost exactly the same time as the call issued by the German Rectors' Conference for universities to redefine information competency (Hochschulrektorenkonferenz 2013). If, therefore, one agrees that we are living in a technology-driven service and knowledge economy, then the management motto of "exit or voice" applies: co-operate with Service Science and build a common transdiscipline or leave the overarching topic of 'information service in the information economy' to others.

Acknowledgments

References

Brown, John Seely; Duguid, Paul (2000). *The social life of information*. Boston, Mass: Harvard Business School Press.

Choudaha, Rahul (2008). *Competency-based curriculum for a Master's program in service science, management and enginieering (SSME). An online delphi study*. Dissertation. Denver University. Morgdrige College of Education.

Dueck, Gunter (2011). *Professionelle Intelligenz. Worauf es morgen ankommt*. Frankfurt am Main: Eichborn.

Glushko, Robert J. (2008). Designing a service science discipline with discipline. In: *IBM Systems Journal*, 47 (1), 15–27.

Glushko, Robert J. (2010). Seven Contexts for Service System Design. In: Paul P. Maglio, Cheryl A. Kieliszewski & James C. Spohrer (Eds.). *Handbook of service science*. New York, NY: Springer, S. 219–250.

Glushko, Robert J. (2011). The Long and Winding Road to a Course on Service System Design. *Art & Science of Service Conference*. IBM Research – Almaden. San

Jose, California, 09.06.2011, p. 8. http://people.ischool.berkeley.edu/~glushko/glushko_files/LongAndWindingRoad-Glushko.pdf <10.01.2015>.

Hobohm, Hans-Christoph (2014). Transdisziplinäre Aspekte der Informationswissenschaften als Kernaufgaben der Informationsberufe. Festvortrag zur Diplomfeier. Universität Bern. Historisches Seminar – Master of Advanced Studies in Archival, Library and Information Science. Bern, 24.11.2014.

Hobohm, Hans-Christoph (2015). Sammelrezension Digital Humanities. zu: Terras, Melissa; Nyhan, Julianne; Vanhoutte, Edward (Eds.): Defining Digital Humanities. A Reader. London 2013; und: Warwick, Claire; Terras, Melissa; Nyhan, Julianne (Eds.): Digital Humanities in Practice. London 2012. In: *H-Soz-Kult* (5.1.2015).

Hobohm, Hans-Christoph; Pfeffing, Judith; Imhof, Andres; Groeneveld, Imke (2015). Reflexion als Metakompetenz. Ein Konzeptbegriff zur Veranschaulichung akademischer Kompetenzen beim Übergang von beruflicher zu hochschulischer Qualifikation in den Informationsberufen. In: Walburga Freitag, Regina Buhr, Danzeglocke, E. & Völk, D. (Eds.). *Übergänge gestalten. Durchlässigkeit zwischen beruflicher und hochschulischer Bildung erhöhen*. Münster: Waxmann (forthcoming).

Hochschulrektorenkonferenz (2013). *Entschließung der 13. Mitgliederversammlung der HRK am 20. November 2012 in Göttingen. Hochschule im digitalen Zeitalter; Informationskompetenz neu begreifen – Prozesse anders steuern.* Bonn: HRK, Hochschulrektorenkonferenz (Beiträge zur Hochschulpolitik, 2013,1).

Ibekwe-SanJuan, Fidelia (2014). Pluri-, Multi-, Trans-, Meta- and Interdisciplinary nature of LIS. Does it really matter? Panel. *ASIS&T Annual Meeting*. Seattle, 04.11.2014.

Ingwersen, Peter; Järvelin, Kalervo (2005). *The turn: integration of information seeking and retrieval in context*. Dordrecht et al.: Springer.

Maglio, Paul P.; Kieliszewski, Cheryl A.; Spohrer, James C. (Eds.) (2010). *Handbook of service science*. New York, NY: Springer.

Martín Peña, María Luz; Marcos Martínez, Esperanza; De Castro Martínez, Valeria; Díaz Garrido, Eloísa (2014). Teaching in service systems: new challenges through Services Science Management and Engineering. *Intangible Capital* 10 (2). doi: 10.3926/ic.500

Mittelstraß, Jürgen (2012). Transdisziplinarität. Oder: von der schwachen zur starken Interdisziplinarität. *Gegenworte. Hefte für den Disput über Wissen*, (28), 11–13.

Motta, Gianmario; Barroero, Thiago; Pigantelli, Giovanni (2011). Higher education curricula for Services Science. In: *International Conference on Computer and Management (CAMAN)*, 2011. 19–21 May 2011, Wuhan, China. CAMAN; International Conference on Computer and Management. Piscataway, NJ: IEEE.

Murphy, Wendy (2012). Skills. In: *Teach Service Science* [Wiki]. https://www.ibm.com/developerworks/community/wikis/home?lang=en#/wiki/We2324b49e6c0_406d_8107_5b36d9b7cc47/page/Skills <10.1.2015>.

Parasuraman, A., Valarie A. Zeithaml, & Leonard L. Berry (1984). *A conceptual model of service quality and its implications for future research*. Cambridge, Mass: Marketing Science Institute.

Picot, Arnold, Ralf Reichwald, & Rolf T. Wigand (2003 [1996]). *Die grenzenlose Unternehmung: Information, Organisation und Management ; Lehrbuch zur Unternehmensführung im Informationszeitalter*. 5th ed. Wiesbaden: Gabler.

Spohrer, Jim (2008). Services Science, Management, and Engineering (SSME) and Its Relation to Academic Disciplines. In: Bernd Stauss, Kai Engelmann, Anja Kremer & Achim Luhn (Eds.): *Services Science*. Berlin, Heidelberg: Springer, pp. 11–40.

Spohrer, Jim; Demirkan, Haluk; Lyons, Kelly (2015). Social Value. A Service Science Perspective. In: Kyoichi Kijima (Ed.). *Service systems science*. Tokyo, Wiesbaden: Springer, pp. 3–35.

Spohrer, Jim; Fodell, Dianne; Murphy, Wendy (2012). Ten Reasons Service Science Matters to Universities. In: *EDUCAUSE review* (Nov./Dec.), pp. 53–64.

Spohrer, Jim; Maglio, Paul P. (2008). The emergence of service science: Toward systematic service innovations to accelerate co-creation of value. *Production and Operations Management*, 17 (3), 1–9.