Proceedings of the Federated Conference on
Computer Science and Information Systems pp. 521–527

ISBN 978-83-60810-22-4

Towards an Interdisciplinary View on Service Science— The Case of the Financial Services Industry

Michael Fischbach
University of St. Gallen,
Müller-Friedberg-Str. 8,
9000 St. Gallen, Switzerland
Email: michael.fischbach@unisg.ch

Thomas Puschmann
University of St. Gallen,
Müller-Friedberg-Str. 8,
9000 St. Gallen, Switzerland
Email: thomas.puschmann@unisg.ch

Rainer Alt
University of Leipzig
Grimmaische Str. 12
04109 Leipzig, Germany
Email: rainer.alt@uni-leipzig.de

***Abstract*—In the last decade service science has received considerable attention in the research community. Most research regards services either from a business or a technical perspective. This paper argues that existing approaches still lack detailed models for the application of the inter-disciplinary nature of Service Science as well as an application of these concepts in practice. This paper describes a first attempt to apply the characteristics of service-oriented architectures from the information systems discipline to the business domain. It depicts autonomy and modularity, interoperability and interface orientation as major design principles that promise potentials when transferred to the business domain. The proposed inter-disciplinary approach was applied at the case of Zürcher Kantonalbank in Switzerland that realized a company-wide Service Management concept according to the presented design principles.**

I. Introduction and Research Questions

THE service sector has the largest share of value creation in almost all developed industrial nations [1, 2]. The employment figures draw a similar picture: meanwhile in Germany more than 60% of the staff is employed in the service sector, in the US even more than 70% [3]. Due to the steadily growing importance of services, Service Science emerged as a new discipline that explicitly focuses on the research of services. The main justifications for Service Science are the specific characteristics of services. Contrary to the traditional notion of products, services are intangible, mainly based on information and produced and consumed simultaneously [4, 5]. Additionally, they are predominantly based on the usage of resources, instead of their ownership.

Since its first discussion in literature in 2006 [4], many research activity has been dedicated to this area [6]. The fact that designing, specifying, developing, implementing and managing services significantly differs from traditional product-oriented approaches has led to many theoretical contributions in Service Science [6]. Most consider services either from a business or a technical perspective, which might primarily be explained from the disciplinary focus of the authors. This paper argues that the existing approaches either fall short of addressing the interdisciplinary nature of Service Science or applying it to practice. Although interdisciplinarity is seen as a major instrument of innovation [7] and also a key idea of Service Science, most approaches lack in detailing how it can be realized. In the following an integrated approach which is applied in practice using case study research is suggested. The financial services industry seems suitable for this as products are immaterial in nature and information technology (IT) has a long tradition in this industry. Three distinct research questions are pursed in this paper:

- *What are the elements of a model that fosters the interdisciplinary transfer of concepts from one domain (computer science / IS) to another (business and management)?*
- *What are the characteristics of the technical view on services and how can these characteristics be transferred to business-oriented services in banking?*
- *How might the findings be implemented in practice and what are the business benefits for using a Service Science approach in practice?*

Chapter 2 outlines the research approach. Chapter 3 introduces Service Science as a super-discipline covering a broad body of service-related academic research, its understanding of services, the research model (research question 1) and commonly accepted technically-oriented characteristics attributed to a service. Based on this, the concepts behind these characteristics are transferred to a business context and their likely impacts are evaluated (research question 2). A case study at the Swiss Zürcher Kantonalbank (ZKB) in chapter 4 describes how these Service Science artefacts are adapted in practice in order to overcome major market challenges (research question 3). Chapter 5 concludes and identifies future research opportunities.

II. Research Approach

This contribution resulted from the consortium research program “Sourcing in the Financial Industry” – short “CC Sourcing” (see [8-11]). In June 2010 CC Sourcing went into its fourth phase. The research objective of this particular phase of the project is the design of artefacts (architectures, methods, reference models and tools) that help solving problems regarding the customer- and service-oriented design of

financial institutions. The basic principle of consortium research is the collaboration between academic institutions and companies, ensuring both an academic and a practice oriented view the problems. Both parties are engaged in the definition of the problems and objectives as well as in the design, development, evaluation and diffusion of artefacts. The chosen consortium research method is based on a process model for Design Science Research [12] and the corresponding guidelines [13].

The collaboration between practitioners and academics basically can either occur in a bilateral or a multilateral setting. An example for the latter are workshops conducted with all participating partners. Bilateral arrange#ments include dedicated projects in which the academic institution(s) work(s) on a specific problem of one industry partner. However, despite the bilateral orientation of such projects, the ultimate goal is to extract knowledge and share it within the consortium. Furthermore, existing knowledge gained in the consortium is used for creating an individual company's utility in such projects. So there is a knowledge input from the consortium, a knowledge creation during the bilateral project and a knowledge output to the consortium. This paper partly resulted from a bilateral project with Zürcher Kantonalbank (ZKB) where the CC Sourcing supported the ZKB in introducing a Service Management, and partly from research activities in the whole consortium. Fig. 1 sums up the overall research setup.

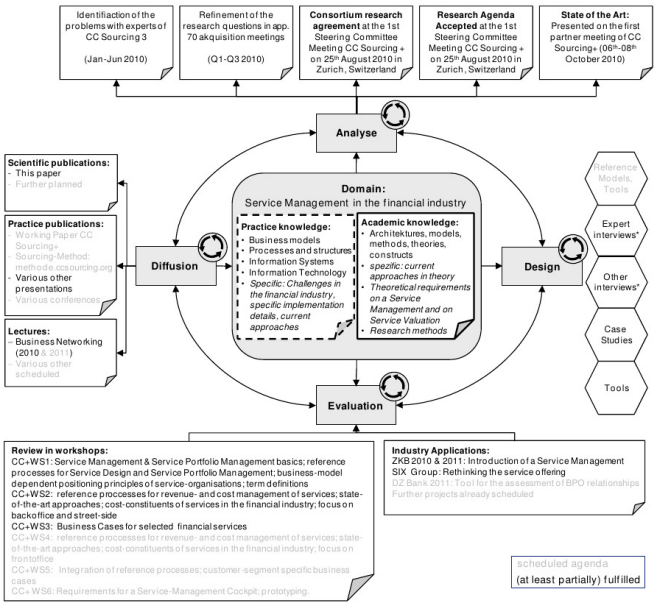

Fig. 1. Consortium Research CC Sourcing+ [10].

III. Service Science

A. Definitions and Objectives

As Service Science is a relatively new research discipline, it still lacks a commonly accepted definition of the term Service Science [14]. Generally, definitions may be negative (i.e. saying what the term is not about), enumerative (i.e. listing of examples) or constitutive (i.e. naming the characteristics of the term) [15]. The latter is regarded the most suitable one from an academic point of view, as it allows detailed insights into the essences of the term Service Science [16]. Based on this definition, certain overlapping definitional parts can be extracted from literature [4, 17, 18]. Generally agreed upon are the objectives of Service Science, the research objects and the interdisciplinary nature [19].

A commonly accepted objective of Service Science is the development of innovative services by means of suitable methods and formal models. Services need to be developed as systematically as physical goods. Another objective is the continuous improvement of services. A service is the main research object in Service Science and at least some authors emphasize the link to IT. Another research object are service systems, which are dynamic, value creating structures, whose entities are humans, organizations, technologies and/or information [6, 14]. [3] mention call centres or the educational sector as examples of service systems. Finally, to a large extent there is consensus about the interdisciplinary nature of the research field. Service Science bases on models and theories developed in computer science, management science, the engineering sciences and organisational science, besides other disciplines such as psychology, liberal arts, law and sociology.

B. Putting an Interdisciplinary View into Practice

As mentioned earlier, despite its interdisciplinary goals, the contributions to Service Science still feature the origin of the researchers. For example, computer scientists regularly pursue a technical view on services, as in the context of web-services and service-oriented architectures (SOA) [20-25]. In contrast, [26] and [27] propose a (relatively wide and unspecific) business-oriented definition: in their view, a service is defined as the application of competency and knowledge in order to create value between supplier and customer. However, Service Science in its original intentions aims at overcoming such unidirectional views by taking a really interdisciplinary view on problems (e.g. [16]). Thereby it qualifies as a valid research object for the IS domain to assume an integrator role between management and computer science [28].

The approach followed in this paper applies characteristics (or design guidelines) from technical services to business-oriented services, thus showing the potential for taking advantage in one discipline from findings of another discipline. Establishing this link, i.e. taking an interdisciplinary view on services, is not a straightforward undertaking. The new definition of a service will not just be a blend of existing definitions, but rather a re-interpretation of them, resulting in an integrated common understanding. It has to fulfil the function of a bridge between business-, IT- and other disciplines [29-33].

The subsequent transfer is grounded on the concept of "conclusion by analogy" (see e.g. [34]): if concepts that proved successful in one domain are applied to another domain that is similar to the first domain, these concepts are likely to be successful in this domain as well. Thus, as technical SOA-services (such as web services) and business services (such as a payments transaction processing service) can

reasonably have a analogical relationship[1], characteristics that were found to be successful in the SOA domain, as for instance modularity or interface orientation, could possibly also be helpful when applied to business services.

In this sense, Fig. 2 shows the research approach, which does not investigate the business impact of designing IT according to SOA paradigms (as e.g. [35], but rather investigates the impact of applying the concepts behind technical service characteristics (stemming from a SOA perspective) onto the business context.

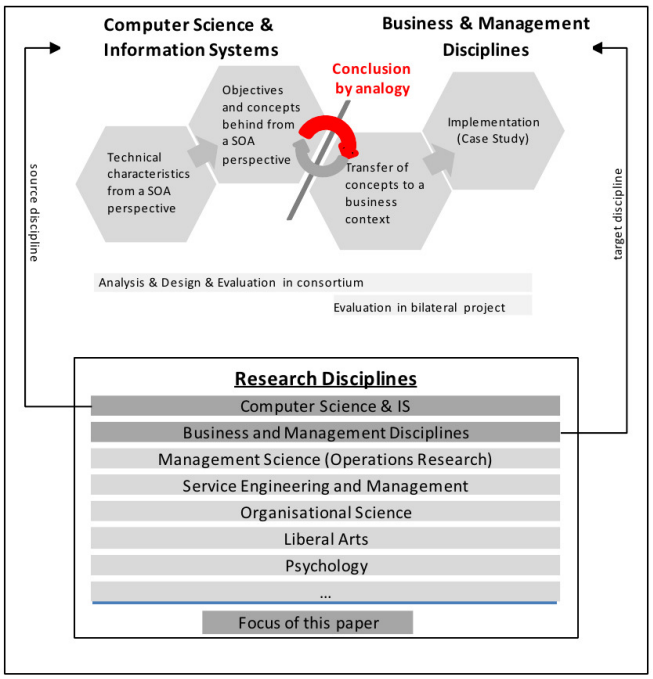

Fig. 2. Conception of the research model

For instance, from a technical point of view, loose coupling means that services are logically independent by "using standardized, dependency-reducing, decoupled message-based methods such as XML" [36], see further [37, 38]. From an interdisciplinary view, the concept would mean, that a bank now has the possibility to dynamically fulfil customer's needs by arbitrarily putting together various services on a case-to-case basis. Consequently, loose coupling would mean that banking services are designed in a way that allows for a flexible orchestration.

An example for such a flexible, modular service is depicted in Fig. 3. It shows a service bundle that is comprised of various other modules and including different "service levels", with the modules being interoperable, i.e. they can be combined arbitrarily.

[1] [34] defines an analogy as: "…a common abstraction or explanation between the source and target analogy components and that common abstraction is known to the analogizer". The mentioned types of services at least exhibit similarity with respect to the name ("service"), the non-transfer of possession, non-storability etc. (see e.g. ([19]) and can thus be said to be in an analogical relationship.

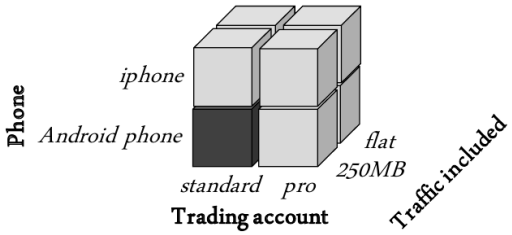

Fig. 3. Exemplary banking service „Mobile trading"

C. Characteristics of Service Orientation

Table I gives an overview over several technically-oriented characteristics of a service.1 According to a scheme proposed by [39], the identified characteristics are aggregated into three major characteristics. After a short description of the concepts behind, it re-interprets them and derives implications from an inter-disciplinary point of view. With this, it lays the foundation for applying the concepts to a purely business-oriented implementation at ZKB.

TABLE I:
IDENTIFIED CONSTITUTIVE CHARACTERISTICS OF A SERVICE FROM A TECHNICAL PERSPECTIVE

Identified characteristic	Exemplary details	Prior research
Use of standards (interoperability)	Technical interface standardization, conceptual interface standardization, use of open and common industry standards	[4, 6, 16, 21, 37, 40-44]
Loose coupling (autonomy and modularity)	High service cohesion and weak logical coupling, loosely coupled communications	[6, 21, 37, 40-44]
Platform-independence/abstraction from service-implementation (interface orientation)	Unified service specification, stable and managed service contracts	[21, 37, 42, 43]

Because a transfer of terms and concepts from one domain to another almost always leaves some space for subjectivity (i.e. differing interpretations), the following characteristics are not necessarily inter-subjectively accepted, but should suggest a possible solution towards the realization of an inter-disciplinary perspective. Additionally, the re-interpretation process cannot be proven rigorously as it requires creative design thinking [45]. Therefore, the outlined research approach seems to be the most suitable.

Characteristic 1: Interoperability

Interoperability results from employing standards on different levels. The technical service should offer interfaces that are based on widespread standards in order to ensure interoperability. Examples for such standards are WebService Description Language (WSDL) for metadata specifications, WS-Trust for security specifications, messaging specifications like SOAP and many others. All efforts in this area are more or less purely technically-oriented. According to [46], interoperability efforts have certain objectives: a platform-spanning integration, re-usability (for a detailed discus-

sion of re-usability see [6, 16, 37, 44] and a reduction of redundancies.

These objectives should be pursued in similar forms when looking from a business-oriented view on the banking services offering: by designing banking services in line with the concept of interoperability, the service-portfolio could be much more flexible, as the number of possible combinations rises significantly, without much additional complexity (as the example in section B showed). A standardized, clearly structured and well-described banking service would enhance re-usability as e.g. other business units in the bank could evaluate the functionality of the service and on request include them into their offered customer service portfolio. This enhances an integrative, company-wide view on the service offering and avoids possible parallel developments of the same service in different organizational units (reduction of redundancies).

A means to provide a standardized description of a service's features is a (standardized) service profile description sheet, a human-readable document that contains all decision-relevant information about a service, as e.g. name, service levels, responsibilities and others1. An example is a service that provides the processing of payments transactions. The service performs all relevant tasks from the scanning of transfer slips to the client transaction confirmation. The service profile description sheet of this service would include the information displayed in Table II.

By providing (potential) customers such a standardized sheet, they are able to assess the services' characteristics and to compare it to other (eventually similar) services. Further, it ensures a certain degree of standardization and thus diminishes quality uncertainty when re-using the service. Such clear and standardized service documentation also aids in revealing redundancies among services and unambiguously points out which processes are supported and with which services it can potentially be combined. Consequently, applying the principle of interoperability to the business domain seems promising.

TABLE II
EXEMPLARY CONTENTS OF A BUSINESS-SERVICE PROFILE DESCRIPTION

Category	Exemplary Contents
Master Data	e.g. Service-ID, Service-Manager
Service Descriptions	e.g. Utility provided, included sub-services, supplier, service-levels (support times, operating time, volume, availability, max. down-time
Financials	e.g. accounting unit, amount per acc. unit, fixed costs
Processes & Services	Supported business processes, services with which it can possibly be combined

Characteristic 2: Autonomy and modularity

Autonomy and modularity means a high cohesion within a single service and concurrent low logical coupling and loosely coupled communication between services. SOA's goal is to group application logic and corresponding data into a set of services [47]. These services are structured in a way that logic and data which are highly dependent on one-another are combined in a service, while keeping dependencies between different services as low as possible (i.e. they exhibit low dependencies on other sub-systems) [48]. Cohesion measures the extent to which the encapsulated functions and data serve the same higher purpose [49]. According to [50], weak logical coupling means that business-requirements that cause a change in one service are not causing a change in the other service as well.

As an example, this concept can be applied to the (business-)service bundle of payments transactions processing, which consists of various process steps including the digitization of payment slips, routing the payments transaction, performing various validity checks such as account balance, black listings etc. Without defining services for each of the process steps, it is almost impossible to consider a (partial) out-sourcing. However, once the service is split into several smaller services, each of which assumes a certain logically enclosed task, parts of the value creation can be outsourced. Thereby, in order to fully reach the objectives that are commonly associated with (out-)sourcing, such as economies of scale, it is important to find a well-considered service cut that enables modularity and autonomy. In the mentioned example, the digitization of the payment forms should be encapsulated in one service. Buying this service from an external supplier lets the firm take advantage of scale economies, as the scanning hardware is rather capital intensive. Further, the digitization comprises a logically encapsulated task. Another benefit of autonomy and modularity in connection with interoperability is the enhanced ability to re-use certain services: eventually, the provider of the digitalization service could also offer it to external customers (i.e. insourcing).

Characteristic 3: Interface orientation

With interface orientation, services abstract from implementation details and service interfaces provide metadata specifying the outcome to be expected and how the service can be used. However, it does not specify the way in which the service produces the output [51]. By providing a programming language-, platform- and middleware-neutral service description [52], service interfaces also abstract from the technical implementation of the services [41].

A bank client advisors' main task is the sale of banking services such as advisory and bank accounts. Possibly she demands different service levels to be provided by the service-producer (i.e. the bank's backoffice), such as different banking accounts whose reporting functionalities and prices vary with the service levels. End customers can thus be provided with price-adequate solutions that fit their needs, i.e. right-sized solutions. But besides these functional properties of the service (depicted by the already mentioned profile description sheet), the customer advisor does not need detailed knowledge about how the service is produced. This abstraction from implementation details enables both parties, the client advisor and the service producer (i.e. the backoffice in this case) to concentrate on their respective core competen-

cies, while not being confused by domain-specific technical terms and explanations that would be of no use for the other party but rather cause confusion. Applying this principle in a business context poses great challenges on the service provider and thus requires him to closely co-operate with the service-buyer (i.e. the bank's frontoffice): the producer has to clearly and understandable formulate the utility the service brings, without getting lost in details about the way the service is produced. Thus, applying the interface-orientation to business-contexts also helps in overcoming discrepancies between different domains of the company; especially it fosters an end-customer-oriented thinking (in terms of end-customer utility) even from non-frontoffice units.

In the payments transactions example, interface-orientation requires the service description sheet to only state information that is understandable for the service requestor, without getting lost in domain-specific details (such as transaction routing algorithms or the exact correspondent banks the bank cooperates with).

Summary

Table III summarises the technically-oriented service characteristics, their application to business-oriented banking services as well as likely effects. In case these effects materialize, undoubtedly at least some of the current challenges in the financial industry could be (partially) solved. The stated re-interpretation examples as well as their likely effects were broadly discussed and validated in several interviews as well as in the consortium (design phase). The accompanying case study shows how the mentioned as well as other concepts were employed by a large Swiss cantonal bank. It further points out first experiences with the approach (evaluation phase).

TABLE III.
SUMMARY OF THE TRANSFER AND LIKELY EFFECTS

Technically-oriented characteristic	**Exemplary application on a business service**	**Effects**
Interoperability	Provision of a standardized service profile description sheet that explicitly points out e.g. which processes are supported. See Table II.	Fostering standardization, reducing quality-uncertainty, aid in revealing redundancies, fosters re-combination of services
Autonomy and modularity	Breaking down the payments transactions service into several sub-services in order to enable sourcing-decisions, as e.g. to outsource the digitalization of payment slips.	Enable the building of value creation networks; fostering re-usability.
Interface orientation	No exchange of production details between front- and backoffice; only exchange functionalities and other properties by means of the service profile description sheet.	Enable all parties to concentrate on their core-competencies.

IV. SERVICE SCIENCE IN PRACTICE – THE CASE OF ZÜRCHER KANTONALBANK

A. Challenges of Zürcher Kantonalbank

Zürcher Kantonalbank (ZKB), headquartered in Zurich, is the largest cantonal bank in Switzerland with about 5000 employees, more than 100 branches and a balance total of 117bn CHF. Customer-proximity and regional anchoring are core elements of the bank's market appearance. The bank concentrates on the region of Zurich (canton), serving retail-, private- and corporate customers. It is internationally active only in the segments Private Banking and Institutionals.

A multi-years project focuses on the introduction of a company-wide Service-Management. Service-Manage#ment is a business area-spanning discipline aiming at improved integration of internal service creation activities into the company as a whole and thus to achieve improved bank management. The implementation includes a transformation of the business unit "logistics" from a cost- to a service-centre, which has far reaching organizational implications.

The business unit "logistics" supplies all other business units with various services. Sales teams and specialists departments (referred to as "frontoffice") order services from the logistics, reaching from the execution of payments transactions to the installation and maintenance of workplaces or the real estate valuation. Logistics does not have any end-customer contact. Prior to the introduction of a Service Management the integration of the internal service production activities into the company as a whole was unsatisfactory with respect to transparency, cost allocation and standardization:

- *Missing transparency: Capacities and resources employed and the steps during production were known in detail neither by the frontoffice nor by the logistics itself. Thus, the possibility to calculate exact costs and time expenditures was rather limited. These issues were largely due to intransparent or even missing service descriptions or any other source of information (such as repositories) and no clear service cuts. Redundancies in the service offering were the consequence.*
- *Undifferentiated cost allocation: missing transparency of the (internal) production activities inevitably had an impact on internal cost allocation: if the amount of input (manpower, material, used infrastructure etc.) is unknown, costs cannot be allocated adequately. Thus, the logistics unit charged the frontoffice lump-sums that could not be verified on a calculatory basis.*
- *Non-uniform Service Level Agreements (SLA): SLAs are the core elements of all agreements between the logistics unit and its purchasers. Despite the vast number of different existing SLA, there were no standards regarding their contents. SLA varied depending on the underlying individual agreements and thus were not comparable. For instance, real estate valuation services differed hugely from case to case. Due to their heterogeneous nature the different SLA were not comparable at all. Additionally, there was a mass of heterogeneous SLAs, several people responsible*

for the same type of service and no structured communication channels between the logistics and other units.

B. Introduction of Service Management

ZKB's Service Management approach follows the three technically-oriented service characteristics, namely interoperability, modularity & autonomy and interface orientation and their application to the business domain:

Interoperability of services

All service managers are obliged to provide a service profile description sheet that adheres to well-defined standards and consist of modular constituents. Supported processes as well as "compatible" services have to be mentioned. Sub-services are stated as well. The service description sheet is part of a repository containing all services and service bundles offered to the frontoffice. Service Managers are advised to capture as much individuality as possible while keeping the number of different service levels at a maximum of 3. Up to now, frontoffice staff reports higher transparency regarding the service offering, i.e. by means of the repository they can check whether a planned service already exists in other areas of the bank and exactly which properties and features it exhibits. Further, combination of different services became easier, due to information transparency as well as the interoperable design of services. Consequently, the frontoffice is enabled to increasingly offer individualized solutions consisting of several services put together on a case-to-case basis, thus increasingly aligning the offering to customer needs while still ensuring a certain level of standardization.

Autonomy & modularity of services

In addition to the repository that contains all service profile description sheets, a service catalogue provides information in much finer granularity, down to single activities of sub-services. All services are cut according to the principles of autonomy & modularity, namely high cohesion within and weak coupling among services. By cutting services according to business logic (as for instance defining a new sub-service for the digitization of payment slips within the payments transaction processing service) enables ZKB to consider partial sourcing (in-/and out-sourcing) of certain services, which lays the foundation for ZKB to concentrate on core competencies and lay out non-core activities into the partner network. Currently, ZKB is considering outsourcing the digitization and certain plausibility checks of domestic as well as international payment slips to specialized providers in order to take advantage of economies of scale. Another effect of the stringent definition of cohesive and loosely coupled business services is that the logistics itself gains a transparent view on its' offering, thus creating potential for improved cost allocation and higher production efficiency.

Interface orientation of services

Due to rigorously applying the concept of interface orientation, the service profile description sheet (which is the central information source for potential demanders) only contains information relevant for a "buying" decision (see Table II). Production details are undisclosed. Thus, potential and actual demanders only get the information relevant for their decision, without being confronted with specific realization details. This enables them to concentrate on their core competencies and leaves all implementation detail to the supplier, i.e. the logistics department. However, although the service offering becomes more transparent (i.e. less complex), now it is no longer possible for the frontoffice to make a judgement about the efficiency with which the backoffice is producing. This problem is solved by giving the frontoffice the right to possibly buy services from outside the company. So the backoffice is put under competitive pressure, which also fosters the development towards the creation of networks.

V. Conclusion

Although the interdisciplinary nature of Service Science is accepted in current research, only few provide more detailed guidelines on how to realize it in practice. This paper drafted an integrated approach that was applied at the case of ZKB. For this purpose, three service characteristics from the IS perspective were identified and applied to the business domain, i.e. banking services. The findings are promising in three areas:

- *Innovation and business benefits through an interdisciplinary approach: The presented interdisciplinary approach to transfer artefacts between two domains. SOA concepts from the IS discipline may be used to design business services and thus enable innovation for the design of new services (e.g. mobile trading services). The case of ZKB showed that current business challenges, such as missing transparency, undifferentiated cost allocation and non-uniform SLAs, can be addressed with these concepts.*
- *Improved business – IT Alignment: The linkage of business and IT remains a major challenge in many businesses in general and especially in service-oriented business as the main object is information. The presented approach supports the linkage between the technical architecture approaches of computer science and IS to the business domain.*
- *Practical relevance of Service Science: Much research in the area of Service Science has been provided for theories and concepts. However, there is still a need for practical applications of Service Science. This includes business benefits and experiences of companies that re-organized towards service-orientation. The case of ZKB provided insights although the company is still in a state of transformation.*

Despite these results, several other opportunities for future research arise. Sustainable practice success of the outlined approach will depend on many additional factors, such as cultural transformation, acceptance, communication to employees etc. Implementing the findings requires to operationalise them in clear guidelines and well-established principles. The presented approach is only an initial step towards a more comprehensive concept for the inter-disciplinary transfer of artefacts between scientific disciplines. To live up to the idea of Service Science the characteristics need to be ver-

ified and enhanced with more disciplines, especially the domain of service engineering, and the benefits of using these design guidelines for practice need to be thoroughly evaluated.

REFERENCES

[1]. Spohrer, J. and P. P. Maglio, *Fundamentals of Service Science.* Journal of the Academy of Marketing Science, 2008. **36**(1): p. 18-20.

[2]. Spohrer, J. and P. P. Maglio, *The Emergence of Service Science: Toward Systematic Service Innovations to Accelerate Co-creation of Value.* Production and Operations Management, 2009. **17**(3): p. 238-246.

[3]. Maglio, P. P., et al., *Service Systems, Service Scientists, SSME, and Innovation.* Commun. ACM, 2006. **49**(7): p. 81-85.

[4]. Chesbrough, H. and J. Spohrer, *A Research Manifesto for Service Science.* Communications of the ACM, 2006. **49**(7): p. 35-40.

[5]. Sasser, E., R. P. Olsen, and D. D. Wyckoff, *Management of Service Operations*. 1978, Boston: Allyn and Bacon.

[6]. Bardhan, I. R., et al., *An Interdisciplinary Perspective on IT Services Management and Service Science.* Journal of Management Information Systems, 2010. **26**(4): p. 13-64.

[7]. Klein, J. T., *A Conceptual Vocabulary of Interdisciplinary Science*, in *Practicing Interdisciplinarity*, P. Weingart and N. Stehr, Editors. 2000: Toronto.

[8]. Back, A., G. v. Krogh, and E. Enkel, *The CC Model as Organizational Design Striving to Combine Relevance and Rigor.* Syst Pract Act Res, 2007. **20:91**: p. 91-103.

[9]. Österle, H. and B. Otto, *Consortium Research: A Method for Relevant IS Research.* Business & Information Systems Engineering, 2010(5): p. 1-24.

[10]. Österle, H. and B. Otto. *A method for consortial research, in: Proceedings of the 18th European Conference on Information Systems (ECIS 2010)*. in *ECIS 2010*. 2010. Pretoria.

[11]. Österle, H. and B. Otto. *Relevance through Consortium Research? Findings From an Expert Interview Study, in: Proceedings of the 5th International Conference on Design Science Research in Information Systems and Technology (DESRIST 2010)*. in *DESRIST 2010*. 2010. St. Gallen.

[12]. Peffers, K., et al., *A Design Science Research Methodology for Information Systems Research.* Journal of Management Information Systems, 2008. **24**(3): p. 45–77.

[13]. Hevner, A. R., et al., *Design Science in Information Systems Research.* MIS Quarterly, 2004. **28**(1): p. 75-105.

[14]. Spohrer, J., et al. *The Service System is the Basic Abstraction of Service Science*. in *Proceedings of the 41st Annual Hawaii International Conference on System Sciences*. 2009. Waikoloa (HI).

[15]. Bullinger, H.-J., Scheer, A.-W., *Service Engineering - Entwicklung und Gestaltung innovativer Dienstleistungen*. 2 ed. 2005, Berlin, Heidelberg: Springer.

[16]. Alt, R., *Innovation durch Services Science.* Managementkompass: Industrialisierungsmanagement, 2009: p. 9-11.

[17]. Abe, T., *What is Service Science*. 2005, Fujitsu Research Institute.

[18]. Maglio, P. P., et al., *Service Systems, Service Scienctists, SSME, and Innovation.* Communications of ACM, 2006. **49(7)**: p. 81-85.

[19]. Buhl, H. U., et al., *Service Science.* Wirtschaftsinformatik, 2008. **50**(1): p. 60-65.

[20]. Bieberstein, N., et al., *Impact of Service-oriented Architecture on Enterprise Systems, Organizational Structures, and Individuals.* IBM Systems Journal, 2005. **44**(4): p. 691-708.

[21]. Papazoglou, M. P., *Service-Oriented Computing: Concepts, Characteristics and Directions.* WISE, 2003: p. 3-12.

[22]. Piccinelli, G. and L. Mokrushin, *Dynamic Service Aggregation in Dynamic Marketplaces*. 2001, Hewlett Packard Laboratories: Bristol (England).

[23]. Sahai, A., V. Machiraju, and K. Wurster, *Managing Next Generation E-services*. 2000, Hewlett-Packard Laboratories: Palo Alto (CA, USA).

[24]. Singh, M. and M. Huhns, *Service-Oriented Computing: Semantics, Processes, Agents*. 2004, New York: John Wiley.

[25]. W3C, *Position Papers for the World Wide Web Consortium (W3C) Workshop on Web Services*. 2001, Hewlett Packard Laboratories: Palo Alto (CA, USA).

[26]. Spohrer, J., et al., *Steps Toward a Science of Service Systems.* IEEE Computer, 2008. **40**(1): p. 71-78.

[27]. Vargo, S. L. and R. F. Lusch, *Evolving to a New Dominant Logic for Marketing.* Journal of Marketing, 2004. **68**: p. 1-17.

[28]. Leyking, K., F. Dreifus, and P. Loos, *Serviceorientierte Architekturen.* Wirtschaftsinformatik, 2007. **49**(5): p. 394-401.

[29]. Baida, Z., J. Gordijn, and B. Omelayenko. *A Shared Service Terminology for Online Service Provisioning*. in *6. International Conference on Electronic Commerce*. 2004. Delft: ACM Press, New York (NY).

[30]. Laartz, J., *SOA revolutioniert das Management.* Wirtschaftsinformatik, 2008. **50**(1): p. 72-73.

[31]. Rust, R. T. and P. K. Kannan, *E-Service: A New Paradigm For Business in the Electronic Environment.* Communications of the ACM, 2003. **46**(6): p. 37-42.

[32]. Stafford, T. F., *E-Services.* Communications of the ACM, 2003. **46**(6): p. 27-28.

[33]. Weigand, H., et al. *Value-based Service Design Based On A General Service Architecture*. in *3. International Workshop on BUSiness/IT ALignment and Interoperability*. 2008. Montpellier: Sun SITE Central Europe, Aachen.

[34]. DeJong, G., *The role of explanation in analogy; or, the curse of an alluring name*, in *Similarity and Analogical Reasoning* S. Vosniadou and A. Ortony, Editors. 1989, Cambridge University Press: New York. p. 346-365.

[35]. Mueller, B., G. Viering, and F. Ahlemann, *Toward Understanding the sources of economic potential of service-oriented architecture: findings from the automotive and banking industry*, in *ECIS 2007*. 2007: St. Gallen.

[36]. Brown, A., S. Johnston, and K. Kelly, *Using Serviceoriented Architecture and Component-based Development to Build Web Service Applications*. 2002, Rational Software Corporation.

[37]. Baskerville, R., M. Cavallari, and F. Virili. *Extensible Architectures: The Strategic Value of Service-Oriented Architecture in Banking*. in *13th European Conference on Information Systems*. 2005. Regensburg.

[38]. Erl, T., *Service-Oriented Architecture (SOA): Concepts, Technology, and Design*. 2005: Prentice Hall.

[39]. Legner, C. and R. Heutschi. *SOA adoption in practice - findings from early SOA implementations.* in *ECIS 2007*. 2007. St. Gallen.

[40]. Bettag, U., *Web-Services.* Informatik Spektrum, 2001. **24**(5): p. 302-304.

[41]. Legner, C. and T. Vogel. *Design Principles for B2B Services - An Evaluation of Two Alternative Service Designs*. in *IEEE International Conference on Service Computing (SCC 2007)*. 2007. Salt Lake City (USA).

[42]. Papazoglou, M. P., et al., *Service-Oriented Computing: A Research Roadmap.* Service Oriented Computing (SOC), 2006(05462).

[43]. W3C. *Web Services Glossary*. 2004 [cited; Available from: http://www.w3.org/TR/ws-gloss/.

[44]. Winkler, V., *Identifikation und Gestaltung von Services: Vorgehen und Beispielhafte Anwendung im Finanzdienstleistungsbereich.* Wirtschaftsinformatik, 2007. **49**(4): p. 257-266.

[45]. Hey, J., et al., *Analogies and Metaphors in Creative Design.* International Journal of Engineering Education, 2008. **24**(2): p. 283-294.

[46]. Heutschi, R., *Serviceorientierte Architektur: Architekturmodell und Umsetzung in der Praxis*. PhD Thesis. 2007: University of St. Gallen.

[47]. Klesse, M., Wortmann, F., Schelp, J., *Erfolgsfaktoren der Applikationsintegration.* Wirtschftsinformatik, 2005. **47**(4): p. 259-267.

[48]. Simon, H. A., *The architecture of complexity*, in *Managing in the modular age*, R. Garud, Kumaraswamy, A., Langlois, R. R., Editor. 2002, Blackwell Publishers: Malden. p. 15-38.

[49]. Papazoglou, M. P., Yang, J., *Design Methodology for Web Services and Business Processes*, in *Technologies for e-services: third international workshop, TES 2002*, A.C. Buchmann, Fiege, L., Hsu, M.-C., Shan, M.-C., Editor. 2002, Springer: Berlin. p. 54-64.

[50]. Gall, H., Hajek, K., Jazayeri, M. *Detection of logical coupling based on product release history*. in *International Conference on Software Maintenance (ICSM)*. 1998.

[51]. Balzert, H., *Lehrbuch Grundlagen der Informatik - Konzepte und Notationen in UML, Java und C++*. 1999, Heidelberg, Berlin: Spektrum Akademischer Verlag.

[52]. Dodd, J., *Practical Service Specification and Design Part 3: Specifying Services.* CBDi Journal, 2005(Juli/August): p. 11-20.