DESIGN AND VALUE OF SERVICE-ORIENTED TECHNOLOGIES FOR SMART BUSINESS NETWORKING

Rainer Alt
*University of Leipzig, Leipzig, Sachsen, Germany, rainer.alt@uni-leipzig.de*

Martin Smits
*Tilburg University, Tilburg, Netherlands, m.t.smits@uvt.nl*

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Alt, Rainer. Leipzig University, Germany, rainer.alt@uni-leipzig.de

Smits, Martin. Tilburg University, The Netherlands, m.t.smits@uvt.nl

Abstract

Business networks that effectively use technologies and outperform competing networks are known as smart business networks. Theory hypothesizes that smart business networking requires a ‘Networked Business Operating System’ (NBOS), a technological architecture consisting of business logic, that enables high performance business networking. At the heart of the NBOS architecture are services (provided and used by organizations in the business network) and a centralized directory that contributes to finding, selecting and executing the services available. While the idea of SOA for NBOS is compelling, SOA has largely remained a technological concept mainly applied in intra-organizational settings and received only limited adoption in business networks. The key question addressed in this paper is how firms in a business network can develop a NBOS so that SOA technologies create business value. This research aims to contribute to the understanding of the business value of SOA for smart business networking. An in-depth case study in a German banking network is used to obtain profound insights in the intricacies of service design and the business value of SOA technologies in practice. The findings are generalized in an initial research model, distinguishing between service network design and service directory design within business networks.

Keywords: Smart business networking, network infrastructure, networked business operating system, service intermediaries, service directory design, business network performance.

1 Introduction

There is a long tradition of research that predicts, explains and designs the growing networking among companies using innovative information technologies (IT) to create inter-organizational processes, virtual organizations, and service networks. Much research was spurred by Malone et al. (1987) who suggested three IT-based effects on inter-organizational relations: (i) the electronic communication effect denoting a rising amount of information that may be shared at less cost, (ii) the electronic brokerage effect postulating that centralized systems may offer brokering services between buyers and sellers, and, (iii) the electronic integration effect, describing that IT leads to closer coupling between organizations. Based on these effects two evolution paths were identified (p. 490ff): one towards electronic markets and one towards electronic hierarchies. In particular, the argumentation towards more market-based coordination (‘move to the market’) became widespread. Other researchers (e.g. Clemons et al. 1993, McAfee et al. 2007) answered that factors, such as the protection of resources and (intellectual) capital as well as other so-called ‘non-contractible issues’, contribute to the emergence of business networks (‘move to the middle’) which are considered as intermediate forms between markets and hierarchies.

As shown by Snow et al. (1992) these networked forms of governance may be internal, stable, or dynamic in nature. Following van Heck and Vervest (2007), the stable form has become known as the ‘traditional business network approach’ opposed to the new ‘smart business network approaches’ that emphasizes the electronic brokerage and electronic integration effects. Smart (‘high performance’)
business networks generate additional business value by (i) increasing efficiencies of establishing and dissolving partner relationships, (ii) orchestrating services while maintaining control as well as decision-making and (iii) offering a network platform in a trusted environment. Van Heck and Vervest (2007) list five factors that affect smart (successful) business networking: network design, network governance, network execution, network outcomes, and enabling technologies. A key question is how enabling technologies relate to the other four critical issues and how alignment between these issues may enhance the success of business networking (Van Liere et al., 2010). Kauffman et al (2010) call for research that develops analytic models to examine elements of smart business network formation and how technology choices at firm and network levels affect network success. This research addresses this gap by suggesting a research model for designing and measuring network technologies.

A Networked Business Operating System (NBOS) is considered as core requirement for smart business networking and denotes a technological architecture consisting of business logic that enables smart business networking (Van Heck and Vervest, 2007). In particular service-oriented architecture (SOA) approaches are considered advantageous smart business networking (Schelp and Aier 2009; Kauffman et al., 2010). A major benefit of SOA is that it aims at systems integration within heterogeneous environments and, thus, would require less pre-negotiation on formats and other standards (Curry and Parrish, 2006). From the perspective of smart business networks, a key business question is how a company may design and develop SOA technologies (in the NBOS) to enable business (network) success. Focussing on this practical gap shall help business as well as technology managers (CIOs) to understand links between the design and business value of applying network technologies.

This research aims to contribute to research on the organizational and technical design choices in a business network, and how these choices relate to the development of the network infrastructure (NBOS) and ultimately on the performance of the network over time. Therefore the research focuses on the design and value of service-based technologies in smart business networking. The analysis is based on an in-depth case study in a large banking network. To identify the impact of organizational design of network technologies on business network value, the paper first defines services in smart business networks in section 2. Section 3 evaluates the impact of these designs on business value using the case of DZ Bank, a large banking network in Germany. Finally, section 4 generalizes the observations in a research framework and section 5 concludes with the major findings.

2 Services in Smart Business Networks

2.1 Smart Business Networks

Business networks that effectively use technologies and outperform competing networks are known as smart business networks (van Heck and Vervest, 2007). The notion of ‘smartness’ is reflected in the ability to quickly realize “scenarios in which business is conducted through a rapidly formed network with anyone, anywhere, anytime regardless of different computer systems and business processes” (van Heck and Vervest 2007, p. 29). A key performance indicator of a smart network is the ability to quickly pick, plug, and play services at network levels. While the strategic and operational impact of electronic networks and their adoption has been extensively studied in the context of interorganizational systems (IOS), less attention has been paid to the organizational and technical design of electronic relationships between firms in a network (Steinfeld et al., 2011). The smart business network concept hypothesizes that the performance of smart business networks depends on the effective use of a shared technological infrastructure. This NBOS mainly consists of a network platform with a networked business operating system that serves “information sharing over and with network partners” (van Heck and Vervest 2007, p. 30), in particular network transactions and network logistics.

Intermediaries and network concepts with centralized topologies are regarded as important enablers for the business operating layer. For example, Schubert and Legner (2011) identify five (technology agnostic) designs for data and application integration among firms in a network and call for research
on how networked businesses can use services of specialized intermediaries. Steinfield et al. (2011) call for research on the impact of coordination hubs (intermediaries in the network) and data and process standards on business network performance. Finally, Shankararaman and Megargel (2013) define three design options for enterprise integration in a business network (‘point to point’, ‘hub-and-spoke messaging’, and SOA with an Enterprise Service Bus (ESB’)), and identify SOA with ESB as a preferred option. However, the authors do not discuss the design and the value of the various elements of a SOA within a (smart) business network.

This research provides a business perspective on the design of network technologies (i.e. NBOS) for smart business networking. Among others, this implies the distribution of services and service directories across service intermediaries the network. For instance, services for human resource management may be obtained from one service intermediary (specialized in human resource management services) or from multiple service intermediaries to create an efficient mix of services. These services may be found, contracted, and stored locally for security reasons in internal directories or found, bound, and executed from external, directory providers.

2.2 Service Architectures

Over the past decade the thinking on service architectures features two important steps. First, SOA emerged from the object-oriented component-based application architectures that aim at re-using standardized software modules. This, so-called basic SOA approach includes Web Service technologies which improve interoperability in heterogeneous environments. A Web Service is defined as “a platform-independent, loosely coupled, self-contained programmable Web-enabled application that can be described, published, discovered, coordinated and configured using XML artifacts for the purpose of developing distributed interoperable applications” (Papazoglou and Ribbers, 2007). Basic SOA consists of (web service) providers, clients and brokers. Providers publish services in directories where these may be retrieved by clients so that binding and service operation can take place. Typical clients are applications, or manual or automated processes, or customers within or outside the organization.

In a second step, extended SOA (xSOA) concepts were proposed (Papazoglou, 2008). The xSOA concept was developed to address the limitations of basic SOA (Demirkan et al., 2009). For example, basic SOA provides a foundation for a distributed computing infrastructure, but does not address overarching concerns, such as service transaction management, coordination of service supply and demand, security, trust, and other concerns that are necessary for a robust and dependable SOA (Papazoglou, 2008), including the NBOS for smart business networking. The xSOA or Web Services functionality stack comprises three layers: (i) the web services foundation layer where basic services are published, found, and bound that are widely accepted and implemented uniformly, (ii) the web services composition layer which includes the necessary roles and functionality for the aggregation of multiple services into single composite services, and (iii) the management and monitoring layer, which ensures that services in lower layers are managed by providing managing services. Similar service types are identified by Alt et al. (2010): (i) services that enable the execution of processes, (ii) services that support finding, searching, comparing and contracting other services, and (iii) infrastructure services. Obviously, xSOA services vary from detailed, fine-grained services to aggregated, coarse-grained services. Regarding granularity, business, functional and data granularity is distinguished (Haesen et al. 2008).

Following the xSOA definition, a technology agnostic business perspective on services has been proposed (Kauffmann et al., 2010; Schubert and Legner, 2011). In this perspective service providers develop and publish services via standardized interfaces in directories where services are found and bound by service consumers. These service consumers can be applications, business processes, or firms. When applied to smart business networks, selecting the right services from the right directories will help to aggregate (Web) services into business services that enhance business performance, network performance, and value (Papazoglou and Ribbers, 2006).
2.3 Assessing Business Value

Business value is a broad concept with multiple assessment methods available. For example, value can be based on business performance measured by financial, market and process performance (Kaplan and Norton, 1992). Traditionally, business performance is analyzed by establishing a set of key performance indicators (KPIs) associated with each business process. Management sets target values for each KPI and compares these targets to actual and historical values (Swabey, 2009; Wetzstein et al., 2011). Process performance denotes how efficient companies transform the available inputs into outputs (Vom Brocke and Rosemann, 2010). With respect to the specific impact of SOA technology on business value, Papazoglou (2008) relates value to the quality of services and lists quality indicators including rapid, low cost, and easy composition of services. Legner and Heutsc (2007) identify three business values related to SOA: ‘to realize a standardized integration infrastructure’, ‘to decouple application domains’, and ‘to create flexible user/ business process integration’.

Several methods for measuring business value exist, including the Balanced Scorecard (Kaplan and Norton, 1992), the self-assessment method (Hakes, 1995), the traditional controlling approach (Harrington, 1991), process performance measurement systems (Vom Brocke and Rosemann, 2010), workflow based monitoring (Hakes, 1995), and statistical process control (Juran and Gryna, 1988). Given the variety of value indicators and measuring methods, the value of smart business networks may be determined in two main areas: (1) the value added at the individual firm level for firms in the business network, and (2) the value added at the network level, as aggregated value, e.g. as a result of increased competitiveness of the business network. An example of a value indicator at network level is “a higher market share for a business network”.

2.4 Research Method

To explore the design and value of SOA technologies in smart business networks this research conducts an in depth case study in a large business network from the banking industry. In general, a case-based research approach is applicable when control over events is not needed and when analyses is done on multiple levels of aggregation (Yin, 1994). Following Provan et al. (2007) and Driedoncks et al. (2005), one business network was analyzed in a single case study over time, identifying structural properties (service network design, network governance, network execution) identifying possible relations to strategies, value, and performance. In-depth analysis of a single case is considered as an appropriate research strategy when it is difficult to separate a phenomenon from its context (Yin, 1994).

The research method is qualitative and consists of a retrospective analysis of a network case based on multiple interactions (bilateral interviews and workshops) with actors in the business network. Two perspectives were analyzed in more detail: the first step concerned the view from the service integrator in four interviews with five representatives from DZ Bank in 2006 to 2008 (see Alt and Smits 2010; Wolf and Kohlmann 2009) and was updated in 2012 with two representatives from DZ Bank. The second step comprised the view from the service provider and was collected from 2011 to 2013 in two interviews with two representatives from Fiducia. In addition, about 40 internal and web-documents describing business and technology aspects of the networks were used for triangulation purposes.

All observations and interpretations took place in a cooperative research design setting where an average of 15 companies from various roles in the banking network participated in a consortium called the Competence Center Sourcing in the Financial Industry (see www.ccsourcing.org) since 2004. The project is still ongoing and among the goals of the consortium was to develop knowledge and practical guidelines for service development in the banking network (2008 to 2012). This type of research is also known as consortial research (Österle and Otto 2010). The findings from the interviews were repeatedly presented and discussed in the tri-annual 2.5 day workshops where an average of 30 representatives from the companies in the consortium attended since 2004.
3 Case Study in the Banking Industry

3.1 Overview of the Banking Industry

The banking industry has seen many transformations in the last decade. Among the drivers in this information-based industry are not only the recent financial crises, but also the growing need to meet federal regulations, to serve customer via multiple channels as well as to face national and international competition. Service-orientation is regarded as a concept that supports banks in meeting the challenges in the contested marketplace and has several links to the banking industry (Baskerville et al. 2010; Hopperman 2008).

First, banks traditionally aim to cover entire customer processes which consist of bundled services from market information, checking accounts, deposits, and mortgages in retail banking to more comprehensive services in the private banking sector. The recent financial crises forced banks to streamline their operations and fostered many initiatives towards outsourcing and more distributed value chains (Bryan and Daruvala, 2009). Despite this ongoing distribution, the services ultimately need to converge to the customer process, implying flexible bundling of financial services, and compatibility of the involved (Web) services.

Second, banks traditionally recognize IT-investments as core competencies and have established large IT-departments for application development and operations. Banks are still at the beginning of using standard software packages, such as SAP, and suffer from low flexibility of existing core banking systems (Anonymous, 2005, p. 7). Many studies believe that future banking needs inter- and intra-enterprise SOA (Hoppermann, 2008, p. 10).

3.2 The DZ Banking Network

DZ Bank is a centralized bank owned by cooperative banks in Germany with some 30 million private and corporate customers and a market share of 23% in Germany. DZ Bank has some 28’000 employees and almost 1’000 subsidiaries with total assets of 396 billion Euro for the first quarter of 2013 (www.dzbank.com). The DZ Bank network yields two perspectives as illustrated by Figures 1 and 2.

Figure 1 shows the business relations in the network. The network comprises some 14’000 branch offices from 1’300 cooperative banks and 30 (separately owned) private banks with a variety of products and services to end customers (private and business customers). Although the local banks source most (90%) of their services from DZ Bank, they may also source services directly from the other 12 service providers in the network or even from providers outside the DZ network. The local banks have a main contractual (business) relationship with DZ Bank which acts as an integrator for a variety of services. To provide the required services, DZ Bank has contracts with service providers in the network. These include (Figure 1) providers of fund investment services (Attrax, Union Invest), loans banks offering refinancing and risk management services (Teambank, Schwäbisch Hall), software, application and IT platform providers (Fiducia, GAD), and providers of financial market data services (VWD, Reuters). Upstream service providers in the network are DWP Bank for custodian and back office securities services, Equens for back office payment services and Kreditwerk for back office loans services. Finally, DWP Bank is linked to the upstream interbank area for a variety of security services (stock exchanges and central securities depositories). Equens is linked to the upstream interbank area for payment services (national clearing, European clearing, and global clearing services).

Due to regulatory reasons DZ Bank does not act as general subcontractor for all services although most services are provided by subsidiaries (actors in white boxes). DZ Bank in turn has contractual relations with most upstream service providers, such as DWP Bank for executing securities, Equens for processing payments and Kreditwerk for similar activities in the loans domain. These organizations have additional contractual relations to service providers in the interbank area.
Figure 1. DZ Bank network from the business perspective showing how 1,300 cooperative banks and 30 private banks are linked to DZ bank and 12 service providers.

The situation is different when focusing on the second perspective which highlights the technological relationships in the network that have been established over the past 2 years with the emergence of Fiducia as a centralized service intermediary. Figure 1 still exists as the core perspective for business managers in the DZ network. However, recently this perspective has changed into the service intermediary perspective of Figure 2. Contrary to the n:m relationships in the first perspective, the front-end of each cooperative/private bank is linked primarily to the Fiducia intermediary as the main service provider (see Figure 2). This integrated front-end bundles all services that have been configured during the set-up or migration phase of a bank. All services besides those from Teambank (these are integrated directly via Web Services from Teambank since they operate on Kordoba, a different core banking system) are included in the centralized service directory from Fiducia. Most of these services are hosted in directories at the respective service providers. Exceptions are highly time-critical applications, such as the routing of payments in the Equens service, which are also hosted at Fiducia.

The service directory at DZ Bank includes services which are linked to service directories at the respective partners. Providers, such as DWP Bank, have a standard solution (WP2 application) which offers the functionality. The same applies for GAD (Bank21 application), Union (Dikka application) and Kreditwerk (ALP application). For example, Bank21 has interfaces to ALP, WP2 as well as applications from other providers, such as Equens for payment processing or Cardprocess for card-based transactions. Bank21 may be implemented with individual cooperative/private banks and may also be hosted at GAD. Several players in the network have discussed SOA. For example, GAD has designed Bank21 with service-based interfaces to reduce costs when third-party applications need to be integrated. Kreditwerk reports results of their SOA based on SAP’s ESR as does Fiducia for their systems. In addition, DZ Bank has launched an overall SOA architecture project in 2008 which mainly emerged as an enhancement to their existing EAI integration infrastructure (Anonymous, 2007). The goal of this project was to establish a centralized service registry for service identification (index) and a service repository (service description using metadata) based on IONA’s (now Progress Software) Artix solution. DZ Bank’s SOA architecture defined the key elements of their SOA, the relationships between these elements and the link to the DZ. In addition, the VR Services initiative aimed at establishing a group-wide interface architecture across the solutions of Fiducia, GAD and DZ Bank.
Finally, to support the service configuration process Fiducia has implemented a process management tool (called Agree) which allows banks to select from some 100 services from the service providers in the DZ network. The configuration process is based on a process modelling tool (Adonis suite) and offers a list of functionalities from the service provider which may be selected for each bank with the resulting instances being stored at Fiducia for service management purposes.

**Figure 2.** DZ Bank network from the technology – service intermediary perspective.

### 3.3 Case Analysis

From the viewpoint of the value of smart business networks DZ Bank is now able to on-board new banks in a time frame of three to six months and to conduct migrations within little over six months. This ‘quick connectivity’ was reported as a competitive advantage which contributed to DZ Bank’s success in acquiring new private banks. This is of particular interest for foreign banks which obtain the ability to quickly establish a presence in the German market and to meet regulatory requirements as well as to link to the necessary service providers (e.g. German central bank, German exchange) at the same time. For DZ Bank this means that additional business volume and revenues are created for the actors in the network. This is of particular interest for areas that are sensitive to scale, such as the execution of transactions for payments, securities and loans as well as the operation of large core banking systems. To establish competencies for acquiring and coaching the customers (i.e. the private banks) on the one hand and to negotiate with service providers (i.e. DWP, Equens, Kreditwerk) on the other, DZ Bank created a separate business unit which also aims to develop the new business segment. Table 1 summarizes the observations from case and suggests three issues for service design:

- There is a need to distinguish between a contractual (business) and a technological perspective. While the former features DZ Bank as the key intermediary for organizing the network, Fiducia acts as the main technological intermediary in the latter. Depending on contractual agreements Fiducia’s (technical) service directory includes available services that may be configured by a bank. Thus, from the business perspective, the key intermediary is DZ Bank while Fiducia is the main intermediary from the technological design perspective. Interviewees mention that a high degree of centralization was beneficial for the network’s ‘smartness’.

- The combination of a highly centralized service directory with functionalities known from process management tools is important for the ability to change the network, i.e. when adding new banks and configuring the services.

- A benefit of the centralized service directory is the centralized data warehouse at Fiducia that also serves as a homogenous platform to measure service performance via a controlling and cockpit ap-
proach. The platform is based on the services included in the Agree tool that can be used to analyze the usage of the various distribution channels.

<table>
<thead>
<tr>
<th>Smart business network properties</th>
<th>Observations in the banking case</th>
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| Network design                    | • Pre-configuration of services by DZ Bank  
                                  | • Service configuration of individual bank |
| Network governance                | • Multiple contractual relationships to business partners  
                                  | • High centralization on technological level |
| Network execution                 | • Standard configurations may be individualized  
                                  | • Centralized execution via the IT provider |
| Infrastructure design             | • Separate applications with each service provider  
                                  | • Pre-standardization of interfaces and centralized directory |
| Network outcome                   | • Specification of customer demand with Agree tool  
                                  | • Measurement of network performance with cockpit |

Table 1. Summary of observations on smart business networking properties in the banking network

4 Research Model for Service Network Design and Value

Based on the DZ banking network case, we develop a research model that distinguishes between two design levels that influence business value: Service Network Design and Service Directory Design.

4.1 Service Network Design

As shown in the case (i) service consumers may obtain required services from one or multiple service providers and intermediaries and (ii) service intermediaries can be more or less concentrated (e.g., in one business unit, one firm, one network, or globally). To further define service network design, an established model of classifying services as trade-off between their reach (in terms of potential service users that reach the market) and richness (in terms of the amount of information per service) is applied (Evans and Wurster, 1997). Evans and Wurster argue that physical shops (classical intermediaries) combine high richness (of services) and only low reach (few customers), and that electronic intermediaries combine high richness and high reach. This model was modified to also include the notion of range which relates to the number and diversity of the services offered (Wells and Gobelli, 2003). In this way, service network design is assessed by assessing each intermediary in the network as follows:

- Reach of an intermediary (intermediary reach) indicates the numbers of clients and providers that use the service directory in the network. High reach means that all network actors have access to the services offered by the intermediary and that service providers use the intermediary’s platform.
- Richness of the services (service richness) offered via the service directory platform(s) serves to measure the granularity and functionality of the services. High richness means that the directory contains highly aggregated business services and no (limited) fine grained basic services.
- Range of services (service range) offered by the intermediary relates to the number of different services offered by the intermediary and the variety of services offered. High range indicates that the intermediary offers relatively many different services.

When analyzing service network design, the intermediary (Fiducia) features a high market reach since it lists the services from various providers for all service users (banks) in the network. Using the Agree process management tool, these services are selected on a functional level along predefined business processes (high richness). Due to several projects within the DZ network, service descriptions were homogenized and are now applicable to a variety of service providers (high range).
4.2 Service Directory Design

A second major element besides service distribution refers to the configuration of the service directories. As mentioned in section 2.2 these directories are electronic catalogs that include a more or less comprehensive and structured description of the services. The main approach towards a global and cross-industry directory is Universal Description, Discovery and Integration (UDDI) which has become a standard hosted by OASIS (Organization for the Advancement of Structured Information Standards) which is now used for structuring directories within individual software solutions. UDDI directories were proposed to include information in three areas (Clement et al., 2004): ‘white pages’ refer to a company’s contact information (e.g. name, address, contact partner, tax ID number) and mainly serve service identification purposes, ‘yellow pages’ assign the services to predefined categories (e.g. automotive business), and ‘green pages’ include technical information on the service (e.g. address of the service, WSDL descriptions). Directories may be distinguished in repositories and registries. A registry mainly consists of the ‘yellow pages’ whereas a repository comprises the ‘green pages’ and acts as the ‘central modelling and design environment’ (Sambeth, 2006). In summary, service repositories contain the actual services, and service registries, (only) include the metadata on the services. The registry helps service consumers to select and find the right service while the repository is the actual location where services are stored in such a way that they can be deployed.

Service directory design indicates the levels of centralization and standardization of repositories and registries that are used in a business network. Low centralization indicates that each node in the business network may have a service directory. Low standardization indicates that each node uses different services to run business processes. Simply stated, one may assume that maximum business value is achieved if (i) there is only one service directory that provides all Web Services to all service consumers the business network (maximum centralization), and (ii) Web Services are standardized for all service consumers and business processes (maximum standardization). However, empirical observations, e.g. in the U.S. mortgage industry, show that balancing the degrees of standardization, standards development, and standards implementation is required (instead of aiming for maximum standardization) to optimize business performance (Markus et al., 2006). Additionally, Steinfield et al. (2011) find that data and process standards need to be complemented by hub-type information technology architectures that are shared by organizations participating in an industrial field, not just by the participants in one business network. Thus the service directory design comprises the degree of:

- **Centralization of services** in the network, being the amount of registries for descriptions of service data and processes in the network, and
- **Standardization of services**, being the amount of repositories for actual storage of services in the network.

In the case, the centralized registry (Fiducia) links to several service directories at the respective service providers which operate individual applications. Although the definitions are not valid outside the DZ Bank network, DZ Bank has achieved to integrate distributed services in a single repository (high centralization and medium to high standardization). At the same time the case shows that service network design is not limited to establishing a single directory. It also relates to the numbers of intermediaries, the variety of intermediaries, and the positions of intermediaries in the network, together forming the structural design of the business network (van Liere et al., 2007; Alt et al., 2010).

4.3 Towards a Research Model

The case illustrates how ‘service network design’ and ‘service directory design’ can be used to determine business value of technology designs in a smart business network. First, the case shows that centralized directories are effective and efficient instruments to compensate for the additional coordination which is required in distributed inter-organizational networks. It connects to earlier findings (Kumar and van Dissel, 1996) which have seen centralized structures as important in enabling inter-
organizational cooperation and in containing inter-organizational conflicts at the same time. Second, the case illustrates that service directory design must not be reduced to technological considerations, but needs to comply with the complex multi-dimensional configuration which is inherent in inter-organizational networks and systems (Klein, 1996). Strategic, political and organizational challenges need to be addressed when designing service directories in inter-organizational SOA implementations. An important element for achieving the design in the network was that all key actors were subsidiaries of DZ Bank. This strongly reduced the intricacies involved in negotiating and enforcing the required standards on a network level. Although standards, such as the Unified Service Description Language (USDL) will reduce transaction costs in this regard, political and strategic restrictions need to be solved before the diffusion of similar solutions on a more global level.

Last but not least, the case has emphasized the need to link the design of service directories with established approaches in business process management. Only if services may be orchestrated efficiently in the “on boarding” of new business partners and only if these service configurations are coherently linked with business intelligence solutions, such as the data warehouse at Fiducia, will SOA implementations see convincing business value. To assess business value the indicators “rapid, low cost, easy composition of services” (Papazoglou, 2008) and “standardized integration infrastructure, decoupled application domains, flexible user-business process integration” (Legner and Heutschi, 2007) were used. This leads to the following propositions and the research model shown in Figure 3:

- **Proposition 1**: Service network design including high intermediary reach, high service richness and high range of services enhances business value.
- **Proposition 2**: Service directory design including high centralization and high standardization enhances business value.

![Figure 3. Research model and propositions](image)

5 Conclusions

Service-oriented technologies are enablers for smart business networks which are receiving growing relevance in many industries. However, the SOA concept has technological roots and requires additional design elements that address the key issues of smart business networks, in particular regarding business network design, network governance and network outcome. To develop a deeper understanding of the business and technological configuration of smart business networks this research uses an in-depth case study from the banking industry. By pursuing a technology agnostic business perspective on technology design, several critical aspects are identified which are combined in the notion of service network design and service directory design.

The banking network case illustrates the emergence of a centralized service registry that consists of around 100 financial services to be used by the network members. The services are based on a proprietary network standard. The Fiducia intermediary provides these services to the banks in the network via a (preliminary) proprietary NBOS which increases the cost of using services external to the network which would be possible. The service network design in the DZ bank network consists of a core intermediary (Fiducia) with a high reach (all banks in the network), high richness (most services are
business services), and high range (covering the full banking spectrum). The network design enables faster connectivity for adopting new banks in the network, and enables ‘plug and play’ functionality for banking services to end-customers.

Obviously, the findings evolved from a single case study in banking which limits the generalization of the results. Although the construction of the research model was also based on existing literature, future research is required to further validate the propositions regarding business value which was positive evaluated in the examined case. This opens up the perspective on future research. Further case studies are needed to further specify hypotheses and validate the exploratory based findings in this research. In a larger picture, the promising results from the in-depth case study and the research model may be helpful in defining theory for understanding smart business networking.

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