

STRATEGIES FOR ESTABLISHING SERVICE ORIENTED DESIGN IN ORGANIZATIONS

Completed Research Paper

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Abstract

Service orientation is a broadly discussed design paradigm for information systems engineering. Only recently there have been several contributions to individual dimensions of service orientation like service definition, service modeling, service management or service governance. However, a combination of useful solutions for partial problems might not constitute an effective overall approach to service orientation. We argue that the establishment of service orientation is a wicked [design] problem, i.e. poorly formulated, confusing, and permeated with conflicting values of many decision makers or other stakeholders. Therefore this paper focuses on understanding the design problem of establishing service orientation in organizations in its design dimensions. The paper identifies four strategies for establishing service orientation and derives four propositions on the development paths which may connect these strategies.

Keywords: Service oriented architecture (SOA), Service management, Enterprise architecture

Introduction

The term service orientation is used to describe very different phenomena like offerings in a value network (Vargo and Lusch 2004), a personal attitude towards tasks or activities (Hogan et al. 1984), or the interface definition and functional description of pieces of software (Erl 2005). In the area of information systems (IS) it is often seen as a design paradigm for engineering IS (Erl 2005; Fielding 2000; Huhns and Singh 2005; Newcomer and Lomow 2005) from standardized (Erl 2005; March et al. 2000) and loosely coupled artifacts (Erl 2005; McGovern et al. 2006), i.e. services (Mueller et al. 2010). These artifacts are, however, not restricted to IT artifacts like for example software but may also include business artifacts like capabilities or business processes (Davenport 1993; Lankhorst 2005; Schelp and Winter 2007).

Service orientation as an IS design paradigm has been intensively discussed (Demirkan and Goul 2006; Demirkan et al. 2008; Zhao et al. 2007) as a means to improve the manageability of increasingly complex IS (Erl 2005; Hagel and Brown 2001; Merrifield et al. 2008). However, the potential benefits of a service oriented IS design come at the cost of the paradigm's complexity (Hau et al. 2008; Lagerström and Öhrström 2007) which results from more fine-grained artifacts, positive network externalities, and the number and diversity of stakeholders with potentially inconsistent design goals (Aier and Winter 2009; Hirschheim et al. 2010).

The utilization of service oriented IS design again is a design problem. A typical strategy to deal with complex design problems is their decomposition (Saaty 1980). In the case of service orientation the design problem can for example be decomposed into a number of dimensions like service definition (Erradi et al. 2006; Yang 2003), service modeling (Quartel et al. 2007), service management (Cox and Kreger 2005) or service governance (Varadan et al. 2008) to name just a few. Although improving the individual dimension's maturity is a necessary condition, it is not sufficient. A combination of useful solutions for partial problems might not constitute an effective overall approach to service orientation. We argue that the establishment of service orientation is a *wicked* [design] *problem*, i.e. "poorly formulated, confusing, and permeated with conflicting values of many decision makers or other stakeholders" (Pries-Heje and Baskerville 2008).

In a recent publication (Aier et al. 2011a) we therefore have built a model of critical success factors for establishing service orientation. However, given the multidimensionality of the design problem, the question arises, whether such a general "one-size-fits-all" model is adequate and sufficient. In practice we do not expect to find one best way of establishing service orientation in an organization. Instead we expect to find different strategies of how to establish service orientation.

Our aim is to analyze service orientation as *one complex approach*. Therefore, the paper at hand focuses on exploring the design factors for establishing service orientation and the factors' typical instantiations in practice. Our explorative analysis is based on the same dataset (and therefore the same theoretical foundation) as our critical success factor model (Aier et al. 2011a). However, in the paper at hand we formulate three original research questions:

- RQ1: What are the design factors of service orientation as an IS engineering design paradigm?
- RQ2: What are instantiations of design factors that form effective approaches for establishing service orientation as an IS engineering design paradigm in organizations?
- RQ3: Which strategies for establishing service orientation as an IS engineering design paradigm in organizations can be derived from RQ1 and RQ2?

We identify four strategies for establishing service orientation and derive four propositions on the development paths which may connect these strategies. The results add to the scientific body of knowledge on the phenomenon of service orientation in organizations. Practitioners may benefit from the paper as well, as it offers decision support when it comes to identifying, analyzing, and evaluating the current situation of a service orientation initiative as well as its implications.

The remainder of this paper is organized as follows. Section 2 introduces the theoretical arguments for the research approach. In section 3, we describe our research methodology. The results of the empirical analysis of our research are presented in section 4. Finally, in section 5 we provide a discussion of the findings and limitations and suggest topics for future research. Section 6 concludes the article.

Theoretical Background

Service Orientation

Service orientation as a design paradigm for engineering IS builds on the properties of the underlying service concept (Aier et al. 2011a). The first property of a service is its production of a *specified result* by performing certain actions. The second property is represented by the fact that the service consumer must *not need to know* which actions are performed in order to produce this result (*transparency*) (Parnas 1972). A third property of services is their *granularity* (Haesen et al. 2008). A service should produce a meaningful result for a given context while overlapping in functionality as little as possible with other services (*separation of concerns*) (Arsanjani 2002).

However, service orientation as a design paradigm for engineering IS is not only defined by its core components—the services—but by the services' *integration*, i.e. coupling of services to form an integrated IS (Arsanjani 2002). This coupling of components focuses on the *flexibility to change* the resulting IS. Therefore service orientation specifically aims at a *loose coupling* of services which is a result of the service properties mentioned above (Stal 2006).

There is consensus of opinion that service orientation contributes to flexibility of organisations (Ahsan and Ye-Ngo 2005; Coronado Mondragon et al. 2004). However, in order to actually achieve these benefits a challenge resulting from the combination of the following three facts has to be mastered (Ciganek et al. 2005): (a) The more exhaustive service orientation coverage is, the more benefit will be generated due to positive *network externalities* (Katz and Shapiro 1985). (b) Because of these network externalities and the fact that service orientation addresses IT as well as business artefacts, the number and *diversity of stakeholders* rises, and thus the probability of inconsistent design goals increases (Varadan et al. 2008). (c) The actions of these diverse stakeholders need to be *coordinated* in order to achieve exhaustive coverage of services that can be integrated to form a service oriented IS (Bieberstein et al. 2005). The resulting challenge represents the *wicked problem* of establishing service orientation which is poorly understood. Therefore in the paper at hand we aim at uncovering strategies for establishing service orientation in organizations (RQ3).

Establishment of Enterprise Wide IS Integration

Although service orientation is discussed for several years now, there still are only a few scientific and/or practitioner-oriented publications *reporting on the establishment of service oriented IS engineering* (e.g. Antikainen and Pekkola 2009; Bieberstein et al. 2005; Heutschi and Legner 2007; Hirschheim et al. 2010; Hochstein and Brenner 2006; Lee et al. 2010; Wong-Bushby et al. 2006). There is no *a priori theory* to explain the phenomenon. Consequently, this paper is of the theory-creating rather than the theory-testing kind. According to Gregor (2006) our theory can be classified as *theory for explaining*. We argue with Iivari and Huisman (2007) that “even though theory-creating research is sometimes associated with qualitative and interpretive research methods rather than with quantitative ones (Järvinen 2001), we do not see any philosophical (Chalmers 1999) or methodological (Dubin 1978; Wallace 1983) reasons why this should be so”. Iivari and Huisman (2007) point out that the relationship between the purpose of a piece of research (exploratory/theory-creating versus confirmatory/theory-testing) and its methods are orthogonal.

However, our research still needs an adequate theoretical foundation to start from. Therefore we build on the concept of *enterprise integration*, i.e. the “breaking down of organizational barriers to improve synergy within the enterprise so that business goals are achieved in a more productive and efficient way” (Vernadat 2002). Enterprise integration is often discussed from the perspective of integration of IS. In such a perspective, two main challenges—among others—exist: (a) The “physical” integration of two or more systems by means of *interfaces* or by *mergence*. (b) The semantic integration or even unification of core concepts of the enterprise by means of enterprise models (Vernadat 2002).

Over the last 20 years the most prominent of these enterprise wide IS integration approaches covering technical as well as semantic integration are—among service oriented IS design itself—enterprise resource planning (ERP), data warehousing (DWH), and enterprise application integration (EAI) (Lee et al. 2003).

In the further discussion we exclude DWH since focusing on analytical data only, it is different from the other approaches which are more generic in nature (Wixom and Watson 2001).

The remaining three concepts—ERP, EAI, and service orientation—share some major characteristics. They all aim for a consistent, enterprise wide semantic and technical integration of IS. From this perspective the ERP integration approach seems the most ambitious. It is to design a comprehensive IS that consolidates, i.e. merges, enterprise wide data and functionality into a single consistent software system (Ragowsky and Somers 2002). However, the tight coupling of data and functionality in ERP systems require significant efforts for changing the system. Thus the successive introduction of ERP systems in large organizations has more often than not led to a number of inconsistent ERP instances, thereby partitioning the big integration challenge into a set of smaller ones (structured by region, product, organizational unit etc.) (Alshawhi et al. 2004).

EAI reduces the tightness of coupling and acknowledges the benefits of a number of smaller best-of-breed ISs. EAI separates the integration function into a central and consistent integration infrastructure that also provides the semantic integration of core concepts (Lam 2005). As a result stakeholders may optimize their ISs in a decentralized way without impacting other ISs as long as the respective changes do not change the system's interfaces or interface changes can be buffered by the EAI system.

Further increasing the level of granularity of the architectural elements, service orientation improves their interoperability by deploying the service paradigm on the technical level as well as on the level of enterprise services. In doing so, service orientation fundamentally breaks with established approaches to IS design, e.g. by challenging the paradigm of highly integrated data (as in ERP and to some degree in EAI), by consequently not restricting itself to IT artifacts (as EAI and to some degree ERP do) and thus by applying the idea of loosely coupled services on each layer of the business to IT stack as well as through this stack (Aier and Winter 2009). Thus service orientation is the most decentralized approach and reduces the commonality of its components to a minimum at the cost of a higher number of components that need to be integrated.

The three approaches of enterprise integration—ERP, EAI and service orientation—are not the result of an incremental evolutionary development, but instead of radical changes followed by phases of stability, i.e. *punctuated equilibria* (Eldredge and Gould 1972). Punctuated equilibrium theory describes organizations as primarily stable residing in an equilibrium where, building on arguments from institutional theory (e.g. Tolbert and Zucker 1983), inertia builds resistance to organizational change due to the “deep structure” (Gersick 1991) of interrelated organizational parts and competitive, regulatory, and technological systems (Romanelli and Tushman 1994). These phases of stability will be punctuated and interrupted by short, discontinuous bursts of change, e.g. caused by technological innovations. Network externalities, as they can be found with ERP, EAI and service orientation, may cause multiple stable equilibria to exist at the same time. Thus the incumbent equilibrium may persist long beyond the time when the new technology has become superior (Loch and Huberman 1999).

Although the ERP, EAI and service orientation are different approaches of enterprise integration, for their establishment, they share the major challenges of positive *network externalities*, a potentially large number of *stakeholders with inconsistent design goals* that need to be *coordinated*. Therefore we initially build on ERP and EAI literature in order to better understand the strategies of establishing service oriented IS design in organizations.

Research Design

Conceptual Framework

Our basic assumption is that enterprise wide IS integration evolves in accordance to the punctuated equilibrium pattern where ERP, EAI, and service orientation are technological punctuations. However, while technologies evolve, the fundamental problem of bridging the conceptual as well as cultural gap between business and IT seems to remain unsolved. For defining our measurement instrument we strive to avoid the latent structures, constructs and thus scales of these punctuations. Instead we aim at circumscribing the design space related to enterprise integration and partition it in reasonable areas that can then be sub-

stantiated by respective measurement items. Hereby we want to derive an impartial instrument that provides a proper basis for an explorative analysis.

We draw on literature on *enterprise architecture* (EA) and on the literature on *enterprise integration* (EI) in order to structure the design space for establishing service orientation. The concept of EA seems appropriate since it aims at (1) the description of “[t]he *fundamental organization* of a system embodied in its components, their relationships to each other, and to the environment”, and at (2) “the *principles guiding its design and evolution*” (IEEE 2000; The Open Group 2009). However, existing literature on EA focuses almost exclusively on (1) the *fundamental organization* of the respective system. The *principles guiding its design and evolution* are hardly covered in literature (Stelzer 2010). Therefore we extend our literature analysis to the field of EI with focus on the *generic enterprise reference architecture and methodology* (GERAM) which covers similar areas as EA and extends pre-existing work by life-cycle concepts and thus explicates the phenomena of change and transformation (Bernus and Nemes 1996).

A large number of publications on EA is available, including contributions which compare and empirically evaluate pre-existing work (e.g. Mykhashchuk et al. 2011; Noran 2004; Schönherr 2009; Winter and Fischer 2007). Instead of replicating this work we build on Winter and Fischer (2007) who analyzed existing EA frameworks, derived essential layers and artifacts of EA, and evaluated their consolidated model in case studies. Winter and Fischer’s essential layers are a *strategy layer*, *organizational layer*, *integration layer*, *software layer* as well as *IT infrastructure layer*. In more recent works the integration layer has been renamed *alignment layer* (Aier and Winter 2009).

- Strategy layer: represents the fundamental organization of the enterprise from a business strategy viewpoint.
- Organizational layer: represents the fundamental organization of service development, service creation, and service distribution.
- Alignment layer: represents enterprise services, applications and domains which are referred to as alignment artifacts. The alignment layer addresses the integration needs of IT/business alignment by linking and decoupling business and IT artifacts through respective alignment artifacts.
- Software layer: represents the fundamental organization of software artifacts, e.g. software services and data structures.
- IT infrastructure layer: represents the fundamental organization of computing/telecommunications hardware and networks.

While this system of layers provides a solid structure for the artifacts affected by change, the layers do not represent change itself very well. However, GERAM which is closely related to EA frameworks focuses the dynamic aspect of enterprises (Bernus and Nemes 1996). GERAM stays on a very abstract level as far as artifacts of EA are concerned but it is explicit on life cycle aspects of enterprises and their components by addressing (Bernus and Nemes 1997):

- decision support (e.g. to identify and select among alternatives for the design of new the operation)
- communication of design decisions among involved parties
- education and training of personnel and explicit representation of company knowledge
- model-driven control of change processes.

We therefore add the layer of *culture and communication*. These six layers derived from EA and EI literature can be used to structure the description of establishing enterprise integration approaches like ERP, EAI, and service orientation.

Measurement Model

By analyzing a select set of both practitioner-oriented and scholarly literature on ERP, EAI and service orientation, we identified items that are suited to instantiate these layers. If necessary, the items suggested by literature on ERP and EAI were reformulated and/or adapted to account for the specific characteristics of service oriented IS engineering. Table 1 lists the identified measurement items in their respective layer. Due to the page limit we do not discuss each publication here but reference the literature that sup-

ports the respective item. In our literature review we focused on items that are described as critical for success and are supported either by a broad literature review or by empirical data.

Table 1. Measurement items of design elements of service orientation

Measurement Items	Contributing Literature
Strategy	
St.1 Definition of tangible goals for service orientation projects	(Hirschheim et al. 2010; Holland and Light 1999; Lam 2005; Linthicum 2000; Loh and Koh 2004; Nah and Delgado 2006; Nah et al. 2001; Remus 2006)
St.2 Derivation of service orientation strategy from corporate strategy	(Holland and Light 1999; Lam 2005; Lewis et al. 2007; Sumner 1999)
St.3 Anchoring of service orientation projects in corporate strategy	(Lewis et al. 2007)
St.4 Definition of a service orientation roadmap	(Bieberstein et al. 2005; Holland and Light 1999; Lam 2005; Loh and Koh 2004; Puschmann and Alt 2004)
Organization	
O.1 Definition of organizational responsibilities for managing the service landscape	(Bieberstein et al. 2005; Hirschheim et al. 2010; Hochstein and Brenner 2006; Lewis et al. 2007)
O.2 Definition of processes for service development and service adaptation	(Bieberstein et al. 2005; Hochstein and Brenner 2006; Lewis et al. 2007)
O.3 Definition of service ownerships	(Bieberstein et al. 2005; Lewis et al. 2007; Themistocleous and Irani 2001)
O.4 Assignment of professionals/experts with adequate knowledge to service orientation project teams	(Holland and Light 1999; Lam 2005; Loh and Koh 2004; Mendoza et al. 2006; Nah and Delgado 2006; Nah et al. 2001; Remus 2006; Sumner 1999; Sumner 2000; Themistocleous 2004)
O.5 Assignment of experienced members to service orientation project teams	(Holland and Light 1999; Lam 2005; Loh and Koh 2004; Mendoza et al. 2006; Nah and Delgado 2006; Nah et al. 2001; Remus 2006; Sumner 1999; Sumner 2000; Themistocleous 2004)
O.6 Assignment of specifically trained members to service orientation project teams	(Lam 2005; Sumner 2000)
O.7 Assignment of external consultants to service orientation project teams	(Lam 2005; Sumner 2000; Themistocleous 2004)
O.8 Assignment of members from business departments that are interested in technology to service orientation project teams	(Lam 2005; Mendoza et al. 2006; Nah and Delgado 2006; Sumner 2000; Themistocleous 2004)
O.9 Existence of service orientation promoters within the organization's senior management	(Hochstein and Brenner 2006; Holland and Light 1999; Lam 2005; Loh and Koh 2004; Mendoza et al. 2006; Nah and Delgado 2006; Nah et al. 2001; Remus 2006; Sumner 1999; Sumner 2000; Teo and Ang 1999; Zaitun and Yaacob 2000)
O.10 Allocation of an adequate budget for service orientation projects	(Hochstein and Brenner 2006; Lam 2005; Loh and Koh 2004)
O.11 Selection of appropriate early adopters for service orientation	(Sumner 1999)
O.12 Application of business process models in conjunction with service orientation projects	(Hirschheim et al. 2010; Lam 2005; Loh and Koh 2004; Nah et al. 2001)

Alignment		
A.1	Establishment/maintenance of common terminology	(Lam 2005; Sumner 1999)
A.2	Observance of the design principle of abstracting services from technical implementations	(Heutschi and Legner 2007; Wong-Bushby et al. 2006)
A.3	Observance of the design principle of aligning services with business processes	(Heutschi and Legner 2007; Hirschheim et al. 2010; Holland and Light 1999; Nah et al. 2001; Remus 2006; Schwinn and Winter 2007; Sumner 1999; Sumner 2000; Wong-Bushby et al. 2006; Zhang et al. 2003)
A.4	Observance of the design principle of aligning services with information objects	(Heutschi and Legner 2007; Sumner 2000)
A.5	Usage of application landscape models in conjunction with service orientation projects	(Holland and Light 1999; Lam 2005; Themistocleous 2004)
A.6	Usage of information object models in conjunction with service orientation projects	(Lam 2005)
A.7	Selection of low-complexity service orientation projects	(Nah et al. 2001; Sneed and Brössler 2003)
A.8	Identification of existing needs for change/definition of correspondent service orientation projects	(Hau et al. 2008; Hochstein and Brenner 2006)
A.9	Usage of models of the service landscape in conjunction with service orientation projects	(Dan et al. 2006; Hirschheim et al. 2010)
Software		
S.1	Definition of mandatory standards	(Lam 2005)
S.2	Observance of the design principle of defining loosely-coupled services	(Heutschi and Legner 2007; Schwinn and Winter 2007; Wong-Bushby et al. 2006)
Infrastructure		
I.1	Existence of a high-performance infrastructure/implementation	(Lam 2005; Schwinn and Winter 2007; Wong-Bushby et al. 2006; Zhang et al. 2003)
I.2	Availability/performance of technical infrastructure	(DeLone and McLean 1992; DeLone and McLean 2003; Lam 2005; Themistocleous 2004; Wong-Bushby et al. 2006)
Culture and Communication		
C.1	Management of communication between business and IT	(Hochstein and Brenner 2006; Loh and Koh 2004; Mendoza et al. 2006; Nah and Delgado 2006; Nah et al. 2001; Sumner 1999; Sumner 2000; Teo and Ang 1999; Wong-Bushby et al. 2006; Zaitun and Yaacob 2000)
C.2	Existence of distinct willingness for change	(Bieberstein et al. 2005; Lam 2005; Loh and Koh 2004; Nah et al. 2001; Themistocleous 2004; Themistocleous and Irani 2001; Zhang et al. 2003)
C.3	Liaison and support of all service orientation project stakeholders	(Holland and Light 1999; Lam 2005; Mendoza et al. 2006; Nah et al. 2001; Sumner 2000; Themistocleous 2004; Zaitun and Yaacob 2000)
C.4	Liaison and support of the service orientation project promoters	(Nah et al. 2001; Sumner 1999; Themistocleous 2004)
C.5	Liaison and support of the service orientation project opponents	(Nah et al. 2001; Sumner 1999; Sumner 2000; Themistocleous 2004)

While our primary aim is to identify and understand the design factors as well as their instantiations, we are also interested in possible differences regarding the success of service orientation in the respective groups. Therefore we have analyzed the body of literature on service orientation in order to identify char-

acteristics of successful service orientation.

Service orientation is not a single project but a design paradigm. The establishment of service orientation needs several projects to build a significant number of services which we refer to as *service orientation infrastructure*. The benefit of an existing service orientation infrastructure lies in the *reuse* potential of existing services in different projects (Bieberstein et al. 2005). The reuse of services is enabled because the required functionality is encapsulated in rather small, but self-contained partitions in contrast to monolithic blocks of functionality (Stal 2006). Thus, service orientation may lead to less redundant implementations of functionality resulting in lower *IT operations costs* (Lam 2005).

On project level, reuse as well as easier recombination of existing services may lead to shorter IT projects and thus to reduced *IT development costs* (Themistocleous and Irani 2001). Shorter cycle times will decrease the *perceived latency* caused by IT departments implementing new or changed business requirements (Wong-Bushby et al. 2006). Finally, service orientation infrastructure may be described as successful if the *business users' satisfaction increases* due to the infrastructure-related services provided by IT departments (DeLone and McLean 2003).

Data Collection

The data set for our analyses was gathered through a written survey which comprises items presented in the previous section. Each item is represented by a particular question on the survey instrument. The items have been measured on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). All questions have been formulated to measure the respondents' personal opinion on the characteristics of service orientation as well as the actually observed success. The survey instrument was both reviewed by academics and pre-tested with selected practitioners. The responses from the pre-test were not included in the final sample. Based on this initial feedback, minor wording changes were applied to the questionnaire. Additionally, four test items were included in the survey instrument to check the reliability of the responses. The final survey included 43 items including items for quality assurance. In addition, the survey featured six questions relating to demographics and the status of service orientation initiatives in the respondent's organizations.

The questionnaire was sent to approximately 12,800 IT professionals from 4,390 organizations that were selected from our research institute's database. Study participants were recruited among medium-sized and large companies from almost all industry sectors, operating in Switzerland, Germany, or Austria. The top three industries—consulting, banking, insurance and financial services, as well as software and information technology—jointly account for about half of the data set. Nearly two-thirds of the respondents work for large companies that employ more than 1,000 persons. The respondents' expertise has been controlled by assessing the status of service orientation in their respective organizations. However, the respondents' expertise shows no significant impact on survey results. The respondents typically represent middle management concerned with aligning IT offerings to business demands. These respondents are mostly part of an IT department rather than part of a business department and thus are familiar with the supply perspective of service orientation as well as to a limited extend with its demand perspective. This organizational positioning is appropriate for our survey since the concept of service and service orientation we use in the paper at hand has its origins in IT and is therefore best understood by IT related participants—as opposed to other perspective on services like in service dominant logic which might be best understood in marketing departments.

The survey was administered in German language only. Respondents were offered free access to the results of the study. 289 completed surveys were returned. 118 respondents actively declined to answer the questionnaire because they had no direct link to service orientation. Additionally we asked organizations for internal coordination in case more than one member has been asked. Based on a thorough examination and comparison of the responses to the test items, 60 questionnaires were discarded due to poor data quality. Accordingly, the final sample comprises 229 observations.

The overall response rate of organizations is therefore roughly 7% (sample size of 4,390 eligible participants; 289 responses). Because of the low response rate we critically reviewed the distribution of industries, size, and experience of the responding organizations finding no significant differences to other surveys we conducted in the field of enterprise integration that showed higher response rates. We also tested for a late-response bias as an—although discussed (Mentzer and Flint 1997)—indicator for a non-response

bias (Armstrong and Overton 1977) and found no significant results. Although the response rate is low when compared to similar surveys, we are reasonably confident that it does not bias our results significantly (Holbrook et al. 2008; Keeter et al. 2006).

Results

We have applied three consecutive types of analyses to extract results from the data set. First we have applied a *factor analysis* in order to identify the latent design factors (RQ1). In a second step we have applied a *cluster analysis* based on the factor scores identified in the first step. The cluster analysis aims at the identification of groups of similar instantiations of design factors (RQ2). In a third step we have applied an *analysis of variance* (ANOVA) in order to identify possibly different goal systems and realization levels of success among the identified groups (RQ2).

Design Factors of Service Orientation

In order to identify common underlying design factors of service orientation, we have applied an exploratory factor analysis using the principal component analysis. Therefore the data set has to meet two criteria. (1) A data set is suitable for factor analysis if the anti image is low: According to Dziuban and Shirkey (1974), the percentage of none diagonal elements of the anti image covariance matrix, which are non-zero (>0.09), should not exceed 25%. This holds true for the data set at hand. (2) The second criterion involves the computation of the Kaiser-Meyer-Olkin measure of sampling adequacy. In the data set at hand, the measure is 0.91. According to Kaiser and Rice (1974), this characterizes the intercorrelation among the variables within the factors found as “marvelous”. The results prove that the data set is generally appropriate for factor analysis.

The factor analysis, using Varimax rotation with Kaiser normalization, has led to seven factors, comprising 27 items of the questionnaire (table 3). Seven items have been deleted because they did not contribute to the factor identification (Hair Jr et al. 2006). The number of factors has been chosen equal to the number of eigenvalues greater than 1. The items selected for the factor analysis explain 63.68% of variance in total.

In order to test the reliability of the factor scale, Cronbach’s Alpha has been calculated for each factor (table 2). For Cronbach’s Alpha a value above 0.7 indicates an adequate reliability, which holds true for four out of seven factor scales. One alpha value is almost 0.7 and two are clearly below. It must be noted, however, that a large number of items may increase the value artificially while a low number of items tends to underestimate reliability (Field 2009). In our case the low alpha values occur with factors described by two or three items only. Reliability analysis shows values mostly between 0.3 and 0.5 for the inter-item correlation within the factors, which indicates that the observed high values of alpha can be regarded as valid for our purposes. We did not exclude factors with low alpha values because they still add information for an exploration of the field—being a different approach that testing hypotheses.

With regard to the interpretation of factors, factor loadings from 0.3 to 0.4 are considered a minimal level (Hair Jr et al. 2006). Generally, factor loadings from at least 0.5 are considered sufficient for an unambiguous assignment to one factor which is the case for the majority of factor loadings in our data set.

Table 2. Factor loadings and reliability								
No	Item	F1	F2	F3	F4	F5	F6	F7
O.4	Assignment of professionals/experts with adequate knowledge to service orientation project teams	.713	.214	.141	.043	.108	.192	.235
A.3	Observance of the design principle of aligning services with business processes	.681	-.041	.224	.119	-.002	.104	.011
St.1	Definition of tangible goals for service orientation projects	.678	.294	.230	.074	.141	.084	.053

O.10	Allocation of an adequate budget for service orientation projects	.655	.288	.102	.126	.036	.008	.159
O.1	Definition of organizational responsibilities for managing the service landscape	.553	.167	.033	.261	.419	.262	-.064
O.12	Application of business process models in conjunction with service orientation projects	.518	.040	.481	.272	.094	-.027	.103
S.1	Definition of mandatory standards	.511	.342	.115	.058	.285	.313	.039
O.3	Definition of service ownerships	.500	.255	.065	.236	.363	.286	.041
O.2	Definition of processes for service development and service adaptation	.486	.187	.094	.123	.425	.375	.015
C.4	Liaison and support of the service orientation project promoters	.157	.797	.087	.167	.162	.106	.169
C.3	Liaison and support of all service orientation project stakeholders	.208	.779	.044	.107	.168	.140	.047
C.5	Liaison and support of the service orientation project opponents	.180	.774	.012	.132	.110	.099	-.003
C.2	Existence of distinct willingness for change	.125	.609	.156	.204	.067	.037	.216
A.6	Usage of information object models in conjunction with service orientation projects	.166	.101	.817	.058	.095	.071	.008
A.5	Usage of models of the application landscape in conjunction with service orientation projects	.162	.056	.762	.136	-.042	.052	.212
A.9	Usage of models of the service landscape in conjunction with service orientation projects	.240	.100	.649	.086	.245	.277	-.004
St.3	Anchoring of service orientation projects in corporate strategy	.116	.177	.078	.823	-.058	.011	.106
St.2	Derivation of service orientation strategy from corporate strategy	.124	.202	.183	.707	.261	.188	.093
O.9	Existence of service orientation promoters within the organization's senior management	.443	.404	.075	.549	.120	.082	.095
St.4	Definition of a service orientation roadmap	.322	.206	.251	.478	.353	.087	-.059
O.11	Selection of appropriate early adopters for service orientation	.069	.146	.091	.019	.731	.051	.063
A.8	Identification of existing needs for change and definition of correspondent service orientation projects	.205	.127	.044	.111	.631	-.062	.180
S.2	Observance of the design principle of defining loosely-coupled services	.103	.090	.131	.069	.063	.810	.210
A.2	Observance of the design principle of abstracting services from their technical implementation	.251	.166	.113	.090	-.021	.767	-.060
O.5	Assignment of experienced members to service orientation project teams	.349	.002	-.024	.074	-.054	.162	.723
O.6	Assignment of specifically trained members to service orientation project teams	.096	.292	.134	.051	.177	-.023	.665
O.7	Assignment of external consultants to service orientation project teams	-.174	.132	.231	.125	.380	.055	.532
Conbach's Alpha		0.884	0.825	0.755	0.791	0.546	0.694	0.543

Factor 1 comprises items describing the *business driven governance* of a service orientation initiative.

Thus the factor focuses on defined governance elements like defined responsibilities, service ownerships, defined processes for service development and adaptation. Furthermore the factor includes parameters which are defined by governance bodies like project goals, assignment of expert knowledge, budget, and relevant standards (Brown and Grant 2005; Weill and Ross 2005). The perspective from which these governance elements and parameters are defined is that of an alignment with business needs.

Factor 2 comprises items describing *culture and communication of change*. Items that describe management of stakeholders, promoters, and opponents as well as willingness for change are included. These items account for the management of the diversity of stakeholders with possibly conflicting goals in enterprise wide IS integration initiatives (Detert et al. 2000).

Factor 3 comprises items describing the importance of *transparency using IT architecture models* including information objects, applications, and service landscapes. Transparency of IT architecture is a crucial precondition for a purposeful service oriented design (Schelp and Winter 2007).

Factor 4 comprises items describing *strategic compliance of and strategic support for service orientation initiatives* as well as the associated top management support. Such means of providing legitimacy are often an important factor for any kind change initiative (Oliver 1991; Suchman 1995).

Factor 5 comprises items describing the *contribution of business value and identification of "Low hanging fruits"* as adequate catalysts of service orientation by addressing urgent needs willing stakeholders (Peppard et al. 2007).

Factor 6 comprises items describing the *sound service design in controlled environment*. The application of well-defined explained design principles like loose-coupling and abstraction from technical implementation in low-complexity service orientation projects are important for the creation of a consistent service landscape (Aier et al. 2011b).

Finally factor 7 comprises items describing the *experience and education of project team members* as a design dimension (Tsai et al. 2006).

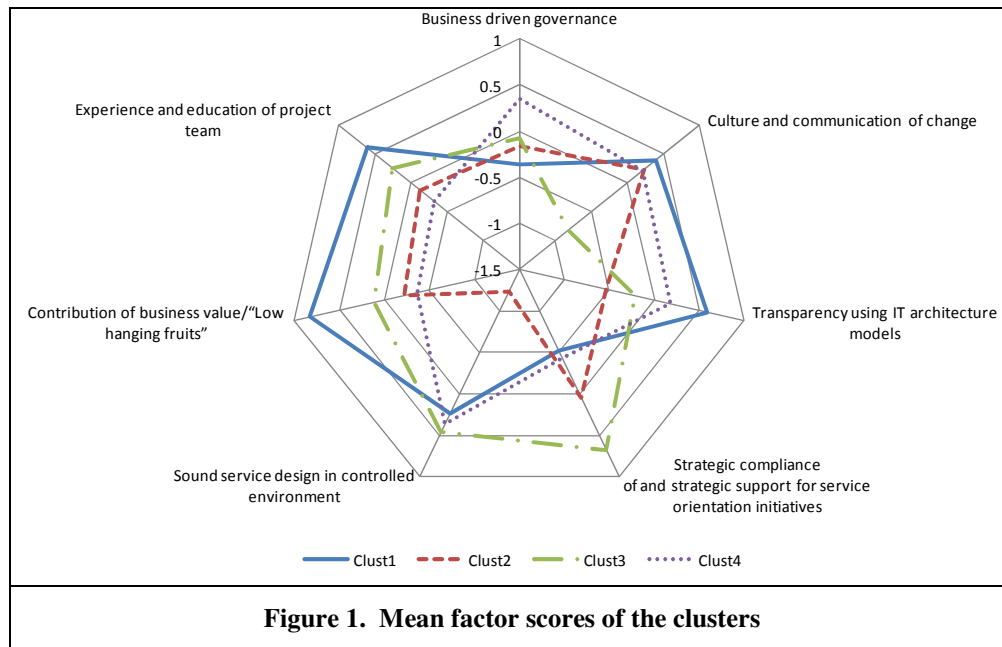
These seven factors represent the latent design dimensions we have identified for establishing service orientation in organizations. They describe the relevant parameters of design. Whether or not these parameters are essential for success and thus become success factors depends on the situation an organization is in and how parameter values are combined. Therefore we analyze which combinations of factor instantiations effectively occur in practice and how these combinations relate to different dimensions of success in the following subsection.

Observed Approaches for Establishing Service Orientation

In order to understand the actual approaches of establishing service orientation, a cluster analysis has been performed upon the seven design factors identified. The cluster analysis aims at finding groups of respondents that adopt similar approaches to service orientation. As they are more common and do not bear the risk of constraining the possible clusters by ex-ante presumptions (Hair Jr et al. 2006), hierarchical clustering algorithms have been used. Those algorithms produce all possible clustering results, so that the final solution must be identified based on the agglomeration schedule and the dendrogram. For the cluster analysis, which is presented below, we have used the Average Within-Group Linkage cluster algorithm provided by SPSS and Squared Euclidean Distance as distance measure. The results of the agglomeration schedule and the dendrogram have led to the identification of four clusters.

In order to interpret the clusters with respect to the underlying characteristics, the cluster centroids have been analyzed. These can be identified by the mean factor scores within each cluster. The mean factor scores for each cluster are illustrated by the net diagram in figure 1.

In order to better understand the clusters we have additionally tested the clusters for significant differences in their respective goal system and goal achievement by applying multivariate ANOVA. Table 3 illustrates that for three out of five items significant differences between clusters exist on at least a 0.05 level.

**Table 3. Significance of differences in goal system per cluster (ANOVA)**

Dependent Variable	Sig.	Observed Power
Go1: New business requirements should be implemented faster in IT	.025	.731
Go2: Software development costs should be reduced	.040	.672
Go3: Operations costs should be reduced	.687	.150
Go4: Business should be satisfied with IT services	.930	.077
Go5: Services should be reused	.003	.897

In order to further understand between which clusters the significant differences occur we have performed a post-hoc analysis using a Tukey test to analyze the differences between each cluster of relevant goals (table 4). We tested the applicability of the Tukey test with Levene's test of equality of error variances (which is not significant in our data set) and double checked results with the Games-Howell test. All but one of the identified differences are significant on a 0.05 level, one is significant on a 0.1 level.

Table 4. Post-hoc analysis of significance of differences in goal system per cluster (ANOVA)

Dependent Variable	Cluster (I)	Mean	Cluster (J)	Mean Difference (I-J)	Sig.
Go1: New business requirements should be implemented faster in IT	1	4.231	2	.49	.119
			3	.64	.021
			4	.29	.478
	2	3.741	1	-.49	.119
			3	.15	.883
			4	-.20	.714
	3	3.593	1	-.64	.021
			2	-.15	.883
			4	-.34	.247

	4	3.937	1	-.29	.478
			2	.20	.714
			3	.34	.247
Go2: Software development costs should be reduced	1	3.923	2	.50	.076
			3	.20	.761
			4	.05	.994
	2	3.426	1	-.50	.076
			3	-.30	.394
			4	-.45	.049
	3	3.722	1	-.20	.761
			2	.30	.394
			4	-.15	.817
	4	3.873	1	-.05	.994
			2	.45	.049
			3	.15	.817
Go5: Services should be reused	1	4.410	2	.56	.033
			3	.21	.742
			4	-.06	.990
	2	3.852	1	-.56	.033
			3	-.35	.237
			4	-.62	.002
	3	4.204	1	-.21	.742
			2	.35	.237
			4	-.26	.412
	4	4.468	1	.06	.990
			2	.62	.002
			3	.26	.412

We have performed the same tests for differences in goal achievements among clusters. While the cluster means show differences in goal achievements (table 5) none of the differences have been found to be statistically significant. Therefore, interpretations of the differences of goal achievements between clusters have to be approached with caution while absolute values may still support the characterization of a cluster.

Table 5. Goal achievements per cluster					
Dependent Variable	Cluster	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Bo1: Faster technical implementation of new business requirements	1	3.125	.259	2.611	3.639
	2	2.833	.244	2.349	3.318
	3	3.032	.186	2.663	3.402
	4	3.226	.186	2.856	3.595
Bo2: Reduction of software development costs	1	2.938	.275	2.391	3.484
	2	3.111	.259	2.596	3.626
	3	3.065	.198	2.672	3.457
	4	3.097	.198	2.704	3.489

Bo3: Reduction of operations costs	1	2.500	.284	1.936	3.064
	2	2.778	.268	2.246	3.310
	3	2.806	.204	2.401	3.212
	4	2.806	.204	2.401	3.212
Bo4: Business are satisfied with IT services	1	3.063	.251	2.564	3.561
	2	2.944	.237	2.474	3.415
	3	3.419	.180	3.061	3.778
	4	3.129	.180	2.771	3.488
Bo5: Services are being reused	1	3.688	.270	3.151	4.224
	2	3.389	.255	2.883	3.895
	3	3.452	.194	3.066	3.837
	4	3.742	.194	3.357	4.127

Based on the analyses above we will characterize the identified clusters and reconstruct their respective strategies for establishing service orientation in the following:

Cluster 1 implements the strategy of *service orientation as an isolated but business value driven problem solution*. Cluster 1 includes 39 of the 229 analyzed cases. Organizations in cluster 1 have an open-minded culture and communication and have transparency and understanding of their IT architecture. Their service orientation projects are isolated or “underground” projects addressing a specific business need and delivering specific business value with a team of experts. Implementation speed for new business requirements, reduced software development costs, and reuse of services are significantly more important than in other clusters. While organizations in cluster 1 indeed achieve a fast implementation of business requirements and a rather high service reuse no reduction in software development costs or IT operations costs could be achieved.

The strategy of organizations in cluster 1 is the demonstration of business value by means of implementing successful service orientation pilots in a rather mature IT environment. Demonstrating the effectiveness and thus potential efficiency gains for the stakeholders concerned has shown to be instrumental for reducing resistance to change in an organization (Oliver 1991). However, this strategy of isolated service orientation projects is not capable of delivering cost benefits that are usually associated with service orientation as an infrastructure because the respective infrastructure is non-existent yet.

Cluster 2 implements the strategy of *service orientation as a revival of IT organization*. Cluster 2 includes 55 of the 229 analyzed cases. Organizations in cluster 2 also have an open-minded culture and communication but they lack transparency and control of their IT architecture. Therefore service orientation is used as a general strategy, principle, and driver to reorganize IT processes. Consequently reuse of services or reduction of software development costs are no particular goals. While organizations in cluster 2 actually achieve a reduction of software development cost, they only achieve a low service reuse and no faster implementation of business requirements.

The strategy of organizations in cluster 2 is the utilization of the momentum of service orientation to improve the generally low maturity of IT development and operations which seems a suitable approach.

Cluster 3 implements the strategy of *service orientation as enactment*. Cluster 3 includes 55 of the 229 analyzed cases. Organizations in cluster 3 do not have an open culture and communication but are operated and coordinated by hierarchy. However, a hierarchical culture also ensures very strong strategic support of service orientation and results in a good standing in the organization (Iivari and Huisman 2007) although faster implementation of business requirements is no particular goal. As a result service orientation has not a big impact on the organization although being instrumental: Organizations in cluster 3 achieve a slightly faster implementation of new business requirements and a small reduction of IT operations costs.

Cluster 4 implements the strategy of *service orientation as sustainable growth*. Cluster 4 includes 80 of the 229 analyzed cases. Service orientation is not enacted as an official strategy but it is business driven and controlled. By generating relevant business value, service orientation is demanded as an approach that has proven to be successful. Service reuse and reduction of software development costs are explicit

goals. In fact, organizations in cluster 4 realize a high service reuse, achieve a faster implementation of new business requirements and generate a small reduction of IT operations costs.

The strategy of organizations in cluster 4 is the demonstration and eventually common understanding that service orientation is a beneficial design paradigm which results in a high acceptance in the stakeholder base (Oliver 1991; Suchman 1995).

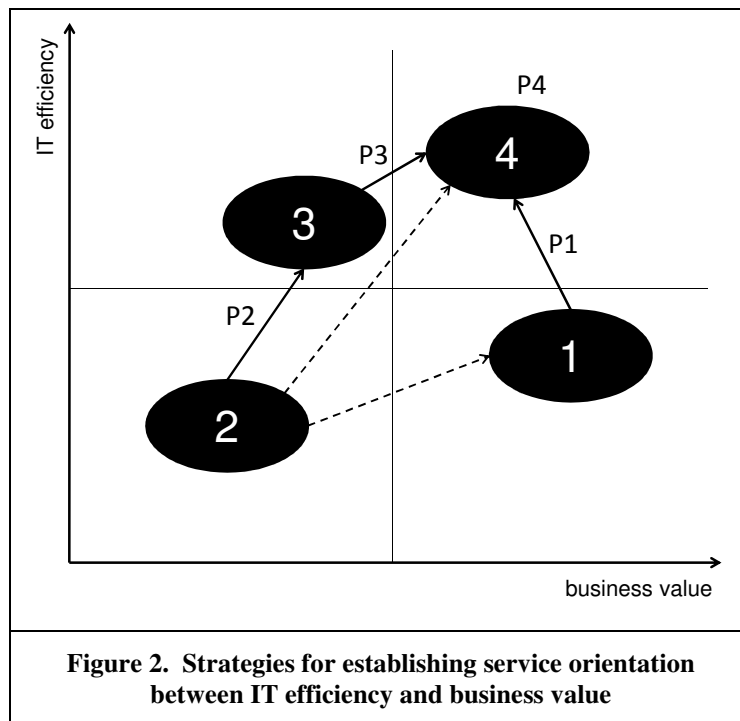
Discussion

Implications: Strategies for Establishing Service Orientation

One finding of the analysis above is that organizations are not free to choose one of the four clusters, i.e. strategies, but the possible realization of a certain strategy depends on the point of departure which can be described for example by the maturity of the IT organization, the standing of IT in the organization, the relationship with business stakeholders and the strategic support of service orientation. This is in line with the theory of dynamic capabilities as it emphasizes the importance of organizational learning for organizational and managerial processes (Teece et al. 1997).

One approach to position the four strategies and thus also to derive possible strategies for development of service orientation in an organization is the *managed evolution* approach by Murer et al. (2010). The approach has been discussed and practically applied for the management of the global IS architecture at Credit Suisse—a globally operating bank—for more than ten years. Murer et al. describe the development of very large IS (by practically applying service orientation) as an evolution guided by *IT efficiency* and *business value*. We have adopted this view and positioned the four strategies identified in the previous subsection in the resulting portfolio (figure 2). In this conceptualization IT efficiency is primarily supported by the *reuse of services* and *IT operations cost*. Business value is supported by the *fast implementation of business requirements* as well as the respective *development costs*.

Based on this positioning we derive four propositions for the strategies of development of the organizations in a respective cluster.



Cluster 1 organizations (*service orientation as an isolated but business value driven problem solution*)

achieve a high business value but lack a holistic approach. Thus these organizations fail in improving IT efficiency. (P1) The one fruitful development strategy (move from cluster 1 to cluster 4) is to consolidate the isolated projects on service orientation and thus identify and leverage reuse potentials. This might result in a reduced business value since individualization has to be reduced, too. However, such a strategy will significantly improve IT efficiency.

Cluster 2 (*service orientation as a revival of IT organization*) is characterized by a low general IT maturity. Organizations in cluster 2 can neither contribute a significant business value nor leverage IT efficiency. From this situation three development strategies are possible (move from cluster 2 to cluster 1, 3 or 4). However, the direct move to cluster 4 seems not realistic and contradicts the managed evolution approach. The move to cluster 1 also seems unlikely since the actual problem is that IT management is unable to deliver their services. Instead, (P2) moving to cluster 3 seems most likely.

Cluster 3 (*service orientation as enactment*) has a strong strategic support of service orientation as an IT approach and also the IT department has a good standing in the organization. Therefore an obvious development strategy is (P3) to leverage existing maturity to deliver business value by moving to cluster 4. It seems, however, that the top-down approach backed by the hierarchy has to be complemented by a sufficient support from the operational level where the actual services are designed and used to generate value.

Cluster 4 (*service orientation as sustainable growth*) may already represent the result of implementing one of the aforementioned development strategies. Cluster 4 achieves a high IT efficiency and is demanded and supported by business stakeholders. An explicit strategy support is not necessary on this maturity level, since the service oriented design practices resulting in service reuse, cost efficiency, and fast implementation became routine tasks. From the perspective of service orientation the most important goal may be (P4) the preservation of current achievements.

Taking this discussion on a more general level we can see a strong contrast between cluster 1 and cluster 3 organizations. This difference stands out and it is important for understanding the nature of how service orientation gets established in organizations. While organizations in cluster 1 are driven in a *bottom-up* approach by the actual (business) needs of the stakeholders, organizations in cluster 3 establish service orientation in a *top-down* approach by the means of hierarchy. While organizations in cluster 1 address the actual (but often isolated) business needs, these organizations fail to implement service orientation as an infrastructure and thus fail to leverage positive network externalities. Organizations in cluster 3 have the mandate to create such an infrastructure but are lacking the actual alignment with business needs and thus “content” for this infrastructure.

These two perspectives basically represent the *customer demand view* (cluster 1) as it can also be found in other conceptualizations of service orientation like for example the service dominant logic (Vargo and Lusch 2004) and the *supplier production or provision view* (cluster 3) as it is typically found in discussions on infrastructure-like IS (Kumar 2004). The challenge of approaches like service orientation offering fine-grained solutions to specific customers based on a common infrastructure with positive network externalities is, that the consumption of these offerings gets more and more detached from its production which increases typical challenges of IS management. One example may be the calculation of business cases to justify investments in IS infrastructures. Here a (potentially) high number of fine-grained consumption processes representing a value creation need to be translated in investment and operations costs of an IS infrastructure. These translation mechanisms, however, are largely missing today.

Limitations

Two limitations to our research seem to be particularly noteworthy: (1) The low reliability of the factor scales especially of factors 5 and 7 and (2) the limited statements on the effectiveness of the identified instantiations.

(1) The challenge of an exploratory quantitative empirical study is of course having a stable research and measurement model without building on an a priori theory. This challenge becomes apparent in the low values of Cronbach’s Alpha for some factor scales. However, the research at hand in the first step strives for discovering new structures and theories. Therefore we did not exclude the items in question but kept them in our analysis because they finally contribute to an interesting and consistent model which can be

refined in future work.

(2) Although service orientation as a design paradigm is discussed for several years now, practitioner's experience is still in a very early stage (Hirschheim et al. 2010). Therefore we had difficulties to reliably measure the actually achieved success of the organizations in the different clusters. As the accessible empirical basis grows, a more differentiated measurement of the strategies' effectiveness will be possible.

Future Research

The paper at hand explores four situations organizations may face with their service orientation initiative. The paper also proposes different possible development strategies for organizations which help to focus on relevant aspects for an overall improvement in goal achievement of a service orientation initiative. However, we cannot yet prescribe how exactly to achieve these improvements. This could be a contribution of future research or of practical implementation by concerned organizations. The paper at hand provides the conceptual framework for this development.

The reasons for why there are different solutions for the class of design problems analyzed here, can be found in the different configurations of the respective organizations as well as in the different contexts these organizations operate in. However, we could only reconstruct some of these configurations and contexts. Another opportunity for future research is a systematic analysis of these *contextual factors*, e.g. building on contingency theory (Fiedler 1964). Especially in the area of IT governance a lot of research on contingency factors has already been done (Brown and Grant 2005). However, surprisingly little has been researched and published on the role of *organizational culture* in these situations. We consider the fields of IT governance and service orientation strongly related as far as contingency is concerned, since both deal with some kind of standardization of significant parts of an organization and thus with the *restriction of design freedom* of actors within an organization (Dietz 2006; Hoogervorst 2004). We believe that organizational culture has significant explanatory power in these areas (Leidner and Kayworth 2006). Another approach for understanding and prescribing development paths between the identified clusters could for similar reasons build on *institutional theory* (DiMaggio and Powell 1983), since the reasons for belonging to a certain cluster seem to be deeply rooted on the organization's regulative, normative and cultural-cognitive configuration (Scott 2001).

Conclusion

In the study at hand we have extended previous research by providing insight into the design factors of service orientation as an IS engineering approach (RQ1). The study honors the multidimensionality of wicked design problems and rejects the sometimes explicit and often implicit assumption that there is one best solution to a class of design problems. Instead we present four possible solutions including their goal systems and to a limited extend their goal achievements (RQ2). Finally, we consistently integrate these four solutions into four propositions describing strategies to develop service orientation in an organization (RQ3). To the best of our knowledge, this article is the first leaving the level of critical success factor analysis or maturity models of service orientation and starting to explore the deeper structures of service orientation in organizations.

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