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Evolutional and Transformational Configuration Strategies: A Rasch Analysis of IT Providers' Service Management Capability

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Abstract

While providers of information technology (IT) services widely rely on reference models for IT service management (ITSM) practices, little is known about the actual configurations of these practices, referring to the patterns in which service providers adopt these practices at different maturity stages. We analyze how practice configurations reflect a provider's ITSM capability and how this capability contributes to provider performance. This study addresses two gaps in the ITSM literature. First, empirical approaches to measuring a capability that manifests in configurations of ITSM practices and potentially different nonlinear configuration strategies are missing. Second, no theory explaining the resulting performance differences of alternative configuration strategies exists. We analyzed data from 315 IT service providers on the configuration of practices described in the widely regarded ITIL (formerly IT Infrastructure Library) reference model for ITSM. With this data, we conducted a Rasch calibration—a psychometric method for modeling latent traits based on noninterval scaled data—to measure practice maturity thresholds and providers' ITSM capability on the same scale. Further, we regressed this measure of ITSM capability on service provider performance. Our findings contribute to the ITSM literature by uncovering two strategies for configuring ITSM practices with distinct capability scales. Drawing on prior theory, we characterize these as evolutionary and transformational configuration strategies. Service providers in the transformational class obtain higher performance gains from building ITSM capability than those in the evolutionary class. This supports our key argument that underlying practice complementarities are a key source of performance gains.

Keywords: IT Service Management, ITIL, Rasch Model, Capability Maturity

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1 Introduction

As the industrialization of information technology service management (ITSM) pressures service providers toward service excellence and customer orientation (Bardhan et al. 2010), providers in many markets show great interest in reference models that describe generally accepted practices for effective IT service delivery. These good practices typically cover the design of service processes, roles, and functions (see Table A1 for an overview). For example, the ITIL reference model has become highly popular for the management of information technology (IT) services (Cannon et al., 2011).

The promise of such reference models is to help IT service providers build an organizational capability and achieve positive performance outcomes, such as improved service quality and higher customer satisfaction (Dekleva & Drehmer, 1997; Ramasubbu et al., 2008). Some models also specify a corresponding practice configuration strategy—that is, a recommended sequence in which these practices are implemented with certain stages of maturity that must be accomplished in ascending order to improve service performance (see Table A1). For example, CMMI Services predicts two different strategies of either investing in substantial improvements in a few selected practices or in small improvements across a broad range of practices (Huang & Han, 2006). However, advancing the maturity of ITSM practices requires investments in, among other things, documentation, employee training, and management tools (Marrone et al., 2014). Adopting IT management reference models may also produce unintended effects, such as long service implementation times and high implementation costs (Bapna et al., 2016; Harter, Krishnan, & Slaughter, 2000; Ply et al., 2012). Because potential performance gains come at a cost, IT service providers struggle with the question of how to configure their ITSM practices and, hence, where to invest in building ITSM capability (Lema et al., 2015; Shrestha et al., 2015).

Academic research has introduced decision instruments that support the improvement of ITSM practices (Shrestha et al., 2015) and, through case studies, has explored how individual service providers configure their service management practices (see Table A2 for an overview). Prior survey studies on practice configurations and ITSM capability, however, have two important methodological and theoretical constraints. First, the current approaches to the measurement of ITSM capability use simple practice counts (Gacenga, Cater-Steel, & Toleman, 2010; Marrone & Kolbe, 2011) or factor analysis (Iden & Eikebrokk, 2014; Winkler & Wulf, 2019). These approaches are incapable of dealing with the nonlinear nature of how improvements of ITSM capability manifest in the maturities of multiple individual practices (Yamakawa et al., 2012). Second, although the reference model literature (Huang & Han, 2006) and case studies (see Table A2) provide initial indications of different strategies in configuring service management practices, the theoretical underpinnings for such configurational choices are missing. Consequently, prior measurements of ITSM capability simply assume that service management practices are configured homogeneously (i.e., that the maturity stages of all practices are equal to each other) and that an overall ITSM capability determines this configuration in only one uniform way (e.g., Gacenga et al., 2010; Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011).

This research addresses the described gap in our understanding of how the potentially *different* strategies of configuring widely accepted service management practices reflect the development of ITSM capability and it tests the performance implications of this configuration strategy choice. On the conceptual basis of capability reconfiguration theory (Lavie, 2006), we first hypothesize the existence of two alternative configuration classes: *Evolutionary* configurations have some practices in advanced maturity stages and others in initial stages, while, in *transformational* configurations, multiple practices are in similar maturity stages (e.g., initial, moderate, or advanced). Drawing on the notion of service innovation (Barrett et al., 2015; Hertog, 2000), we then hypothesize that transformational configurations exhibit stronger effects on service provider performance because of complementarities between individual service management practices.

To test these propositions, we analyze survey data from 315 IT service providers and apply the Rasch calibration because this method can model a capability based on ordinal and probabilistic items with varying difficulties (Wright, 1996). Rasch measures are widely applied to psychometric assessments in various fields (Eid & Rauber, 2000; Rasch, 1980). Some researchers have begun to argue for the advantages of the Rasch model in business research (Chang & Wu, 2015; Dekleva & Drehmer, 1997; Marx, Wortmann, & Mayer, 2012; Rusch et al., 2017; Salzberger & Sinkovics, 2006) owing to its ability to measure organizational capability with items that reflect concrete firm activities rather than abstracted and self-developed scales.

Our analysis supports the existence of the evolutionary and transformational service provider classes with respect to practice configurations. Further, regression analyses confirm that service providers in the transformational class obtain higher performance gains from building ITSM capability. Addressing calls by Barrett et al. (2015) and Iden and Eikebrokk (2013) for further research on the design of ITSM practices, our results enable a deeper understanding of the performance effects of ITSM capability, which manifests in the adoption of ITSM practices with varying stages of maturity. Specifically, our results suggest that underlying practice complementarities are a key source of performance gains in ITSM. We discuss how our findings more broadly contribute to the current knowledge in service management and we outline practical implications that emanate from this research.

2 Background and Foundations

This section first explains why practices of quasi-normative reference models reflect ITSM capability. Then, it introduces the notion of capability configuration strategies and lays the methodological foundations for employing the Rasch calibration in this research.

2.1 IT Service Management Reference Models, Capability, and Practices

Over time, ITSM has been subject to advancing industrialization (Bardhan et al., 2010; Tallon, 2010). The practices for IT infrastructure management and user support, in their nature of being secondary activities for most firms, have gradually become more isomorphic across industries since the 1980s. For this reason, practice reference models are increasingly gaining attention (Winniford, Conger, & Erickson-Harris, 2009). Reference models describe and generalize the collective experiences of organizations regarding the design of service management processes as quasi-normative practices. Practice descriptions include information about practice attributes, such as activities, goals, monitoring, and roles and responsibilities. Further, reference models often also include a maturity scale and specify to what extent one must fulfill these attributes to achieve a specific stage of practice maturity (see Table A1).

For instance, the ITSM reference model ITIL, which was first published in 1989, includes 26 practices in its current version. ITIL allocates these practices to the life cycle domains service strategy, service design, service transition, and service operation (see Figure 1). ITIL distinguishes five practice maturity stages that are adapted from the widely used CMMI reference model (Dekleva & Drehmer, 1997): initial, repeatable, defined, managed, and optimized (Cannon et al., 2011, vol. 2 pp. 339–344).

Prior literature suggests that an organization's successful implementation of reference model practices is a manifestation of organizational capability (Akhlaghpour & Lapointe, 2018). Levina and Ross (2003, p. 344), for example, found that a company's "long history of methodological development" enabled the company to advance the maturities of reference model practices within a short time. High practice maturity levels signal a service provider's superior ability to deliver high-quality work (Dawson, Watson, & Boudreau, 2010).

The ITSM capability characterizes the service provider's ability to select, contextualize, and coordinate practices that ITSM reference models describe. The configuration in which these practices are adopted reflects the level of ITSM capability. The organizational capability literature discusses three aspects of organizational capability, which we review in the following paragraphs to guide our conceptualization of ITSM capability: (1) capabilities serve to solve complex problems, (2) capabilities require practice and are tied to success, and (3) capabilities are the outcome of an organizational learning process (Schreyögg & Kliesch-Eberl, 2007).

First, organizational capabilities serve organizational problem solving and thus address ambiguous and ill-structured tasks that require decision-making under uncertainty. Solving such complex tasks requires "complex combinations of cognitive and habitual acts" that gather and effectively combine organizational resources (Dosi, Hobday, & Marengo, 2003, p. 170). These habitual acts are often referred to as practices or routines. They present "repetitive, recognizable patterns of interdependent actions, involving multiple actors" (Feldman & Pentland, 2003, p. 95). In contrast to practices, which have limited size and complexity, organizational capability is substantial in scale because it *centrally orchestrates* organizational practices toward solving a complex organizational problem (Winter, 2000).

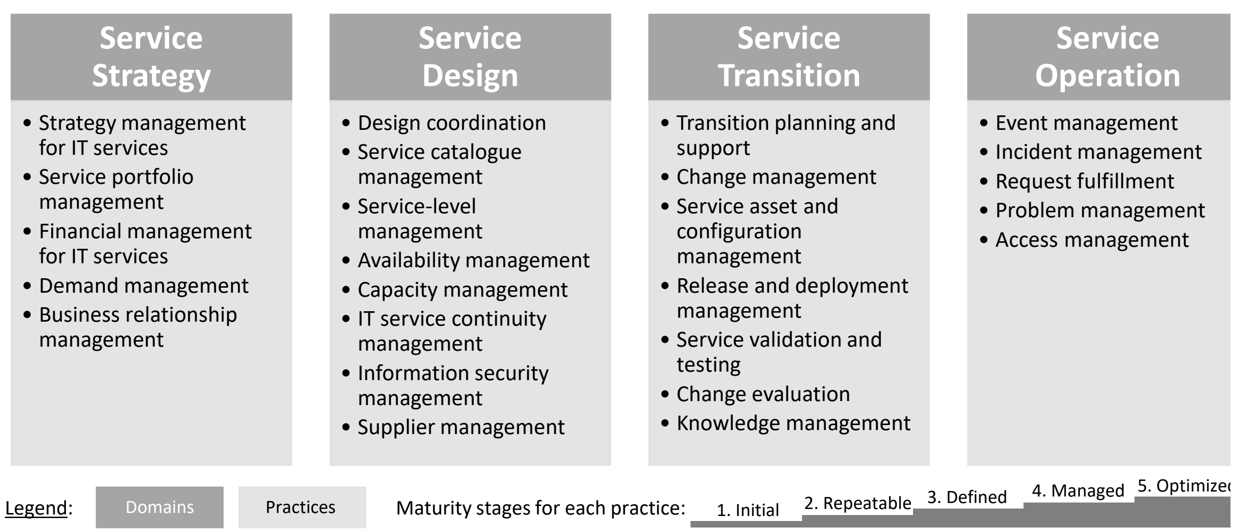


Figure 1. ITIL Service Management Practice Reference Model (Based on Cannon et al., 2011)

Practice reference models provide guidance on how to design individual, quasi-normative practices; however, the development of a capability that addresses a complex business problem requires a deliberate and contextual coordination of the individual practices (Lavie, 2006; Ramasubbu et al., 2008). For IT service providers, the provisioning of customer-oriented IT services in accordance with business process needs is an example of an ill-structured task (Jia, Reich, & Pearson, 2008; Winniford et al., 2009). The large number of interdependent practices in ITSM practice reference models reflects the complexity of this task. Adopting and orchestrating ITSM practices under consideration of the specific application context represent a major challenge for IT service providers (Shrestha et al., 2015). Isolated improvements of practice maturities likely fail to generate the intended performance effects if organizations do not carefully consider how the resulting system of practices contributes to customer orientation and business process needs. For example, advancing the maturity of the ITSM problem management practice will not improve IT service quality if operational incidents cannot be detected in a timely and reliable manner and if the business impact of the incidents cannot be assessed (Cannon et al., 2011, vol. 4 p. 109).

Second, organizational capabilities require successful practice and must produce recognized and appreciated performance outcomes that are significant to an organization's prosperity (Winter, 2000). Practices, in contrast, may individually have little significance for organizational performance (Winter, 2000). A capability is inherently *goal-oriented* because it is bound to the repeatable and successful mastering of a problem situation (Schreyögg & Kliesch-Eberl, 2007). Establishing an IT capability that manifests in high maturities of IT management practices results in improved output quality, reduced efforts (Harter et al., 2000), higher revenues (Bapna et al., 2016), and increased shareholder value (Filbeck, Swinarski, & Zhao, 2013). A well-developed ITSM capability, in particular, leads to a high IT service performance outcome (Iden & Eikebrokk, 2013; Marrone & Kolbe, 2011), which can be reflected in service quality, customer satisfaction, and business process effectiveness, among others (Chang & King, 2005; Fitoussi & Gurbaxani, 2012). Adopting quasi-normative ITSM practices are coordinated centrally toward a common goal, the improvement of the performance of the IT service provider. Advancing the maturity of individual practices in an isolated fashion without assessing the effect on IT service performance may prove unproductive (Patnayakuni & Ruppel, 2006). For example, a high maturity stage of the ITSM change management practice entails formalized change procedures which, in isolation, may negatively affect performance outcomes, such as a service customer's need for responsiveness (Ruiz et al., 2018).

Third, the development of a reliable "problem-solving architecture composed of a complex set of approved linking or combining rules" is the outcome of an *organizational learning process*, in which this architecture gradually develops over time (Schreyögg & Kliesch-Eberl, 2007, p. 915). Organizational learning implies that one develops successful solutions to a complex problem through selecting and linking resources that proved successful and reproducible across various situations. The improvement of practices is caused by a coordinated variation of actions that may increase the organizational capability to solve a particular business problem and the actors' reflection about action-outcome relationships (Prashantham & Floyd, 2012; Zollo & Winter, 2002). The outcome of organizational learning processes that improve an organizational capability is manifested in stable organizational practices (Huber, 1991). Regarding practice reference models such as ITIL, organizational learning refers to contextualizing and institutionalizing the described quasi-normative practices in a centrally coordinated manner (Kishore, Swinarski, Jackson, & Rao, 2012; Ramasubbu et al., 2008). Contextualizing indicates the tailoring of practices to organization-specific goals and environments. Institutionalizing refers to the diffusion of contextualized practices within the organization. Practice diffusion is a longer-lasting process that involves multilayered organizational interests (Akhlaghpour & Lapointe, 2018). Contextualizing and institutionalizing ITSM practices pose significant challenges to organizations and prove successful only if a coordination toward the overarching goal, the improvement of service provider performance, is secured (Iden & Eikebrokk, 2013).

Combining these three characteristics of an organizational capability, we define ITSM capability as the *ability of an IT organization to provide high-performance IT services, which is characterized by contextualizing and institutionalizing ITSM practices in a centrally coordinated manner and deliberately orchestrating ITSM practices*. The level of ITSM capability denotes the progress of organizational learning geared toward improving service provider performance and is reflected by the maturities of institutionalized quasi-normative ITSM practices.

2.2 Capability Configuration Strategies and Research Gap

The coordinated adoption of multiple practices, which comprises contextualizing and institutionalizing activities, may follow archetypical patterns in terms of the sequence in which and the extent to which these practices are implemented (Dekleva & Drehmer, 1997). In this paper, we use the term configuration to refer to the pattern in which a service provider adopts these practices, which also reflects ITSM capability. We use the term configuration strategy to refer to the approach to the improvement of ITSM capability that manifests in the sequence in which service providers advance from one configuration to the next higher configuration.

The reference model literature and case research on practice configurations provide initial indications that there may be more than just one capability configuration strategy. For example, the CMMI Services reference model discusses two alternative approaches: continuous and staged representation (see Table A1). The continuous representation is an advancement of ITSM capability that causes improvements in one or a few targeted practices. The staged representation describes advancements of ITSM capability that result in maturing many practices (Huang & Han, 2006).

Case research similarly provides some indications of the existence of different archetypical practice configurations in service management. The sequence of initially adopted service management practices has been found to vary because some service providers focus on selected operational practices, while others tackle operational and tactical practices concurrently (see Table A2). Therefore, there are grounds to hypothesize that there is more than one configuration strategy.

Consequently, when measuring the overall ITSM capability that manifests in a certain configuration of service management practices, one may need to consider different classes of service providers with different capability scales. The capability improvement of some service providers may result in a focused maturing of isolated practices, while the capability improvement of others may result in a broad maturing of multiple practices. Against this background, Iden and Eikebrokk (2013, p. 520) called for studies that “address strategies for implementation and companies’ priorities when they are selecting processes for implementation.” However, apart from the initial indications for the existence of different archetypical practice configuration strategies, research designed to hypothesize and unveil these different strategies is lacking.

Employing measurement approaches that are incapable of dealing with the nonlinear nature of the sequence in which service providers configure ITSM practices has constrained prior empirical research on ITSM capability. The measurement of ITSM capability levels is nonlinear because a maturity increase in a specific practice may reflect the achievement of a capability level, while a further improvement above this capability level does not manifest in an additional maturity increase of the same practice. Such a nonlinear sequencing of practice maturities is essentially what practice maturity models for service management suggest by describing a phased approach (staged representation) to advancing practice maturities (Huang & Han, 2006).

There are several pieces of empirical evidence suggesting a nonlinear relationship between ITSM capability and the maturity stages of ITSM practices (see Table A2). For example, four Peruvian firms in the financial sector used a staged approach to ITIL implementation (Yamakawa et al., 2012). At an initial stage, the companies focused on raising selected service support and service delivery practices (incident management, change management, service desk, and service level management) to maturity level three. In a second phase, they included more practices in their practice improvement initiative (Yamakawa et al., 2012).

Despite the nonlinear nature of ITSM maturity stages, prior quantitative empirical studies on implementing ITSM practices have simply assumed a linear relationship between the overall implementation progress and the observed maturities of the individual practices. Some studies have used simple practice counts as a measure for the implementation progress (Gacenga et al., 2010; Marrone & Kolbe, 2011). Other studies use factor analysis approaches (Iden & Eikebrokk, 2014; Winkler & Wulf, 2019). In summary, a gap exists in how to measure the ITSM capability that manifests in configurations of practice maturities and nonlinear configuration strategies.

2.3 Measurement Alternative: Rasch Calibration

Comparable to confirmatory factor analysis (CFA), Rasch models draw inferences about a continuous latent trait (e.g., ITSM capability) based on manifest indicators (e.g., maturity stages of service management practices). However, while commonly used for psychometric measurement in empirical economics research, CFA has three substantial shortcomings (Rusch et al., 2017), as summarized in Table 1.

First, CFA treats Likert-type scales as metric scales with equal distance between assigned numerals. For the case of measuring ITSM capability that manifests in practice maturities, prior research suggests that maturity stages for individual practices are not equidistant (see Table A2). For example, a service provider may advance the maturity of a single service management practice (e.g., service demand management) above the initial maturity stage only at an advanced overall level of ITSM capability. At an advanced capability level, however, the provider may tackle multiple maturity stages of this individual practice simultaneously.

Table 1. Comparison of Confirmatory Factor Analysis and Rasch Calibration for Measuring Service Management Capability (based on Rusch et al., 2017)

Criteria	Confirmatory Factor Analysis	Rasch Calibration	Applicability for measuring ITSM capability (see Table A2)
Scale level of items	Metric: equal distance between numerals on a Likert-type scale	Categorical or ordinal: categorical items or unequal distance between numerals on a scale	Practice maturity stages are not equidistant on a difficulty scale because the effort required to advance to a maturity stage depends on the present stage
Model type	Linear relationship between latent and observed scores	Nonlinear relationship between latent and observed scores	The development of ITSM capability manifests in nonlinearly adopting practices because configuration strategies may follow a staged logic
Invariance of item statistics	Item weights are sample dependent	Item statistics reflect the Rasch model requirement for local independence; sample homogeneity is tested	Multiple service provider classes may differ in how the overall ITSM capability manifests in practice configurations

Second, CFA assumes a linear relationship between the latent trait and multiple observed practice maturity indicators (Rusch et al., 2017). Case evidence suggests, however, that nonlinear practice configuration strategies reflect the development of ITSM capability (see Table A2). For example, a service provider may advance selected practices (e.g., incident management) to high maturity stages already at low overall ITSM capability levels, while it tackles other practices (e.g., continual service improvement) at only advanced ITSM capability levels (Lema et al., 2015). Third, CFA assumes that the latent factor score is determined by weighted sums of the individual items and that the calculation of item weights is dependent on the sample (Rusch et al., 2017). Moreover, CFA does not require and test for factor score homogeneity across subsamples and thus is unable to uncover subsample heterogeneity. In ITSM, however, the literature indicates that there may be multiple service provider classes that differ in how practice configurations reflect ITSM capability (see Table A2).

The Rasch model is an alternative approach to measurement that is frequently used to infer a latent organizational capability reflected in configurations of measurable organizational practices based on cross-sectional data (e.g., Chang & Wu, 2015; Dekleva & Drehmer, 1997; Marx et al., 2012; Rusch et al., 2017; Vrontis, Thrassou, & Lamprianou, 2009). The Rasch model addresses the above three shortcomings (Table 1) as follows (Rusch et al., 2017). First, in contrast to CFA, the Rasch model for partial credit scoring (the partial credit model) uses an adjacent-category logit model to infer a continuous scale from ordinal levels and thus applies to ordinal (i.e., nonmetric) measurement items with ordered levels (Masters, 1982). Chang and Wu (2015), for example, have used the partial credit model to measure the difficulties of ordinal scale items required to achieve the Authorized Economic Operator certification based on an empirical analysis of supply chain-related companies. Second, the Rasch model performs a probabilistic analysis of response behavior and thus does not presume linearity between the latent trait and observed indicators. Dekleva and Drehmer (1997), for example, have used the Rasch model to generate a measure of software engineering evolution that assesses the nonlinear implementation sequence of key software practices via maximum likelihood estimation (Masters, 1982; Wright & Masters, 1982). Third, the Rasch model requires and tests for local independence. That is, the interdependency between the observations of different items must solely be due to the subject's location on the latent trait and must not be due to further subject characteristics (Masters, 1982; Rusch et al., 2017). For example, Kenett and Salini (2011) have employed the Andersen likelihood ratio statistic (Andersen, 1973) that compares subgroup calibrations to test the assumption that the estimates for difficulty parameters of six customer satisfaction dimensions are independent of the underlying sample.

An extension of the partial credit model, the mixed Rasch model for polytomous data, allows for scenarios in which a specific partial credit model only holds for respondents in one out of multiple respondent classes. The mixed Rasch model separates the entities into a number of classes defined a priori (Rost, 1991). Mixed Rasch models can be applied to conduct exploratory analyses that uncover and characterize multiple latent classes (Maij-de Meij, Kelderman, & van der Flier, 2008). Eid and Rauber (2000), for example, have used the mixed Rasch model to detect the existence of two different response styles in organizational surveys. This research employs the mixed Rasch model for polytomous data on cross-sectional data from IT service providers to address the shortcomings of prior research in measuring ITSM capability.

3 Hypothesis Development

3.1 Configuration Strategies of Service Management Capability

We draw on capability reconfiguration theory to characterize and hypothesize the existence of two alternative configuration strategies (Lavie, 2006; Zollo & Winter, 2002). Capability reconfiguration theory conceptualizes a firm's reconfiguration of capabilities in reaction to changing market conditions as organizational learning based on existing resource endowments (Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997). Lavie (2006) has distinguished two different approaches to the reconfiguration of organizational practices: an evolutionary and a transformational approach.

In the *evolutionary approach*, the scope of reconfiguration is limited to a small set of practices. Learning is accomplished experimentally through trial and error and the selection and retention of successfully adapted practices (Gavetti & Levinthal, 2000). Capability evolution depends on endogenous processes of internal learning, in which managerial cognition and organizational inertia determine the capability dynamics (Tripsas & Gavetti, 2000). Practice experimentation is alternated with "offline-deliberation and analysis" (Winter, 2000, p. 985), in the course of which the outcomes of practice variation are evaluated with respect to superordinate performance effects. Owing to the internal focus in capability evolution, there is a strong path dependence on existing practice configurations; however, practice-level experimentation may result in capability improvement if supplemented with deliberate cognitive steering processes (Zollo & Winter, 2002).

In contrast to capability evolution, the scope of the *transformational approach* covers a broad range of practices that represent manifestations of a particular capability. Here, organizational learning consists of the novel combination of prior knowledge and the external acquisition of knowledge and skills. Capability improvement is rooted in a synchronized directed acquisition and modification of multiple practices, and it is informed by internal and external sources of learning (such as reference models) (Lavie, 2006). Because capability transformation involves fundamental changes in the organization's core knowledge, it entails step-function learning rather than incremental improvements (Helfat & Raubitschek, 2000).

While prior research addressed the adoption of IT management reference models from a diffusion of innovation perspective to explain *why* organizations adopt such reference models (Akhlaghpour & Lapointe, 2018), scant research exists on *how* organizational capabilities manifest in contextualizing and institutionalizing IT management reference models. Building on this notion of evolutionary and transformational configuration strategies, we hypothesize a distinction between two classes of IT service providers. In both classes, achieving certain maturity stages for each practice reflects the level of ITSM capability; hence, the capability level is expressed in terms of the difficulty in achieving these practice maturity stages. However, we expect the two classes to exhibit distinct scales for measuring this ITSM capability, as stylized in Figure 2. Service providers in the evolutionary class raise a few existing practices to advanced maturity stages to achieve a certain overall capability, while other practices do not exist or are only beginning to be implemented. Service providers in the transformational class, in contrast, simultaneously raise the maturity stages of all (or a broad range of) practices to achieve a certain level of overall capability.

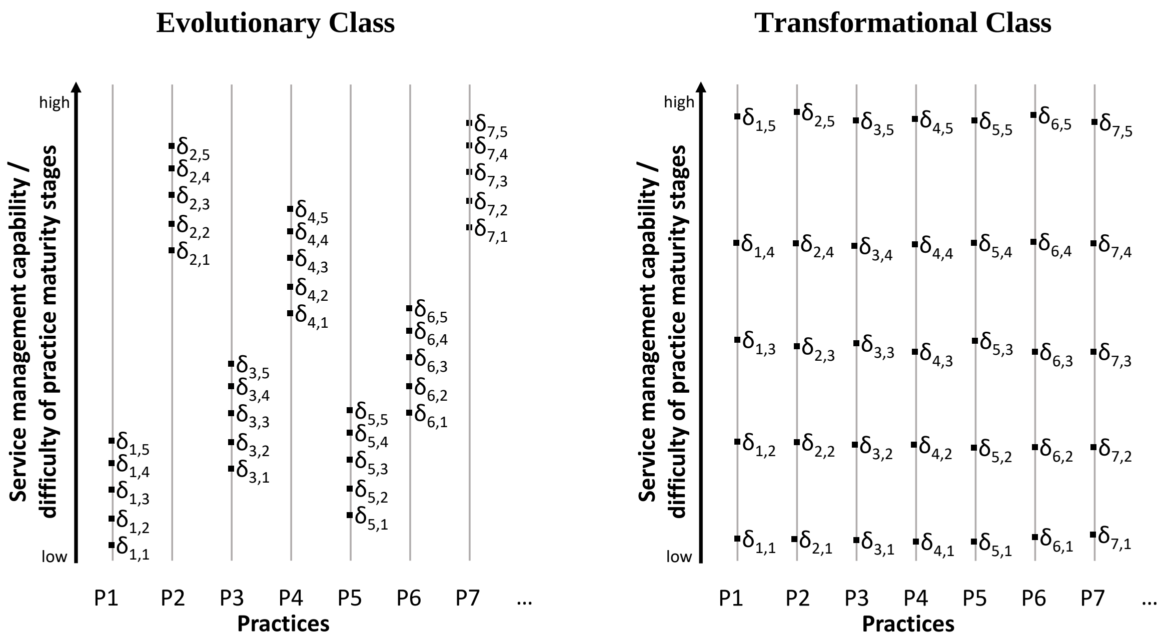
If we assume that we can measure and express the overall level of ITSM capability at which a service provider advances the practice *i* from maturity stage *j*-1 to *j* as a threshold location parameter $\delta_{i,j}$ (see Figure 2, here with $j_{max} = 5$ stages), then we can analytically hypothesize differences between the scales of ITSM capability in the two classes of practice configuration. First, on the scale in the evolutionary class, the threshold location parameters (simply called thresholds herein) for any maturity stage *j* will exhibit a greater variance compared to the transformational class. Second, the ITSM capability scale in the evolutionary class will exhibit higher threshold means for low practice maturity stages (e.g., Stages 1 and 2) and lower threshold means for high maturity stages (e.g., Stages 4 and 5), while the scale in the transformational class will exhibit lower threshold means for low maturity stages and higher threshold means for high maturity stages. Following our theoretical argument and the stylized representation of the two classes, we posit the following research hypothesis, which we will test using three subhypotheses.

H1: An IT service provider falls into one of two archetypical classes with respect to developing ITSM capability: the evolutionary or transformational class.

H1a (archetype existence): An IT service provider falls into one of two mutually exclusive classes with distinct scales for ITSM capability.

H1b (threshold variance): The scale for ITSM capability in the evolutionary class exhibits a greater threshold variance for any maturity stage than the scale in the transformational class.

H1c (threshold means): The scale for ITSM capability in the evolutionary class exhibits higher threshold means for low practice maturity stages and lower threshold means for high practice maturity stages than the scale in the transformational class.



Note: $\delta_{i,j}$ = threshold between maturity stages *j*-1 and *j* of practice *i*.

Figure 2. Stylized Scales for Service Management Capability Reflected by Practice Configurations (Authors' Representation)

3.2 Performance Effects of IT Service Management Capability

The ITSM literature conceptualizes IT service provider performance as *positive outcomes achieved by the IT service provider from developing ITSM capability*, and it discusses five performance dimensions: service efficiency, service quality, customer satisfaction, business process effectiveness, and strategic effectiveness (Iden & Eikebrokk, 2013). Capabilities are bound to performance outcomes because they are inherently goal-oriented (Schreyögg & Kliesch-Eberl, 2007). Increased ITSM capability causes improvement in performance through service innovation (Iden & Eikebrokk, 2013; Lusch & Nambisan, 2015; Miles, 2008). The improvement of ITSM capability leads to a novel or improved design of services in four interrelated service dimensions: service concept, client interface, service delivery system, and technology (Barrett et al., 2015; Hertog, 2000). (Figure A1 provides an illustration of how a coordinated configuration of service management practices corresponds to service innovations in the four service dimensions.)

The *service concept* describes the approach to organizing a solution to a customer problem. The ITIL service portfolio management practice, for example, is concerned with assessing, incorporating, and communicating the value propositions of new services (Cannon et al., 2011, vol. 1 pp. 170–199). The *client interface* refers to the design of technology-mediated interactions with customers. An associated ITIL practice, incident management, deals with designing and improving the procedures for customer communication and detecting and resolving service incidents (Cannon et al., 2011, vol. 4, pp. 72–86). The *service delivery system* describes the inter- and intraorganizational arrangements, which regulate how actors involved in service production interact and perform their tasks. The ITIL service-level management practice facilitates the definition and monitoring of service levels and provides a reliable communication channel for service-related issues at the tactical and strategic levels (Cannon et al., 2011, vol. 2 pp. 106–125). *Service technology* describes the application and design of IT in service provisioning. An associated ITIL practice, capacity management, monitors the current capacity and estimates the future capacity needs to ensure sufficient levels of capacity and performance in a cost-effective manner (Cannon et al., 2011, vol. 2 pp. 157–179).

Despite the increasing use of ITSM practice reference models (Winniford et al., 2009), scarce research exists on how such reference models affect the performance of a service provider. We argue that improvements in ITSM capability, manifested in changed configurations of service management practices, correspond to service innovation in the described service dimensions. Service innovation, in turn, positively affects the performance of a service provider (Iden & Eikebrokk, 2013; Lusch & Nambisan, 2015).

The ITSM literature provides some empirical evidence for a relationship between ITSM practice implementation progress and service provider performance. For instance, Marrone and Kolbe (2011) found significant correlations of the perceived service management maturity with the following benefits: service quality, call fixed rate, and financial contributions. Gacenga et al. (2010) identified the following key benefits of implementing service management practices: improved quality of business operations, customer relationships, and business process support and higher efficiency and adaptability. Based on the argument that improvements in ITSM capability correspond to service innovation, we posit the following hypothesis:

H2: ITSM capability is positively associated with service provider performance.

3.3 The Moderating Role of Practice Configuration Strategies

Prior research on the influence of ITSM capability does not distinguish different classes of service providers with respect to their practice configuration strategies (e.g., Gacenga et al., 2010; Marrone & Kolbe, 2011). Anecdotal evidence, however, indicates that the approach toward configuring service management practices matters because it may influence performance outcomes. Poorly configured practices, for example, may primarily generate documentation overhead, communication overload, and disproportional implementation costs (Lema et al., 2015; Shrestha et al., 2015).

We draw on the service innovation literature (Barrett et al., 2015; Hertog, 2000; Miles, 2008) to theorize why the practice configuration strategy plays a moderating role in the capability-performance relationship. In the service innovation model, Hertog (2000) considered complementarity to be the main source of service innovation, owing to the concurrency of service production and delivery. Service innovations are often initiated by the modification of a dominant feature within four dimensions of service innovation (service concept, client interface, service delivery system, and service technology). To generate a successful service innovation, this modification triggers changes in other dimensions (Barrett et al., 2015; Miles, 2008). Thus, complementarities between the dimensions represent stronger sources of service innovation than isolated modifications (Barrett et al., 2015; Hertog, 2000). Service management reference models put a considerable focus on specifying practice interdependencies (Cannon et al., 2011). For example, raising the service level management practice to advanced maturity stages has limited effects when service portfolio management, capacity management, or incident management practices provide unreliable internal interfaces (see Figure A1). Owing to the complementarity of practices, advancing the maturities of interrelated practices leads to superadditive effects. We can interpret superior ITSM capability in the transformational class of service providers as having followed deliberate paths in the design of the interrelated dimensions of service innovation. In contrast, one can interpret superior performance in the evolutionary class of service providers as the result of having selectively advanced practice maturities without leveraging practice complementarities. Following this argument, we posit the following:

H3: ITSM capability has a stronger influence on service provider performance in the transformational class than in the evolutionary class.

4 Methodology

To test our research hypotheses, we draw on survey data from informants representing 315 IT service provider organizations. We conducted a Rasch calibration for modeling ITSM capability and performed regression analyses. Our choice for Rasch calibration was motivated by the suitability of this method to provide a measure based on nonmetric indicators that can have nonlinear relationships with a latent trait, and by the ability of the method to validate sample homogeneity (see Table 1).

4.1 Construct Operationalization and Survey Instrument

To provide a reflective measure of *ITSM capability* (*ITSMCapability*), we operationalized the maturity stages of the 26 common service management practices based on the nomenclature and process descriptions of the widely used ITIL reference model (Cannon et al., 2011). We measured the maturity stage of each practice on a multi-attributive ordinal scale using the six CMMI-based maturity stages (0: none, 1: initial, 2: repeatable, 3: defined, 4: managed, and 5: optimized), where each stage is detailed with specific descriptors (see Table A3)[1].

The *service provider performance* construct (*Perform*) used items identified by the empirical literature on service management outcomes: service provider efficiency, service quality, support of client business processes, user satisfaction, and effectiveness in supporting strategic business goals (Gacenga et al.,

[1] The paper by Wulf, Winkler, and Brenner (2015) reports on the development and validation of the multi-attributive practice maturity scale.

2010; Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011). These items match earlier conceptualizations of IT service function performance (Chang & King, 2005). Survey respondents rated these items compared to other service providers (with the scale endpoints *far below average* and *far above average*).

We further included three potential industry-level and two organization-level confounders. Regarding the industry level, industry differences may influence implementing ITSM reference models (Marrone et al., 2014). To control for industry influence, we included *service orientation*, *degree of regulation*, and *market uncertainty*.

We measured *service orientation* along a continuum between manufacturing and service firms with two items following an approach by Winkler and Brown (2013). The IT service providers for service-oriented firms may exhibit a higher performance than those for manufacturing firms. This is because a service-oriented customer focus, compared to a product focus, may involve a higher value cocreation between the IT service provider and IT service customers within the firm (Bardhan et al., 2010; Tallon, 2010).

We measured the *degree of regulation* with two self-developed items that capture the exposure to statutory requirements and other requirements (e.g., industry standards). A high exposure may tie up a large share of IT resources (de Vaujany et al., 2018). These IT resources could otherwise contribute to IT service improvement initiatives.

We operationalized *market uncertainty* with systematic factors for credit risk calculated at the industry level by Schwaab, Koopman, and Lucas (2017), who characterized the volatility of firm assets in different industries. Market uncertainty may affect IT service provider performance because firms in stable markets partially require other IT capabilities than those required by firms in volatile markets (Tallon, 2008).

An important organization-level variable that can influence implementing service management reference models is *organization size* (Iden & Eikebrokk, 2013; Marrone et al., 2014). Organization size may also influence IT service provider performance because larger firms may possess richer IT resources and may be able to generate higher economies of scale (Bharadwaj, Bharadwaj, & Konsynski, 1999). We controlled for organization size using two log-transformed measures that capture the number of employees for both the service provider and customer organization.

A second potential organization-level confounder is whether the *service provider type* is internal, shared, or external. Whether or not IT services are internal or outsourced (the shared type is often also characterized as "internal outsourcing," i.e., as a hybrid) can influence the effectiveness and efficiency of IT service provisioning (Han & Mithas, 2013; Williams & Karahanna, 2013).

To control for potential common rater effects owing to the job roles of the respondents, we included the *management level* (executive, senior management, management, or staff level) and the rater's *horizontal position* (customer or IT service provider) as additional respondent-level controls (Burton-Jones, 2009; Podsakoff et al., 2003). We describe operationalizing the study variables in Table A4 (see Appendix).

We provided the survey instrument (presented in Table A5) online in English and German and performed several iterative steps to ensure the validity, reliability, and language consistency in the survey. These included interviews with three service management consultants, a focus group workshop with three experts at a service management audit firm that focused on the survey instrument's face validity from a respondent perspective, and a pretest with 23 practitioners and service management researchers. These iterations helped us refine our research instrument and the feedback received supported its fit for purpose.

4.2 Data Collection

The data used in this research were collected in the course of a survey of ITSM professionals at internal and independent external providers of IT services. Invitations to the survey were distributed via mailing the regional chapters of the ITSM Forum (itSMF) in Germany, Denmark, and Switzerland in late 2013 and 2014.[2] The approximately 6,000 recipients qualified as subject matter experts because the itSMF is an independent professional association dedicated to ITSM practitioners and supports knowledge exchange among its members. To ensure a sufficient rater expertise level on service management practices, we filtered out the raters who stated they had no qualification certifications and, out of the 362 responses, used the 315 responses from participants with an ITIL qualification of at least the foundation level (foundation 51%, intermediate 19%, and expert 30%).[3] Participants reported an average of 5.2 years of work experience at their affiliated organizations. Of all service provider organizations, 58% were internal service providers, 25% were shared service providers, and 17% were external service providers with a median size of 120 employees (mean: 1,645). We report the detailed descriptive statistics in Table A6.

[2] The paper by Wulf et al. (2015) provides detailed information on the data collection approach.

[3] The ITIL qualifications include four levels: foundation, intermediate, expert, and master.

4.3 Psychometric Properties of Reflective Measurement Items and Method Bias Assessment

We initially checked for the dimensionality of the reflective measurements through an exploratory factor analysis (EFA) with varimax rotation and an eigenvalue greater than 1, which produced the expected four factors (i.e., *service provider performance*, *service orientation*, *degree of regulation*, and *organization size*). We then conducted a CFA and followed the procedure by Hair et al. (2017, p. 122) for evaluating reflective measurement models. The values for composite reliability (CR > 0.7) and for Cronbach's alpha (α > 0.7) assert the internal consistency. The value for average variance extracted (AVE > 0.5) confirms the convergent validity. We retained all factors (factor loadings ≥ 0.555, provided in Table A7) because CR and AVE are above the suggested thresholds. Regarding the discriminant validity, we calculated the heterotrait-monotrait ratios for all correlations (see Table A8). Because all heterotrait-monotrait ratios are far below the conservative threshold of 0.85 (Henseler, Ringle, & Sarstedt, 2015), they assert the discriminant validity, as does the Fornell-Larcker criterion because construct-to-construct correlations are below the square root of AVE (see Table A8).

We took several precautions in the survey design to avoid potential method biases (Burton-Jones, 2009; Podsakoff et al., 2003). First, we guaranteed the respondents' anonymity. Second, we separated predictor and criterion variables in our survey design by distributing them over multiple survey pages and used explanatory text to ensure correct understanding. Third, we also used different scales to measure predictor and criterion variables. Fourth, we carefully constructed the items and sought to reduce cognitive load by drawing on the widely known ITIL practice descriptions for service management (Cannon et al., 2011). Finally, we provided incentives for respondents to provide reliable ratings by offering practically relevant benchmark scores at the end of the survey using a prediction-technique proposed by Winkler et al. (2015).

To compare provider and customer perspectives, we use service provider performance (*Perform*) ratings that matched pairs of respondents at 22 organizations from the original sample provided. For these matched pairs, the interrater agreement score (median score: 0.96, James, Demaree, & Wolf, 1993) and the *T*-index (0.67, Tinsley & Weiss, 2000) both suggest acceptable interrater agreement between customer and provider representatives.

Moreover, we performed reliability checks post hoc to detect potential method biases. As a statistical check, we first used Harman's one-factor test (MacKenzie, Podsakoff, & Podsakoff, 2011; Podsakoff & Organ, 1986). The first factor of an EFA of all model indicators accounts for 33.4% of the total variance, which is well under the suggested critical threshold of 50% (Podsakoff & Organ, 1986). Thus, the Harman's test provided no evidence of substantial bias owing to the method. We included the individual-level control variable management level and position to control for potential contamination owing to common rater effects (Podsakoff et al., 2003; Spector & Brannick, 2011).

5 Rasch Calibration and Regression Analyses

5.1 Mixed Rasch Calibration and Tests for Structural Class Differences

We first formalize our model before presenting the results of the mixed Rasch calibration and hypotheses tests. The Rasch model for partial credit scoring (partial credit model) is a unidimensional latent trait model for ordinal items that includes two or more ordered categories (Masters, 1982), such as the six practice maturity stages in our study. The capability location parameter β_n captures the capability level of service provider *n*, our latent trait. The variable $\pi_{x,n,i}$ is the probability for provider *n* of configuring a practice *i* to stage *x* with the stages $x = 0$ to 5 and $\sum_{x=0}^{5} \pi_{\mathrm{x,n,i}} = 1$. The threshold location parameter $\delta_{i,j}$ describes the difficulty of mastering the step from the practice maturity stage *j*-1 to stage *j* at practice *i*.

Following the partial credit model approach, we define a threshold probability $\varphi_{j,n,i}$, that is, the probability of mastering a step between practice maturity stages *j*-1 and *j* at practice *i* for a service provider *n* as an exponential function of the distance between a service provider's capability location parameter β_n and a threshold location parameter $\delta_{i,j}$ (Masters, 1982):

$$\varphi_{\mathrm{j,n,i}} = \frac{\pi_{\mathrm{j,n,i}}}{\pi_{\mathrm{j-1,n,i}} + \pi_{\mathrm{j,n,i}}} = \frac{\exp\,(\beta_n - \delta_{i,j})}{1 + \exp\,(\beta_n - \delta_{i,j})}, \qquad (1)$$

The threshold probability takes on the value $\varphi_{j,n,i} = 0.5$ if and only if the threshold location parameter $\delta_{i,j}$ is equal to the service provider's capability location parameter β_n. The more $\delta_{i,j}$ increases above (or decreases below) the level of β_n, the smaller (or higher) the threshold probability $\varphi_{j,n,i}$. We formulate the probability of a service provider *n* of configuring practice *i* to maturity stage *x*, $\pi_{x,n,i}$, as follows (Masters, 1982):

$$\pi_{\mathrm{x,n,i}} = \frac{\exp \sum_{j=0}^{x} \left(\beta_n - \delta_{i,j}\right)}{\sum_{k=0}^{5} \exp \sum_{j=0}^{k} \left(\beta_n - \delta_{i,j}\right)}, \qquad (2)$$
$$j = 0,1, \ldots 5 \; and \; \sum_{j=0}^{0} \left(\beta_n - \delta_{i,j}\right) = 0.,$$

An extension of the partial credit model, the mixed Rasch model (MRM) for polytomous data, incorporates a latent class analysis and allows us to analyze samples for heterogeneity, that is, for the existence of multiple latent classes (Rost, 1991). To approach our hypothesis test on the existence of evolutionary and transformational classes of service providers (H1), we use the MRM approach to separate the service providers into a predefined number *G* of classes and estimate the relative class sizes υ_g, group-specific threshold location parameters $\delta_{i,j,g}$, and group-specific capability levels of the service providers $\beta_{n,g}$. Following the MRM approach, we model the probability of mastering maturity stage *x* at practice *i* for service provider *n*, $\pi_{x,n,i}$, as follows (Rost, 1991):

$$\pi_{x,n,i} = \sum_{g=1}^{G} \upsilon_g \frac{\exp \sum_{j=0}^{x}(\beta_{n,g} - \delta_{i,j,g})}{\sum_{k=0}^{m} \exp \sum_{j=0}^{k}(\beta_{n,g} - \delta_{i,j,g})}, \quad x = 0,1, \ldots m \, , \sum_{j=0}^{0}(\beta_n - \delta_{i,j,g}) = 0 \; and \; \sum_{g=1}^{G} \upsilon_g = 1., \tag{3}$$

We used the maximum likelihood estimation to fit the above model with Winmira software (von Davier, 1997b). Table 2 presents the results of the comparison of solutions with a number of classes *G* between 1 and 5. Following Maij-de Meij et al. (2008), we used Schwartz's best information criterion (BIC) to identify the optimal number of classes, which has a minimum of two classes; hence, the results yield an optimal two-class solution.

The iterative elimination of nonfitting items suggested for partial credit models (Rost & von Davier, 1994) reached stability after four item-elimination rounds, with four ITSM capability items excluded: financial management (ITSM3), security management (ITSM12), knowledge management (ITSM20), and request fulfillment (ITSM23). These items did not reliably measure our latent trait (i.e., ITSM capability), and therefore we removed them (Rost & von Davier, 1994). Based on the remaining 22 items, the resulting MRM (with a probability higher than 0.85) allocated 89% (279) of the service providers to either of the two classes.

The Rasch calibration procedure requires the confirmation of preconditions by testing for item fit with the *Q*-index (Rost & von Davier, 1994; Wright et al., 1994), entity homogeneity with Andersen's (1971) likelihood ratio (LR) test, and item homogeneity with the Martin-Löf test (Christensen et al., 2002; for test descriptions see Table A10). A standard approach to assess model fit uses parametric bootstrapping to re-simulate artificial datasets and to produce approximations of an unknown distribution of a goodness-of-fit statistic (von Davier, 1997a). For the homogeneity and goodness-of-fit tests, we fitted and analyzed the two classes individually and excluded the remaining 11% (36) of unclearly assigned service providers with class membership probabilities below 0.85, retaining only the 279 service providers in the sample with class membership probabilities above 0.85 ($n1 = 197$; $n2 = 82$). We then selected the main potential contingencies for ITIL implementation, service orientation, organization size, and region (Marrone et al., 2014) and used these to conduct Andersen LR tests for subgroup differences. We also carried out Martin-Löf tests (with 100 random splits). We implemented the Andersen LR and Martin-Löf tests with the extended Rasch modeling package in *R* (Mair, Hatzinger, & Rusch, 2007).

The tests indicated no significant differences among subgroups and thus asserted that our data are calibratable with the Rasch model. The parametric bootstrap approximations to the Pearson chi-squared goodness-of-fit measure with 500 simulated datasets did not reject our model at a significance level of $p < 0.05$. Thus, the analysis supports H1a: Service providers fall into one of two mutually exclusive classes with distinct scales for ITSM capability. We report all test results in Table 3. Figure 3 displays the two class thresholds. Their structures resemble the scales we stylized in the hypothesis development (Figure 1). On the evolutionary scale (Class 1), the different thresholds that belong to the same practice are located relatively close to each other, coincide on the same ITSM capability level, or are reverse-ordered, indicating that service providers tackle the maturity stages of a practice simultaneously. In contrast, on the transformational scale (Class 2), thresholds appear ordered along similar overall ITSM capability levels across many practices, indicating that service providers in this class tackle the maturity stages of multiple practices simultaneously.

Table 2. Mixed Rasch Models and Selection Criteria (Optimal Solution Highlighted)

Number of classes	Log-likelihood	# of parameters	BIC
1	-10,602.10	131	21,957.78
2	-10,164.30	263	21,841.53
3	-10,021.79	395	22,315.85
4	-9,921.26	527	22,874.13
5	-9,804.79	659	23,400.53

Note: BIC denotes Schwartz's best information criterion.

Table 3. Tests for Entity Homogeneity, Item Homogeneity, and Goodness of Fit

		Class 1 (*n* = 82)	**Class 2 (*n* = 197)**
Andersen LR tests (Andersen, 1971) Split criterion:	Service orientation (≤ versus > median)	*p*: 0.846 LR: 48.00	*p*: 0.843 LR: 64.56
	Size (≤ versus > median)	*p*: 0.694 LR: 61.61	*p*: 0.057 LR: 86.21
	Region (Germany versus other)	*p*: 0.141 LR: 48.53	*p*: 0.515 LR: 70.89
Martin-Löf test (# 100 random splits) (Christensen et al., 2002) Test results (extremes and median):	Maximum LR	*p*: 1 LR: 314.19	*p*: 1 LR: 485.36
	Median LR	*p*: 1 LR: 271.64	*p*: 1 LR: 386.44
	Minimum LR	*p*: 1 LR: 233.71	*p*: 1 LR: 317.55
Parametric bootstrap approximation to Pearson chi-squared goodness-of-fit measure (von Davier, 1997a)	Pearson statistic	3.74 + 16	3.13E + 14
	# of simulated datasets	500	500
	p-value	0.084	0.102
Note: All *p*-values are non-significant at the 5% level; LR = likelihood ratio statistic.			

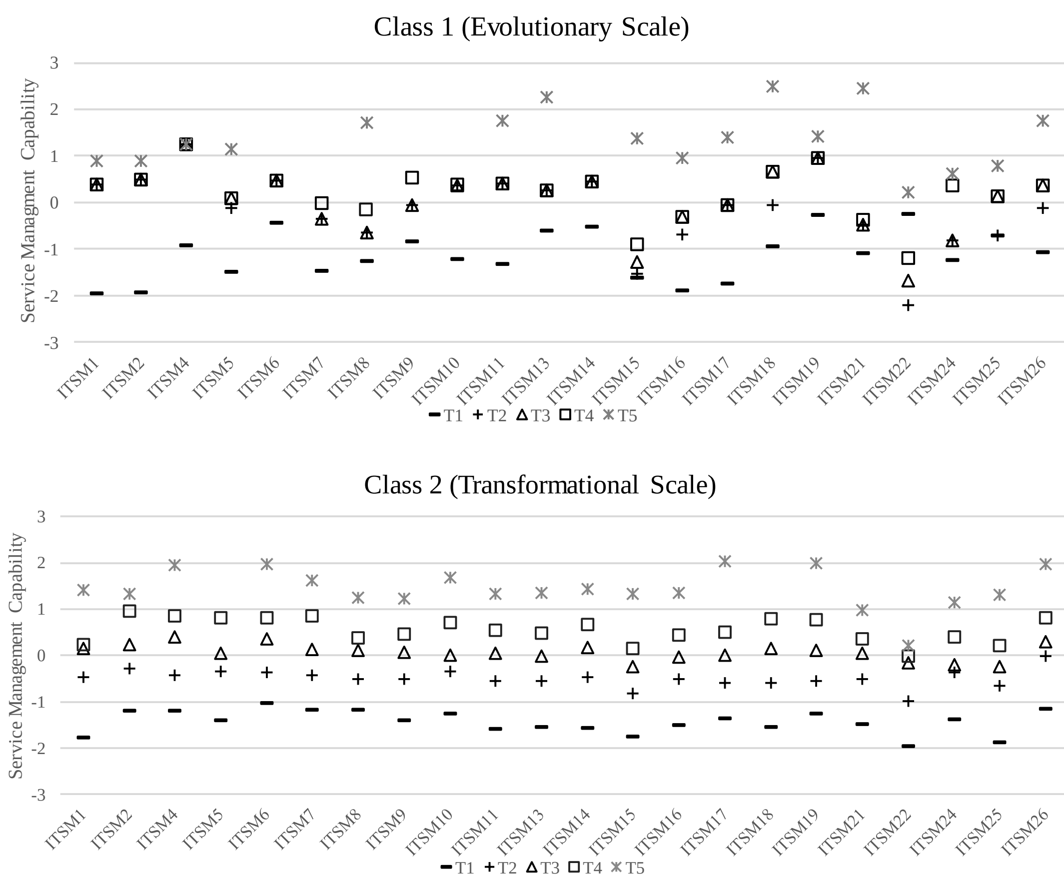


Figure 3. Practice Maturity Stage Thresholds on Two Scales for Service Management Capability (T1 = Threshold for Maturity Stage *i*, ITSM = IT Service Management Practice Item).

Table 4. Tests for Equality of Threshold Location Parameter Means and Variances Among Classes 1 and 2

	Stage:		1 initial	2 repeatable	3 defined	4 managed	5 optimized	
H1b	Class 1 (evolutionary)	*SD* [a]	0.5262	0.7853	0.6983	0.5485	0.6413	Sup.
	Class 2 (transformational)	*SD* [a]	0.2500	0.1924	0.1744	0.2706	0.4350	
	Levene's test	*F*-value	11.081	15.024	14.083	2.7102	2.9407	
		p-value	**0.0018****	**0.0003*****	**0.0005*****	**0.1000***	**0.0952***	
H1c	Class 1 (evolutionary)	Mean [a]	-1.1330	-0.1362	0.0182	0.1833	1.3669	Sup.
	Class 2 (transformational)	Mean [a]	-1.4352	-0.4939	0.0637	0.5541	1.4424	
	Welch's *t*-test	*t*-value	-2.434	-2.075	0.2964	2.8435	0.4116	
		p-value	**0.0211***	**0.0491***	0.7695	**0.0079****	0.6839	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (significant values in bold), H = hypothesis, Sup. = supported, [a]over 22 practices, and *SD* = standard deviation.

To substantiate these structural differences between the two classes, we tested the hypothesized differences between estimated standardized thresholds (H1b). Table 4 shows the results of a comparison of the two class threshold variances with Levene's test for homoscedasticity. The threshold parameter variances ($\frac{1}{22}\sum_{i=1}^{22}(\delta_{i,j} - E(\delta_{i,j}))^2, j = 1,2,\ldots5$) for all five stages are higher for Class 1 compared to Class 2. Levene's test showed significant differences at all stages. This fits the theorized differences of evolutionary versus transformational scales, supporting H1b: The scale for ITSM capability in the evolutionary class exhibits a greater threshold variance for any maturity stage than the scale in the transformational class.

In the third step, we validate the hypothesized differences of threshold means per stage between the two classes (H1c). As shown in Table 4, the threshold means for the 22 practices on the evolutionary scale take on higher values for the low stages ($\frac{1}{22}\sum_{i=1}^{22}\delta_{i,1}$ and $\frac{1}{22}\sum_{i=1}^{22}\delta_{i,2}$, at the initial and repeatable maturity stages) and lower values for the high stages ($\frac{1}{22}\sum_{i=1}^{22}\delta_{i,4}$ and $\frac{1}{22}\sum_{i=1}^{22}\delta_{i,5}$, at the managed and optimized maturity stages). In addition, as expected, threshold means were almost equal at stage j=3 of the defined maturity stage ($\frac{1}{22}\sum_{i=1}^{22}\delta_{i,3}$).

Welch's t-test for the equality of means identifies significances at the initial (1), repeatable (2), and managed (4) stages. The fact that only a few practices in the overall sample attain Stage 5 could explain the lack of significance at the optimized stage (5; see Table A9). In summary, this test supports H1c: The scale for ITSM capability in the evolutionary class exhibits higher threshold means for low practice maturity stages and lower threshold means for high practice maturity stages than the scale in the transformational class. Altogether, these tests support H1: IT service providers fall into one of two mutually exclusive classes that, building on the theories of organizational capability, we characterized as following evolutionary and transformational practice configuration strategies.

5.2 Regression Analyses

We used three regression models to assess the hypothesized relationships between ITSM capability and service provider performance (H2 and H3) and retained only the service providers in the sample with clear class assignments and complete data ($n1 = 81$; $n2 = 197$). A summary of the results appears in Table 5. We tested the hypothesized positive effect of ITSM capability on service provider performance (H2) using the following linear regression model (Model M1):

$$\begin{aligned} Perform = \beta_0 + \beta_1\, ITSMCapability + \beta_2\, Size \\ +\beta_3\, ServiceOrientation + \beta_4\, Regulation + \\ \beta_5\, MarketUncertainty + \beta_6\, ProviderType + \\ \beta_7\, MgmtLevel + \beta_8\, Position, \end{aligned} \quad \text{(M1)}$$

The results showed a significant positive effect of ITSM capability on performance ($\beta_1 = 0.472^{***}$, $t = 8.559$) and further significant influences of the respondent-level controls, management level, and position (Table 5). This result supports H2: Service management capability is positively associated with service provider performance.

Table 5. Summary of Path Model Assessment

Hypotheses	Variable	Model[a]			R[b]
		M1 (whole sample; n = 278) β (t)	**M2a (evolutionary class; n = 81)** β (t)	**M2b (transformational class; n = 197)** β (t)	
H2	ITSMCapability	.472*** (8.559)	.363** (3.252)	.531*** (8.081)	S
H3	ITSMCapability* Class	–	Chow test: F = 3.089* (> F 0.95) p = 0.047		S
–	Service Orientation	.074 (0.998)	.047 (1.528)	.012 (0.683)	–
–	Regulation	.048 (0.810)	–	–	–
–	Market Uncertainty	.018 (1.347)	.175* (2.309)	.021 (0.466)	–
–	ProviderType Shared	-0.103 (-1.041)	-.008 (-0.039)	-0.153 (-1.348)	–
	ProviderType External	.219 (0.522)	-1.159 (-0.915)	.249 (0.383)	
–	Size	.027 (0.452)	-.021 (-0.193)	.065 (1.028)	–
–	MgmtLevel	.120* (2.285)	.212 (1.365)	.093 (1.230)	–
–	PositionIT ServiceProvider	.159** (2.985)	–	–	–
	R^2	.286***	.174*	.328***	

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (one-sided); [a] β = standardized beta; [b] R = result, S = supported

To test the hypothesized difference of the effect of ITSM capability on service provider performance between the two service provider classes (H3), we conducted a dummy variant of the Chow test based on Model M1 (Kennedy, 2008, p. 238). The F-test shows that the coefficient of difference between the two classes is significant at the $p < 0.05$ level ($F = 3.089$). We further carried out split-group regressions for the evolutionary class (Model M2a in Table 5) and the transformational class (Model M2b). In these models, we dropped two controls (regulation and position) that are uncorrelated with IT service provider performance in the evolutionary and transformational classes (see Table A11) to not compromise statistical power, as advised by Becker (2005) and Bernerth and Aguinis (2016).

The effect of ITSM capability on performance is weaker in the evolutionary class (M2a: $\beta_1 = 0.363$**, $t = 3.252$) and stronger in the transformational class (M2b: $\beta_1 = 0.531$***, $t = 8.081$). Notably, the effect is positive in both classes. The split-group regressions with all controls provide consistent results (see Table A12). In combination with the Chow test, the split-group regression analysis confirms that ITSM capability has a stronger influence on IT service provider performance in the transformational class than in the evolutionary class (H3).

5.3 Methodological Limitations

First, our sampling strategy in which single respondents volunteered for the sample might result in biases that we were unable to control for (Podsakoff et al., 2003). The fact that the main result of our analysis is the moderating effect of the configuration class further strengthens confidence in our results because moderating effects cannot be artifacts of common method variance or be detected in the presence of substantial common method variance (Evans, 1985; Siemsen, Roth, & Oliveira, 2010). Second, we distributed this survey among members of professional ITSM associations in three central European countries, which may restrict the generalizability of our results. Third, the statistical analyses of our cross-sectional sample generate statements about the significance of relationships. They substitute neither the notions of causality nor the argument for longitudinal processes transported by our theoretical development. Our findings on the effect of ITSM capability on service provider performance are consistent with the causal inferences by prior researchers that ITIL implementation progress leads to a monotonic increase in performance outcomes (Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011).

6 Discussion and Conclusion

We set out to analyze how archetypical configurations of widely accepted service management practices reflect strategies for the development of ITSM capability. Further, we studied how different configuration strategies affect service provider performance. We found empirical support for the theoretically derived proposition that a service provider falls into either an evolutionary or transformational class with respect to how service management practices are configured (H1). We argue that ITSM capability brings about service innovation in different dimensions. We found support for the hypothesis that ITSM capability positively relates to service provider performance (H2). We developed the hypothesis that, owing to practice complementarities when innovating services, improvements of ITSM capability in the transformational class will have a stronger influence on service provider performance, as compared to the evolutionary class (H3). Our analyses support this hypothesis.

6.1 Research Contributions

This research provides two key contributions to the literature in information systems, one being methodological and the other being theoretical. As a methodological contribution, we demonstrate how to employ the Rasch analysis for uncovering novel insights into the nature of organizational capability. This item-response theoretical approach to measuring organizational capability as a latent trait has remained underappreciated in information systems, and it is new to the field of ITSM. As introduced in Table 1, the Rasch analysis has a number of important methodological and conceptual advantages over the factor models that are traditionally employed for measuring organizational capabilities (e.g., ITSM capability).

First, while prior approaches have implied that maturity stages are equidistant, the Rasch model is capable of dealing with categorical or ordinal practice maturity stages. This approach is thus able to build on actionable practice maturity stages as defined by many contemporary reference models, rather than relying on Likert-type scales developed by researchers (e.g., Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011). Second, prior maturity research in information systems either uses simple practice counts (e.g., Gacenga et al., 2010; Marrone & Kolbe, 2011) or a more complex factor analysis approach (e.g., Iden & Eikebrokk, 2014; Kishore et al., 2012). Both are incapable of dealing with the nonlinearity inherent in how an improved capability manifests in advanced practice maturities. In contrast, the reflective measurement of ITSM capability in a Rasch model caters to a nonlinear relationship between organizational capability and the maturities of its practices. Third, although in some fields, such as ITSM, case studies have provided initial indications for the existence of different archetype configuration strategies of organizational capability (see Table A2), prior empirical studies have been constrained in that these capabilities have been conceptualized and measured as single and homogeneous latent constructs (e.g., Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011).

Our application of the Rasch analysis techniques has key methodological advantages over traditionally applied factor analysis methods. It creates verbal and statistical correspondence when conceptualizing and measuring organizational capability as a latent trait based on potentially nonlinear relationships with categorically or ordinally scaled practice maturity stages configured in potentially different archetype configuration strategies. Nevertheless, our conceptualization of ITSM capability as a reflective construct is bound to important theoretical assumptions. Some authors treat ITSM practices as formative indicators that generate an index (Iden & Eikebrokk, 2014). Formative measurement approaches do not consider ITSM capability to be a latent factor that explains the covariance in the ITSM practice maturities (practice configurations) and configuration strategies. Rather, they assume that ITSM practices independently contribute to a formative index. They consider neither causality between the focal construct (ITSM capability) and indicators (ITSM practices) nor interrelationships between the indicators (ITSM practices, Hsu et al., 2018; Lee, Cadogan, & Chamberlain, 2013). The specification of whether a measure is reflective or formative relies on theoretical arguments regarding whether a measure causes its items or whether a measure is formed by its items (Hsu et al., 2018; MacKenzie et al., 2011; Petter, Straub, & Rai, 2007).

The organizational capability literature informed our theorizing on the ITSM capability construct (Lavie, 2006; Schreyögg & Kliesch-Eberl, 2007; Winter, 2000). This literature implies a reflective measurement approach because the progress of organizational learning characterizes ITSM capability as the ability of an IT organization to provide high-performance IT services. This organizational learning involves contextualizing and institutionalizing in a centrally coordinated manner and deliberately orchestrating ITSM practices, which results in configurations of ITSM practices. Our reflective measurement approach is further informed by prior theorizing on the organizational adoption of management reference models, suggesting that a company's configuration of quasi-normative practices reflect a company's "long history of methodological development" (Levina & Ross, 2003, p. 344) and signals its ability to deliver high-quality work (Dawson et al., 2010). We thus follow the stream of research that treats IT practices as reflective indicators of a latent trait (Dekleva & Drehmer, 1997; Kishore et al., 2012; Tanriverdi, 2006). Because the same indicators that can be formative for a composite construct can also be manifestations of a reflective construct (Tesio, 2014), the way we conceptualize ITSM capability as a reflective construct does not question prior works that interpret IT practices as formative indicators. In contrast to formative approaches, however, we highlight the organizational capability that underlies ITSM practice configurations and that explains the existence of configuration strategies.

Our mixed Rasch analysis provides support for the existence of two alternative approaches to the configuration of service management practices (Lavie, 2006). Our results imply that only service providers in the transformational class approach capability improvement through synchronized directed action to increase the maturity of multiple practices based on external sources of learning such as reference models. Service providers in the evolutionary class, in contrast, develop ITSM capability in an experimental fashion based on internal learning with a strong path dependence on prior practice configurations. The application of the MRM has thus helped us uncover a novel distinction between two important ITSM capability configuration classes whose existence corroborates arguments from prior capability reconfiguration theory (Lavie 2006). Thus, similar to the approach presented here, Rasch analysis may be an adequate means for measuring organizational capabilities in other domains of information systems literature.

On a theoretical level, we contribute to research on IT service innovation and delivery as well as the use of associated reference models by demonstrating the performance implications of following evolutionary versus transformational practice configuration strategies. Tallon (2010) has emphasized the need for research on service innovation and delivery because service delivery, in comparison to product delivery, involves distinctive challenges, such as customer involvement, joint production, and outcome intangibility. Similarly, Iden and Eikebrokk (2013) have called for further research on how firms prioritize service management processes when adopting a service management reference model. The ITSM reference models have attracted great attention among IT service providers (see Table A1) and IT service researchers (e.g., Gacenga et al., 2010; Iden & Eikebrokk, 2014; Marrone & Kolbe, 2011; Yamakawa et al., 2012). Even though such reference models strongly influence the design of IT service processes, there is a lack of knowledge on how the development of ITSM capability manifests in configurations of quasi-normative ITSM practices and how this relates to positive (or negative) performances (Iden & Eikebrokk, 2013).

We show that IT service providers adopting a transformational approach achieve higher performance gains from building ITSM capability than providers following an evolutionary approach. These higher gains, we argue, are due to complementarities that are grounded in the concurrence of service design, production, and delivery. Because customers coproduce services and because service production and delivery coincide (Lusch & Nambisan, 2015), associated processes are closely interlinked and service innovation requires coordinated activities in all process areas (Barrett et al., 2015; Hertog, 2000). This finding extends the knowledge of how implementing reference models for service management improves service provider performance. Rather than thinking of service management as the result of implementing a number of seemingly isolated individual practices, our results direct our attention to the complex interfaces between practices and to the ability to orchestrate different practices for creating superior performance outcomes.

6.2 Implications for Practice

IT service provider managers face the challenge of how to improve service delivery when configuring the practices described in contemporary ITSM reference models. Our results show that managers pursuing a transformational approach are likely to achieve greater performance gains than those following an evolutionary approach. Thus, technically, investing in advancing multiple practices by one maturity stage per practice likely leads to greater performance increases than advancing a single practice via multiple maturity stages. These superadditive effects emerge from interdependencies between practices owing to service features, such as customer involvement and concurrency of service production and delivery (Cannon et al., 2011). Hence, we advise service providers that start building ITSM capability with the aim of increasing service performance to assimilate service management practices broadly and focus on practice complementarities, rather than opportunistically improving their organization's current practices where they appear weakest.

6.3 Future Research

Several promising avenues exist in which future research can build on the identified configuration strategies and the performance implications highlighted by this research. First, because this study is bound to services related to IT (i.e., IT services), further research would be required to validate whether our results also hold for other service industries with potentially different environmental dynamics. Other service industries for which practice reference models are in use, such as insurance services, retail services, or product maintenance services, appear to be adequate fields to expand the use of the Rasch calibration approach that we demonstrated in this study. Second, understanding these different approaches to ITSM practice configuration opens new avenues for studying the contingencies and managerial challenges surrounding implementing ITSM. For instance, IT service providers that wish to follow a transformational approach may need more synchronized managerial actions and thus require much greater effort to configure practices than service providers in the evolutionary class. Finally, our research also provides avenues for practically oriented research that describes the transformational strategy—the superior configuration choice—in greater detail with the goal of helping service providers benchmark their ITSM capability and assess potential practice maturity improvements at a given capability level.

References

Ahmad, N., Tarek Amer, N., Qutaifan, F., & Alhilali, A. (2013). Technology adoption model and a road map to successful implementation of ITIL. *Journal of Enterprise Information Management, 26*(5), 553-576.

Akhlaghpour, S., & Lapointe, L. (2018). From Placebo to Panacea: Studying the Diffusion of IT Management Techniques with Ambiguous Efficiencies: The Case of Capability Maturity Model. *Journal of the Association for Information Systems, 19*(6), 441-502.

Andersen, E. B. (1971). The asymptotic distribution of conditional likelihood ratio tests. *Journal of the American Statistical Association*, *66*(335), 630-633.

Andersen, E. B. (1973). A goodness of fit test for the Rasch model. *Psychometrika, 38*(1), 123-140.

AXELOS. (2015). *Full year, 2014 consolidated regional exam figures*. AXELOS Limited. https://www.axelos.com/Corporate/media/Files/Exam%20Data/Full-Year-2014-Consolidated-Regional-Examination-Data.pdf

Bapna, R., Gupta, A., Ray, G., & Singh, S. (2016). Research Note—IT outsourcing and the impact of advisors on clients and vendors. *Information Systems Research*, *27*(3), 636-647.

Bardhan, I. R., Demirkan, H., Kannan, P., Kauffman, R. J., & Sougstad, R. (2010). An interdisciplinary perspective on IT services management and service science. *Journal of Management Information Systems*, *26*(4), 13-64.

Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L. (2015). Service innovation in the digital age: key contributions and future directions. *MIS Quarterly, 39*(1), 135-154.

Becker, T. E. (2005). Potential problems in the statistical control of variables in organizational research: A qualitative analysis with recommendations. *Organizational research methods, 8*(3), 274-289.

Bernerth, J. B., & Aguinis, H. (2016). A critical review and best-practice recommendations for control variable usage. *Personnel Psychology, 69*(1), 229-283.

Bharadwaj, A. S., Bharadwaj, S. G., & Konsynski, B. R. (1999). Information technology effects on firm performance as measured by Tobin's q. *Management Science*, *45*(7), 1008-1024.

Burton-Jones, A. (2009). Minimizing method bias through programmatic research. *MIS Quarterly*, *33*(3), 445-471.

Cannon, D., Hanna, A., Hunnebeck, L., Lacy, S., Lloyd, V., Macfarlane, I., . . . Wheeldon, D. (2011). *ITIL version 3 book series: Service strategy, service design, service transition, service operation*. TSO (The Stationery Office).

Cater-Steel, A., Toleman, M., & Tan, W.-G. (2006). Transforming IT service management-the ITIL impact. *Proceedings of the 17th Australasian Conference on Information Systems*.

Chang, H.-L., & Wu, J.-G. (2015). Exploring company ability to meet supply chain security validation criteria. *International Journal of Physical Distribution & Logistics Management*, *45*(7), 691-710.

Chang, J. C. J., & King, W. (2005). Measuring the Performance of Information Systems: A Functional Scorecard. *Journal of Management Information Systems, 22*(1), 85-115.

Christensen, K. B., Bjorner, J. B., Kreiner, S., & Petersen, J. H. (2002). Testing unidimensionality in polytomous Rasch models. *Psychometrika*, *67*(4), 563-574.

CMMI-SVC. (2010). *CMMI for Services, version 1.3*. Retrieved from http://www.sei.cmu.edu

CMMI Institute. (2017). *Published appraisal results*. https://sas.cmmiinstitute.com/pars/pars.aspx

Coelho, A. M., & Rupino da Cunha, P. (2009). IT service management diagnosis at Grefusa Group and ITIL implementation proposal. *AMCIS Proceedings*.

Dawson, G. S., Watson, R. T., & Boudreau, M.-C. (2010). Information asymmetry in information systems consulting: Toward a theory of relationship constraints. *Journal of Management Information Systems*, *27*(3), 143-178.

de Sousa Pereira, R. F., & da Silva, M. M. (2010). *A maturity model for implementing ITIL v3*. Paper presented at the 6th World Congress on Services (SERVICES-1).

de Vaujany, F.-X., Fomin, V. V., Haefliger, S., & Lyytinen, K. (2018). Rules, practices, and information technology: A trifecta of organizational regulation. *Information Systems Research, 29*(3), 755-773.

Dekleva, S., & Drehmer, D. (1997). Measuring software engineering evolution: A Rasch calibration. *Information Systems Research, 8*(1), 95-104.

Disterer, G. (2009). Iso 20000 for IT. *Business & Information Systems Engineering, 1*(6), 463-467.

Dosi, G., Hobday, M., & Marengo, L. (2003). Problem-solving behavior, organizational forms, and the complexity of tasks. In C. Helfat (Ed.), *The SMS Blackwell handbook of organizational capabilities* (pp. 167–192). Blackwell.

Eid, M., & Rauber, M. (2000). Detecting measurement invariance in organizational surveys. European *Journal of Psychological Assessment, 16*(1), 20-30.

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal, 21*(10-11), 1105-1121.

Evans, M. G. (1985). A Monte Carlo study of the effects of correlated method variance in moderated multiple regression analysis. *Organizational Behavior and Human Decision Processes, 36*(3), 305-323.

Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly, 48*(1), 94-118.

Filbeck, G., Swinarski, M., & Zhao, X. (2013). Shareholder reaction to firm investments in the capability maturity model: an event study. *European Journal of Information Systems, 22*(2), 170-190.

Fitoussi, D., & Gurbaxani, V. (2012). IT Outsourcing contracts and performance measurement. *Information Systems Research, 23*(1), 129-143.

Flores, J., Rusu, L., & Johanneson, P. (2010). Evaluating IT service delivery amongst ISPs from Nicaragua. *AMCIS Proceedings*.

Gacenga, F., Cater-Steel, A., & Toleman, M. (2010). An international analysis of IT service management benefits and performance measurement. *Journal of Global Information Technology Management, 13*(4), 28-63.

Gavetti, G., & Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly, 45*(1), 113-137.

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM) (2nd ed.). SAGE.

Han, K., & Mithas, S. (2013). Information technology outsourcing and non-IT operating costs: An empirical investigation. *MIS Quarterly, 37*(1), 315-331.

Harter, D. E., Krishnan, M. S., & Slaughter, S. A. (2000). Effects of process maturity on quality, cycle time, and effort in software product development. *Management Science, 46*(4), 451-466.

Helfat, C. E., & Raubitschek, R. S. (2000). Product sequencing: co-evolution of knowledge, capabilities and products. *Strategic Management Journal, 21*(10-11), 961-979.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135.

Hertog, P. D. (2000). Knowledge-intensive business services as co-producers of innovation. *International Journal of Innovation Management, 4*(4), 491-528.

Hsu, J., Chiu, C.-M., Lowry, P. B., & Liang, T. P. (2018). Solving the interpretational-confounding and interpretational-ambiguity problems of formative construct modeling in behavioral research: proposing a two-stage fixed-weight redundancy approach. *Journal of the Association for Information Systems, 19*(7), 618-671.

Huang, S.-J., & Han, W.-M. (2006). Selection priority of process areas based on CMMI continuous representation. *Information & Management, 43*(3), 297-307.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 2*(1), 88-115.

Iden, J., & Eikebrokk, T. R. (2013). Implementing IT service management: A systematic literature review. *International Journal of Information Management, 33*(3), 512-523.

Iden, J., & Eikebrokk, T. R. (2014). Using the ITIL process reference model for realizing IT governance: An empirical investigation. *Information Systems Management, 31*(1), 37-58.

ISO. (2017). *The ISO survey of management system standard certifications 2016*. https://www.iso.org/the-iso-survey.html:

ISO/IEC. (2006). ISO/IEC 15504. 2006. Information technology—process assessment. https://www.iso.org/standard/38934.html itSMF. (2017). About us: itSMF homepage. http://www.itsmfi.org/?page=AboutUs

James, L. R., Demaree, R. G., & Wolf, G. (1993). r wg: An assessment of within-group interrater agreement. *Journal of Applied Psychology, 78*(2), 306-309.

Jia, R., Reich, B. H., & Pearson, J. M. (2008). IT service climate: An extension to it service quality research. *Journal of the Association for Information Systems, 9*(5), 294-320.

Kenett, R. S., & Salini, S. (2011). Modern analysis of customer satisfaction surveys: Comparison of models and integrated analysis. *Applied Stochastic Models in Business and Industry, 27*(5), 465-475.

Kennedy, P. (2008). A guide to econometrics (6th ed.): Wiley-Blackwell.

Kishore, R., Swinarski, M. E., Jackson, E., & Rao, H. R. (2012). A quality-distinction model of IT capabilities: Conceptualization and two-stage empirical validation using CMMi processes. *IEEE Transactions on Engineering Management, 59*(3), 457-469.

Lavie, D. (2006). Capability reconfiguration: An analysis of incumbent responses to technological change. *Academy of Management Review, 31*(1), 153-174.

Lee, N., Cadogan, J. W., & Chamberlain, L. (2013). The MIMIC model and formative variables: problems and solutions. *AMS Review, 3*(1), 3-17.

Lema, L., Calvo-Manzano, J. A., Colomo-Palacios, R., & Arcilla, M. (2015). ITIL in small to medium-sized enterprises software companies: towards an implementation sequence. *Journal of Software: Evolution and Process, 27*(8), 528-538.

Levina, N., & Ross, J. W. (2003). From the vendor's perspective: exploring the value proposition in information technology outsourcing. *MIS Quarterly, 27*(3), 331-364.

Lucio-Nieto, T., Colomo-Palacios, R., Soto-Acosta, P., Popa, S., & Amescua-Seco, A. (2012). Implementing an IT service information management framework: The case of COTEMAR. *International Journal of Information Management, 32*(6), 589-594.

Lusch, R. F., & Nambisan, S. (2015). Service innovation: A service-dominant logic perspective. *MIS Quarterly, 39*(1), 155-175.

MacKenzie, S., Podsakoff, P., & Podsakoff, N. (2011). Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques. *MIS Quarterly, 35*(2), 293-334.

Maij-de Meij, A. M., Kelderman, H., & van der Flier, H. (2008). Fitting a mixture item response theory model to personality questionnaire data: Characterizing latent classes and investigating possibilities for improving prediction. *Applied Psychological Measurement, 32*(8), 611–631.

Mair, P., Hatzinger, R., & Rusch, T. (2007). eRm-extended Rasch modelling. *Journal of Statistical Software, 20*(9), 1-20.

Marrone, M., Gacenga, F., Cater-Steel, A., & Kolbe, L. (2014). IT service management: a cross-national study of ITIL adoption. *Communications of the Association for Information Systems, 34*(1), 865-892.

Marrone, M., & Kolbe, L. (2011). Impact of IT service management frameworks on the IT organization. *Business & Information Systems Engineering, 3*(1), 5-18.

Marx, F., Wortmann, F., & Mayer, J. H. (2012). A maturity model for management control systems. *Business & Information Systems Engineering, 4*(4), 193-207.

Masters, G. N. (1982). A Rasch model for partial credit scoring. *Psychometrika, 47*(2), 149-174.

Miles, I. (2008). Patterns of innovation in service industries. *IBM Systems Journal, 47*(1), 115-128.

Patnayakuni, R., & Ruppel, C. P. (2006). Managing the complementarity of knowledge integration and process formalization for systems development performance. *Journal of the Association for Information Systems, 7*(1), 21.

Petter, S., Straub, D., & Rai, A. (2007). Specifying formative constructs in information systems research. *MIS Quarterly, 31*(4), 623-656.

Ply, J. K., Moore, J. E., Williams, C. K., & Thatcher, J. B. (2012). IS employee attitudes and perceptions at varying levels of software process maturity. *MIS Quarterly, 36*(2), 601-624.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879-903.

Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management, 12*(4), 531-544.

Prashantham, S., & Floyd, S. W. (2012). Routine microprocesses and capability learning in international new ventures. *Journal of International Business Studies, 43*(6), 544-562.

Ramasubbu, N., Mithas, S., Krishnan, M. S., & Kemerer, C. F. (2008). Work Dispersion, Process-Based Learning, and Offshore Software Development Performance. *MIS Quarterly, 32*(2), 437-458.

Rasch, G. (1980). *Probabilistic models for some intelligence and attainment tests.* University of Chicago Press.

Rost, J. (1991). A logistic mixture distribution model for polychotomous item responses. *British Journal of Mathematical and Statistical Psychology, 44*(1), 75-92.

Rost, J., & von Davier, M. (1994). A conditional item-fit index for Rasch models. *Applied Psychological Measurement, 18*(2), 171-182.

Ruiz, M., Moreno, J., Dorronsoro, B., & Rodriguez, D. (2018). Using simulation-based optimization in the context of IT service management change process. *Decision Support Systems, 112*, 35-47.

Rusch, T., Lowry, P. B., Mair, P., & Treiblmaier, H. (2017). Breaking free from the limitations of classical test theory: Developing and measuring information systems scales using item response theory. *Information & Management, 54*(2), 189-203.

Salzberger, T., & Sinkovics, R. R. (2006). Reconsidering the problem of data equivalence in international marketing research: Contrasting approaches based on CFA and the Rasch model for measurement. *International Marketing Review, 23*(4), 390-417.

Schreyögg, G., & Kliesch-Eberl, M. (2007). How dynamic can organizational capabilities be? Towards a dual-process model of capability dynamization. *Strategic Management Journal, 28*(9), 913-933.

Schwaab, B., Koopman, S. J., & Lucas, A. (2017). Global credit risk: World, country and industry factors. *Journal of Applied Econometrics, 32*(2), 296-317.

Shrestha, A., Cater-Steel, A., Toleman, M., & Tan, W.-G. (2015). A method to select IT service management processes for improvement. *Journal of Information Technology Theory and Application, 15*(3), 31-56.

Siemsen, E., Roth, A., & Oliveira, P. (2010). Common method bias in regression models with linear, quadratic, and interaction effects. *Organizational Research Methods, 13*(3), 456-476.

Spector, P. E., & Brannick, M. T. (2011). Methodological urban legends: The misuse of statistical control variables. *Organizational Research Methods, 14*(2), 287-305.

Tallon, P. P. (2008). Inside the adaptive enterprise: an information technology capabilities perspective on business process agility. *Information Technology and Management, 9*(1), 21-36.

Tallon, P. P. (2010). A service science perspective on strategic choice, IT, and performance in US banking. *Journal of Management Information Systems, 26*(4), 219-252.

Tanriverdi, H. (2006). Performance effects of information technology synergies in multibusiness firms. *MIS Quarterly, 30*(1), 57-77.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.

Tesio, L. (2014). Causing and being caused: Items in a questionnaire may play a different role, depending on the complexity of the variable. *Transactions of the Rasch Measurement SIG, 28*(1), 1454-1456.

Tinsley, H. E., & Weiss, D. J. (2000). Interrater reliability and agreement. In H. E. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 95–124). Academic Press.

Tripsas, M., & Gavetti, G. (2000). Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal, 21*(10/11), 1147-1161.

von Davier, M. (1997a). Bootstrapping goodness-of-fit statistics for sparse categorical data: Results of a Monte Carlo study. *Methods of Psychological Research Online, 2*(2), 29-48.

von Davier, M. (1997b). WINMIRA program description and recent enhancements. *Methods of Psychological Research Online, 2*(2), 25-28.

Vrontis, D., Thrassou, A., & Lamprianou, I. (2009). International marketing adaptation versus standardisation of multinational companies. *International Marketing Review, 26*(4/5), 477-500.

Williams, C. K., & Karahanna, E. (2013). Causal explanation in the coordinating process: A critical realist case study of federated IT governance structures. *MIS Quarterly*, *37*(3), 933-964.

Winkler, T. J., & Brown, C. V. (2013). Horizontal allocation of decision rights for on-premise applications and software-as-a-service. *Journal of Management Information Systems*, *30*(3), 13-48.

Winkler, T. J., Sarstedt, M., Keil, M., & Rost, P. (2015). selfsurvey.org: A platform for prediction-based benchmarking and feedback-enabled survey research. *ECIS Proceedings*.

Winkler, T. J., & Wulf, J. (2019). Effectiveness of IT service management capability: value co-creation and value facilitation mechanisms. *Journal of Management Information Systems*, *36*(2), 639-675.

Winniford, M., Conger, S., & Erickson-Harris, L. (2009). Confusion in the ranks: IT service management practice and terminology. *Information Systems Management*, *26*(2), 153-163.

Winter, S. G. (2000). The satisficing principle in capability learning. *Strategic Management Journal*, *21*(10/11), 981-996.

Wright, B. D. (1996). Comparing Rasch measurement and factor analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, *3*(1), 3-24.

Wright, B. D., Linacre, J. M., Gustafson, J., & Martin-Lof, P. (1994). Reasonable mean-square fit values. *Rasch Measurement Transactions*, *8*(3), 370-370.

Wright, B. D., & Masters, G. N. (1982). Rating scale analysis: Rasch measurement. Mesa Press.

Wulf, J., Winkler, T. J., & Brenner, W. (2015). Measuring IT service management capability: Scale development and empirical validation. *Proceedings of the 12th International Conference on Wirtschaftsinformatik*.

Yamakawa, P., Obregón Noriega, C., Novoa Linares, A., & Vega Ramírez, W. (2012). Improving ITIL compliance using change management practices: A finance sector case study. *Business Process Management Journal*, *18*(6), 1020-1035.

Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, *13*(3), 339-351.

Appendix

Table A1. IT Service Management Reference Models

Reference	Description	Practice maturity stages	Practice configuration strategies
Cannon et al. (2011)	The ITIL reference model is highly popular for IT service management, as the growing number of employee certifications (AXELOS, 2015) and professional association membership numbers (itSMF, 2017) indicate.	initial, repeatable, defined, managed, optimizing (Cannon et al., 2011, vol. 2, pp. 339-344).	n/a
CMMI-SVC (2010)	CMMI Services is a comprehensive set of guidelines on how to provide superior services that belongs to the CMMI family. The number of CMMI-SVC appraisals has steadily increased in the past years (CMMI Institute, 2017).	incomplete, performed, managed, defined	• continuous representation • staged representation
Disterer (2009)	ISO/IEC 20000 is the first international standard for IT service management. It is closely related to ITIL. In conjunction with the ISO/IEC15504 standard (ISO/IEC, 2006), it allows a process-level assessment of ITSM practices. A growing number of companies are obtaining the associated certification (ISO, 2017).	initial, repeatable, defined, managed, optimizing	n/a
Niessink, Clerc, and van Vliet (2005)	The IT service CMM is a capability maturity model for organizations that provide IT service. It bases on the Software CMM Version 1.1 and is in use at several medium-sized and large organizations (Niessink & Clerc, 2018).	n/a	• five maturity levels that describe key process areas

Table A2. Empirical ITSM Implementation Studies

Reference	Empirical basis	Results	O[1]	N[2]	M[3]
Ahmad et al. (2013)	Stock exchange firm in the United Arab Emirates	The company limited its implementation efforts to adopting the incident, problem, and change management practices.		x	
Cater-Steel, Toleman, & Tan (2006)	Five large public-funded organizations	The sequence of service management practices that organizations initially adopted varies. Some organizations focus on selected operational practices while others tackle operational and tactical practices conjunctively.		x	x
Coelho & Rupino da Cunha (2009)	European snack food industry organization	The organization assigned an initial priority to implementing selected service support processes.		x	
de Sousa Pereira & da Silva (2010)	Two Portuguese organizations	Even though the two organizations implemented 60% of incident management measures, they missed out on critical measures and, thus, stay at incident management maturity level one.	x	x	
Flores, Rusu, & Johanneson (2010)	Three Nicaraguan internet service providers	The firms lifted selected practices (such as financial management) to high maturity levels; other practices (such as continuity management) stayed at low maturity levels.		x	
Lema, Calvo-Manzano, Colomo-Palacios, & Arcilla (2015)	40 SMEs	Some SMEs started with implementing selected operational practices such as incident management and tackled strategic practices only at advanced ITSM capability levels. Other SMEs also tackled tactical practices such as service portfolio management early on.		x	x
Lucio-Nieto et al. (2012)	Mexican construction company	The company improved its ITSM capability by an initial focus of ITIL implementation efforts on raising the incident and problem management practices to maturity stage three. Further implementation efforts then addressed the configuration and change management practices in a second phase and continuous improvement, service level management, and access management in a third phase.	x	x	
Yamakawa, Obregón Noriega, Novoa Linares, &Vega Ramírez (2012)	Four Peruvian firms in the financial sector	The companies use a staged approach to ITIL implementation. At an initial stage, companies focus on raising selected service support and service delivery practices (incident management, change management, service desk, service level management) to maturity level 3. In the second phase, the companies further improved these practices and included more practices.	x	x	

Notes:
[1] O = Ordinality evidence: Practice maturity stages not equidistant on a difficulty scale
[2] N = Nonlinearity evidence: Nonlinear adoption of practices because configuration strategies follow a staged logic
[3] M = Multiple practice configuration strategies evidence: Multiple service provider classes that differ in how the overall ITSM capability level manifests in practice configurations

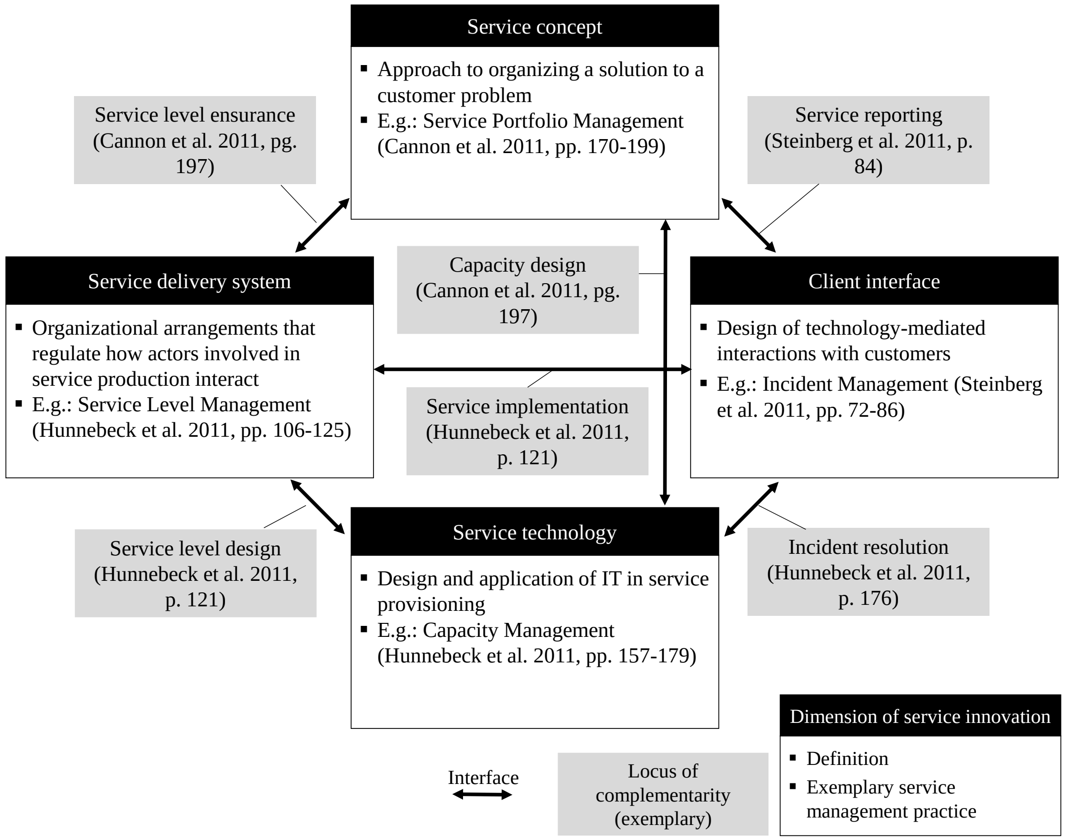


Figure A1. IT Service Innovation Dimensions (Hertog, 2000) with Exemplary Service Management Practices and Their Complementarities (Authors' Adaptation)

Table A3. Multi-Attributive Practice Maturity Scale (Wulf, Winkler, & Brenner, 2015)

Attributes	0. None	1. Initial	2. Repeatable	3. Defined	4. Managed	5. Optimized
(a) Awareness & stakeholder communication	no awareness	partial awareness	wide awareness	full awareness	comprehensive reporting	proactive communication
(b) Plans & procedures	no process	ad hoc process	informal process	formally defined process	robust process execution	good practice process
(c) Tools & automation	no tools	only standard desktop tools	individually managed tools	centrally managed tools	fully integrated tools	end-to-end automation
(d) Skills & expertise	unknown required skills	identified required skills	informal ad hoc training	formal training plan	long-term training program	continuous skill improvement
(e) Responsibility & accountability	unknown responsibilities	no responsibility allocation	informal responsibilities	defined responsibilities	fully dischargeable responsibilities	fully harmonized responsibilities
(f) Goal setting & measurement	no goals	unclear goals	partial goals	globally defined goals	enforced goals	proactive control

Table A4. Operationalization of the Study Variables

Construct (variable name)	Definition	Items	Scale	Key guiding references
IT service management capability (ITSM-Capability)	Repeatable patterns of actions in the uses of assets to provide IT services to a customer organization	26 (22 after item elimination)	multi-attributive ordinal 6-point scale of CMM stages	Ramasubbu et al., 2008; Schreyögg & Kliesch-Eberl, 2007; Winter, 2000
Configuration strategy class (Class)	Archetypical approaches to how service providers configure service management practices	Inductively derived (mixed Rasch model)	dichotomous (evolutionary vs transformational)	Lavie, 2006
Service provider performance (Perform)	Outcomes achieved by the service provider from the configuration of service management practices	5	7-point (far below / above average)	Chang & King, 2005; Iden & Eikebrokk, 2014
Controls:				
Service orientation (Service-Orientation)	Manufacturing versus service industries	2	7-point bipolar	Marrone et al., 2014; Winkler & Brown, 2013
Degree of regulation (Regulation)	Industry-level exposure to regulatory requirements	2	7-point (much less / more)	Marrone et al., 2014; Schlarman, 2007
Market uncertainty (MarketUncertainty)	Industry-level score for the volatility of company assets	1	numeric	Marrone et al., 2014; Schwaab et al., 2017
Service provider type (Provider-Type)	Type of service provider (internal, shared, external)	1	categorical	Iden & Eikebrokk, 2013; Valorinta, 2011
Organization size (Size)	Number of employees at the business/customer and at the service provider organization (log-transformed)	2	numeric	Iden & Eikebrokk, 2013; Marrone et al., 2014
Management level (MgmtLevel)	Management level of the rater's job position from executive to staff level	1	4-point (executive / staff level)	Podsakoff et al., 2003
Horizontal position (Position)	Rater affiliation with the business/customer side (0) or service provider side (1)	1	dichotomous	Podsakoff et al., 2003

Table A5. Survey Instrument

Id	Stem / item	Scale / type		
	[Size:] Please estimate the total number of employees...			
Emp1	at the business/customer organization	[number]		
Emp2	at the IT service provider	[number]		
	[Service orientation:] Please classify the business's/client's core activities via the following dichotomies:			
Ind1	Manufacturing sector	Service sector		
Ind2	Physical products	Informational products		
	[Sector:] Please indicate the main industry the business/client operates in:			
Sec1	[dropdown menu provided]			
	[Regulation:] Please compare the business's/client's industry with others with regards to the regulatory environment:			
Reg1	Statutory requirements and laws	much less	much more	
Reg2	Other requirements (e.g., industry standards)			
Prov1	**[Service provider type:]** Please indicate the type of service provider that best describes your organization.	Internal service provider	Shared services provider	Independent service provider
	On the following page, we will ask you to evaluate the maturity level of a number of common IT service management (ITSM) processes. Please use the following scale to do this:			
	[Table with detailed maturity scale and explanations]			
	Please confirm: I have looked at the table and I understand the maturity scale	[Checkbox]		
	[Service management capability:] Service management practice maturity assessment	0 (none)	5 (optimized)	
ITSM01	Strategy management for IT services (The process responsible for the assessment of the service provider's offerings, capabilities, competitors as well as current and potential market spaces in order to develop a strategy to serve customers. Once the strategy has been defined, strategy management for IT services is also responsible for implementing the strategy.)			
ITSM02	Service portfolio management (The process responsible for managing the service portfolio. Service portfolio management ensures that the service provider has the right mix of services to meet required business outcomes at an appropriate investment level.)			
ITSM03	Financial management for IT services (The function and processes responsible for managing an IT service provider's budgeting, accounting, and charging requirements. Financial management for IT services secures an appropriate funding level to design, develop, and deliver services that cost-effectively meet the organization's strategy.)			
ITSM04	Demand management (The process responsible for understanding, anticipating, and influencing customer demand for services. Demand management works with capacity management to ensure that the service provider has sufficient capacity to meet the required demand.)			
ITSM05	Business relationship management (The process responsible for maintaining a positive relationship with customers. Business relationship management identifies customer needs and ensures that the service provider is able to meet these needs with an appropriate catalog of services.)			
ITSM06	Design coordination (The process responsible for coordinating all service design activities, processes, and resources. Design coordination ensures the consistent and effective design of new or changed IT services, service management information systems, architectures, technology, processes, information, and metrics.)			
ITSM07	Service catalog management (The process responsible for providing and maintaining the database or structured document with information about all live IT services, including those available for deployment and for ensuring that it is available to those authorized to access it.)			
ITSM08	Service-level management (The process responsible for negotiating achievable service-level agreements and ensuring that these are met. It is responsible for ensuring that all IT service management processes, operational-level agreements, and underpinning contracts are appropriate for the agreed service-level targets. Service-level management monitors and reports on service levels, holds regular service reviews with customers, and identifies required improvements.)			
ITSM09	Availability management (The process responsible for ensuring that IT services meet the business's current and future availability needs cost-effectively and timeously. Availability management defines, analyzes, plans, measures, and improves all aspects of the availability of IT services, and ensures that all IT infrastructures, processes, tools, roles, etc., are appropriate for the agreed service-level targets for availability.)			

ITSM10	Capacity management (The process responsible for ensuring that the capacity of IT services and the IT infrastructure are able to meet agreed capacity-related and performance-related requirements cost-effectively and timeously. Capacity management considers all resources required to deliver an IT service and is concerned with meeting the business's current and future capacity and performance needs.)		
ITSM11	IT service continuity management (The process responsible for managing risks that could seriously affect IT services. IT service continuity management ensures that the IT service provider can always provide minimum agreed service levels by reducing the risk to an acceptable level and by planning for the recovery of IT services.)		
ITSM12	Information security management (The process responsible for ensuring that the confidentiality, integrity, and availability of an organization's assets, information, data, and IT services match the agreed needs of the business. Information security management supports business security and has a wider scope than the IT service provider, including the handling of paper, building access, phone calls, etc. for the entire organization.)		
ITSM13	Supplier management (The process responsible for obtaining value for money from suppliers, ensuring that all contracts and agreements with suppliers support the business's needs, and that all suppliers meet their contractual commitments. See also supplier and contract management information system.)		
ITSM14	Transition planning and support (The process responsible for planning all service transition processes and coordinating the resources they require.)		
ITSM15	Change management (The process responsible for controlling the lifecycle of all changes, enabling beneficial changes to be made with minimum disruption to IT services.)		
ITSM16	Service asset and configuration management (The process responsible for ensuring that the assets required to deliver services are properly controlled, and that accurate and reliable information about these assets are available when and where needed.)		
ITSM17	Release and deployment management (The process responsible for planning, scheduling, and controlling the building, testing, and deployment of releases, and for delivering new functionality required by the business while protecting the integrity of existing services.)		
ITSM18	Service validation and testing (The process responsible for validation and testing of a new or changed IT service. Service validation and testing ensure that the IT service matches its design specification and will meet the business's needs.)		
ITSM19	Change evaluation (The process responsible for formal assessment of a new or changed IT service to ensure that risks have been managed and to help determine whether to authorize a change.)		
ITSM20	Knowledge management (The process responsible for sharing perspectives, ideas, experience, and information, and for ensuring that these are available in the right place and at the right time. The knowledge management process enables informed decisions and improves efficiency by reducing the need to rediscover knowledge.)		
ITSM21	Event management (The process responsible for managing events throughout their lifecycle.)		
ITSM22	Incident management (The process responsible for managing the lifecycle of all incidents. Incident management ensures that normal service operation is restored as quickly as possible and that the impact on the business is minimized.)		
ITSM23	Request fulfillment (The process responsible for managing the lifecycle of all service requests.)		
ITSM24	Problem management (The process responsible for managing the lifecycle of all problems. Problem management proactively prevents incidents from happening and minimizes the impacts of incidents that cannot be prevented.)		
ITSM25	Access management (The process responsible for allowing users to make use of IT services, data, or other assets. Access management helps to protect the confidentiality, integrity, and availability of assets by ensuring that only authorized users are able to access or modify them. Access management is sometimes referred to as rights management or identity management.)		
ITSM26	Continual service improvement (Continual service improvement ensures that services are aligned with changing business needs by identifying and implementing improvements to IT services that support business processes. The performance of the IT service provider is continually measured, and improvements are made to processes, IT services, and IT infrastructure in order to increase efficiency, effectiveness, and cost effectiveness.)		
	[Performance:] Please estimate the service provider's overall performance (compared to others):		
P1	The service provider's efficiency in performing its work	Far below average	Far above average
P2	The quality of the services provided by the service provider		
P3	Support of business's or client's processes		
P4	Satisfaction of the users of the business or client		
P5	The service provider's effectiveness in supporting the business's or client's strategic goals		
	[Management level:] Please specify the management level of your job role:		
Level1	[Dropdown menu provided: 1: executive, 2: senior management, 3: management, or 4: staff level]		
Pos1	**[Position:]** Please specify the organization you are affiliated with:	0: Business/ customer	1: Service provider

Table A6. Detailed Sample Characteristics

Variable	**Distribution (percent), *n* = 315**					
Industry	Financial and insurance activities 49 (15.6)	Information and communication 27 (8.6)	Manufacturing 75 (23.8)	Professional, administrative, and public services 53 (16.8)		
	Transportation, accommodation and food services 12 (3.8)	Utilities, construction, and trade 42 (13.3)	Other 57 (18.1)			
Employees	Median 4,000	Mean 21,963.2	*SD* 55,633.3	N/A 2		
IT employees	Median 120	Mean 1,644.8	*SD* 11,059.9			
Provider Type	Internal service provider 181 (57.5)	Shared services provider 78 (24.8)	External service provider 55 (17.5)			
Management Level	Executive management 17 (5.4)	Senior management 73 (23.2)	Management 125 (39.7)	Staff 67 (21.3)	Other 32 (10.2)	
Position	Business / customer 58 (18.4)	IT service provider 257 (81.6)				
Work experience	< 1 year: 67 (21.9)	1 to 2 years: 37 (11.8)	2 to 5 years: 68 (21.6)	5 to 10 years: 80 (25.4)	10 to 20 years: 46 (14.6)	> 20 years: 15 (4.8)
ITSM qualification	Foundation 161 (51.1)	Intermediate[a] 60 (19.1)	Expert 94 (29.8)			

Note: [a] including practitioner level

Table A7. Exploratory Factor Analysis Results

Construct	**Indicator**	**Factor1**	**Factor2**	**Factor3**	**Factor4**
Industry	Ind1	0.064	**0.973**	0.089	-0.002
	Ind2	-0.007	**0.700**	0.054	0.025
Organization size (employees)	Emp1	0.046	-0.023	0.165	**0.826**
	Emp2	0.097	0.050	0.083	**0.758**
Regulation	Reg1	-0.006	0.215	**0.555**	0.163
	Reg2	0.093	-0.064	**0.987**	0.095
Performance	P1	**0.800**	-0.009	0.064	0.060
	P2	**0.850**	0.055	0.082	0.146
	P3	**0.881**	0.045	0.010	0.063
	P4	**0.860**	0.038	-0.002	-0.014
	P5	**0.848**	-0.040	-0.009	0.019
SS loadings		3.622	1.497	1.337	1.323
Proportion var.		0.329	0.136	0.122	0.120

Note: The bold terms highlight factor structure patterns.

Table A8. Construct Correlations and Psychometric Properties

Construct		**Validity criteria**			**Factor correlations (root AVE in bold on diagonal) [HTMT ratio]**			
	#it	Alpha	CR	AVE	Performance	Organization size	Regulation	Service orientation
Performance	5	0.928	0.928	0.722	**0.850** [1]	0.184** [0.158]	0.106 [0.112]	0.091 [0.074]
Organization size	2	0.778	0.787	0.650	0.184** [0.158]	**0.806** [1]	0.399*** [0.337]	0.020 [0.052]
Regulation	2	0.707	0.720	0.568	0.106 [0.112]	0.399*** [0.337]	**0.753** [1]	0.223*** [0.198]
Service orientation	2	0.812	0.874	0.788	0.091 [0.074]	0.020 [0.052]	0.223*** [0.198]	***0.888*** [1]

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (2-tailed), AVE square roots in **bold**

Table A9. Practice Frequencies and Descriptives (n = 315)

Practice	**Frequency per stage**						**Mean**	***SD***	**Median**
	0	**1**	**2**	**3**	**4**	**5**			
ITSM01_ServStrat	29	117	72	48	40	9	1.9	1.3	3
ITSM02_SPfMgt	57	129	66	42	16	5	1.5	1.2	2
ITSM03_FinMgt	57	85	75	55	33	10	1.8	1.4	3
ITSM04_DmdMgt	78	108	74	33	18	4	1.4	1.2	2
ITSM05_BRelMgt	53	112	65	53	29	3	1.7	1.2	2
ITSM06_SCatMgt	56	100	70	60	27	2	1.7	1.2	3
ITSM07_SLMgt	59	82	74	52	41	7	1.9	1.4	3
ITSM08_AvMgt	63	95	74	49	29	5	1.7	1.3	2
ITSM09_CapMgt	71	106	60	52	24	2	1.5	1.3	2
ITSM10_ContMgt	49	101	68	53	38	6	1.8	1.3	3
ITSM11_SecMgt	36	78	73	52	65	11	2.2	1.4	3
ITSM12_SupMgt	57	96	68	53	36	5	1.8	1.3	3
ITSM13_DgnCoord	95	100	70	29	19	2	1.3	1.2	2
ITSM14_TPlanSup	61	109	76	40	26	3	1.6	1.2	2
ITSM15_ChangeM	20	64	76	71	72	12	2.5	1.3	3
ITSM16_ConfMgt	34	102	77	55	38	9	2.0	1.3	3
ITSM17_RelMgt	48	96	73	54	40	4	1.9	1.3	3
ITSM18_SValTestM	53	99	88	42	32	1	1.7	1.2	3
ITSM19_ChngEval	76	86	68	54	28	3	1.6	1.3	2
ITSM20_KnowMgt	70	113	69	38	22	3	1.5	1.2	2
ITSM21_EvtMgt	46	93	77	47	43	9	1.9	1.4	3
ITSM22_IncMgt	6	44	61	85	85	34	3.0	1.3	4
ITSM23_ReqFul	17	65	79	75	57	22	2.5	1.3	3
ITSM24_ProbMgt	46	92	53	74	37	13	2.0	1.4	3
ITSM25_AccMgt	30	75	88	59	52	11	2.2	1.3	3
ITSM26_CSI	75	126	59	33	19	3	1.4	1.2	2

Table A10. Tests for Rasch Calibratability

Test	Objective	Hypothesis (Wright & Stone, 1999)	Application to service management capability context
Andersen's Likelihood Ratio Test (Andersen, 1971)	Person homogeneity	Latent construct determines item levels throughout the entire test group.	Service management capability represents a common and uniform latent trait in the configuration of practices among the surveyed service providers.
Martin-Löf Test (Christensen et al.)	Item homogeneity	Items measure the same latent construct.	The difficulties of the individual practices' maturity stages are measurable on a single scale.
Bootstrapped Chi-squared test (von Davier, 1997)	Model-level goodness-of-fit	Group of items sufficiently measure a latent respondent trait.	Service management capability is a latent trait that is reflected by configurations of service management practices.
Q-index (Rost & von Davier, 1994)	Item-level goodness-of-fit	Item sufficiently discriminates persons with high and low trait manifestations.	The maturity stage of a service management practice sufficiently reflects service management capability.

Table A11. Performance Correlations for Evolutionary and Transformational Classes

Correlation coefficients for Performance in …	ITSM capability	Size	Regulation	Service orientation	Mgmt Level	Position	Market uncertainty
Evolutionary Class	.30**	.03	.12	.12	.06	.08	.14
Transformational Class	.55***	.21**	.08	.08	.14	.13	.00

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (2-tailed)

Table A12. Full Control Models

Path	Model[a] M2c (evolutionary class; $n = 81$) β (t)	M2d (transformational class ; $n = 197$) β (t)
ITSMCapability	.356** (3.144)	.543*** (8.366)
ITSMCapability * Class	Chow test: $F = 3.089$* (> F0.95) $p = 0.047$	
Service Orientation	.237 (1.372)	.041 (0.496)
Regulation	.069 (0.553)	.030 (0.438)
Market Uncertainty	.064* (2.193)	.005 (0.290)
ProviderType Shared	.023 (0.107)	-.123 (-1.101)
ProviderType External	-.616 (-0.704)	.365 (0.747)
Size	-.056 (-0.460)	.027 (0.395)
MgmtLevel	.147 (1.304)	.086 (1.432)
PositionIT ServiceProvider	.046 (0.413)	.166** (2.752)
R^2	.180$^+$	.355**

Notes: $^+ p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$ (one-sided); [a] β =standardized beta

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