Measuring IT Service Management Capability: Scale Development and Empirical Validation

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Abstract. This paper conceptualizes *IT service management (ITSM) capability*, a key competence of today's IT provider organizations, and presents a survey instrument to facilitate the measurement of an ITSM capability for research and practice. Based on the review of four existing ITSM maturity models (CMMI-SVC, COBIT 4.1, SPICE, ITIL v3), we first develop a multi-attributive scale to assess maturity on an ITSM process level. We then use this scale in a survey with 205 ITSM key informants who assessed IT provider organizations along a set of 26 established ITSM processes. Our exploratory factor analysis and measurement model assessment results support the validity of an operationalization of ITSM capability as a second-order construct formed by ITSM processes that span three dimensions: *service planning*, *service transition*, and *service operation*. The practical utility of our survey instrument and avenues for future research on ITSM capability are outlined.

Keywords: IT service management, Organizational capability, Process maturity models, Scale development, Survey instrument, Factor analysis.

1 Introduction

As internal IT providers are increasingly becoming independent service units within the company, and external providers are facing growing competition, the assessment of an IT provider's service management capability is becoming increasingly important and popular (e.g., [1]). IT service management (ITSM) is a widely recognized approach that organizes IT processes and functions around customer-oriented units of delivery, rather than around technology-oriented management tasks, which has been shown to aid in achieving numerous benefits (see [2]). Several frameworks for ITSM have evolved, such as the IT Infrastructure Library (ITIL), which by now has become very widely used [3, 4]. IT service providers—both internal and external—spend significant sums on implementing ITSM and assessing themselves against the practices suggested by these frameworks.

While the advantage of such commercial ITSM assessments is their reliance on in-depth, process-specific questions and the expert judgment through an ITSM specialist,

they are evidently very detailed, time-consuming, and thus hardly feasible in case a company is looking for a simple, yet reliable indication of its current ITSM maturity status. A service management professional, for example, might at times want to look at the next areas of improvement in his/her organization's ITSM capability using a more generic and lightweight process maturity scale.

The academic literature has, despite significant theoretical groundwork around the concepts of organizational capability (e.g., [5-9]) and maturity (e.g., [10, 11]), so far only incidentally touched upon the subject of measuring ITSM-related capabilities. The few existing studies have either employed single-item measures for an overall 'ITSM maturity' [12], or simply measured the 'implementation stage' of different ITSM processes on an ordinal scale [13, 14]. Both of these approaches, however, appear to fall short to adequately conceptualize and capture the nature of such abstract and broad concept as the organizational capability for practicing ITSM, which develops during *and beyond* the implementation stage.

Given the practical and theoretical relevance of ITSM capability for today's IT provider organizations as well as for research, we believe there are good reasons to venture a theoretically grounded conceptualization and an empirical validation of this construct. Therefore, this research aims to address the question: *How can we parsimoniously operationalize and reliably measure ITSM capability?*

The resource-based view of the firm [7-9] provides a theoretical perspective to understand ITSM capability as the 'routines' of IT service providers that make use of different IT assets in order to achieve desirable outcomes. Due to the existence of several established ITSM frameworks, we first follow Becker et al.'s [10] methodology to synthesize a generic ITSM process maturity scale from four existing process maturity frameworks. This maturity scale unites six process attributes (1. awareness and stakeholder communication, 2. plans and procedures, 3. tools and automation, 4. skills and expertise, 5. responsibility and accountability, 6. goal setting and measurement), whose traits jointly determine the maturity of a specific process. We then use this scale for several ITSM process items in a survey with key informants from 205 companies and apply standard instrument development procedures (e.g., [15]). The factor analysis and measurement model validation results suggest that the ITSM capability construct is composed of three sub-dimensions and that this instrument is psychometrically valid. Besides providing a parsimonious and reliable way to assess an IT provider's ITSM capability for practice, we argue that this measurement instrument also opens avenues for future research on the influences on and outcomes of ITSM capability.

In the remainder, we review related work on the theoretical foundation of organizational capability, IT service management and maturity models (Section 2), before we explain our methodology (Section 3), describe our process maturity scale (Section 4), present the results of our empirical validation (Section 5), and conclude the paper by outlining practical and theoretical implications (Section 6).

2 Related Work

2.1 Organizational Capability in the IS Literature

The resource-based view (RBV) of the firm [9] provides a perspective to conceptualize organizational capabilities as the application of the firm's assets to a desired end. According to the RBV, competitive advantage of a firm is determined by the utilization of its resources, which are inherently firm-specific, distributed heterogeneously across organizations, and costly to imitate [9]. One can broadly classify a firm's resources into assets, i.e. "anything tangible or intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market" and capabilities, i.e. "repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market" [7, p. 109]. In a similar vein, Amit and Schoemaker [8, p. 35] define capabilities as "a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end." Kishore et al. [16] emphasize that capabilities therefore do not only capture the codification of routines, e.g. through standardized process descriptions (ostensive aspect), but also their actual execution, i.e. the use of assets to achieve performance outcomes (performative aspect).

Organizational capability has also been characterized as a high-level construct that can have different sub-capabilities (or competences) [6]. Different models have been proposed to measure IT-related capabilities of IT user organizations. For example, Bharadwaj et al. [5] propose an IT capability construct consisting of six dimensions; Peppard and Ward [6] propose a different model using six 'competences' emphasizing that not all of these competences are solely located in the IS function. Literature on the capabilities of IT provider organizations, in contrast, focuses on particular types and lifecycle stages of the IT service provided. For example, Feeny et al. [17] study the core capabilities of business process outsourcing providers and identify three capability areas. Ethiraj et al. [18] study the project performance of software service providers and identify two classes of capabilities. Kishore et al. [16] build on the CMM-framework [19] and provide a model with four capabilities that can help IT vendors to ensure distinctive software quality.

Our study contributes to the emerging IT capability literature that focuses on specific IT provider capabilities. We seek a conceptualization of an ITSM capability that complements prior models in that it has a specific focus on IT services covering the entire IT service lifecycle. The need for such conceptualization is motivated by the increasing proliferation of ITSM frameworks that span the application of routines related to the strategy, design, transition, and operation of IT services [1]. Analogously to prior definitions of organizational capabilities [7, p. 109] we define ITSM capability as *repeatable patterns of actions in the use of assets (such as people, knowledge, technology, tools, plans, etc.) to provide IT services to a customer organization.*

2.2 IT Service Management and ITIL

ITSM is an approach to the management of an IT provider's daily activities with a specific emphasis on service-, customer- and user-orientation [12, 20]. In contrast to more technology oriented approaches to IT operations, ITSM considers its primary goal to design and provide IT services which meet the customers' requirements [2]. IT provider organizations utilize ITSM to achieve numerous benefits, such as an improved level of IT services [21-25], better financial control [21, 26], and better business/IT alignment [27].

ITIL is a set of defined practices which can be employed to implement ITSM [28]. A first version was published in the 80s and 90s. The second version (ITIL v2), published between 1999 and 2003, particularly the Service Support and Service Delivery books, became highly popular among practitioners. Service Support was the first book published in the v2 series and focusses on *operating* IT services [29] through five processes: incident management, problem management, configuration management, change management, and release management. Service Delivery, the second book, covers processes for *planning* IT services: service level management, financial management, IT service continuity management, availability management and capacity management [30]. The third version of ITIL was published in 2007 and consists of five domains, which describe the planning and operational processes required to manage IT services more comprehensively along its entire lifecycle: Service Strategy, Service Design, Service Transition, and Service Operation. It emphasizes the idea of a Continual Service Improvement by a dedicated section [31], even though practitioners still often focus on the core ITIL v2 processes [4].

In the course of ITIL's history, it has become a reference for ITSM concepts and terminology. While ITIL by now has become a de-facto standard [3, 4], there are a number of other frameworks with different emphases that firms can use alternatively or in addition, e.g. the Microsoft Operations Framework, HP IT Service Management Reference Model and IBM`s IT Process Model, the Control Objectives for Information and Related Technology (COBIT) [32], the Capability Maturity Model Integration for Services (CMMI-SVC) [33], and the ISO/IEC 20000 standard [34]. [32-34] particularly provide useful concepts for assessing the maturity of ITSM processes, which are discussed in the following.

2.3 Maturity Models for IT Service Management

Maturity models describe stages of evolutionary improvement in a specific process or domain [35]. For each stage of maturity they typically provide a general description and formally specify a number of specific characteristics along a set of well-defined attributes [36]. In the context of "repeatable patterns of action," maturity can be defined as the degree to which such pattern is explicitly defined, managed, measured, controlled, and effective as a process [19]. Maturity models not only cover the ostensive definition of organizational routines, but also the performative perspective and are therefore also used to describe the level of organizational capability (e.g., CMM [19]).

Process maturities can be aggregated to a domain level maturity either by a staged logic (i.e., certain processes need to be in place for a certain domain level), or a continuous logic (i.e., the domain-level maturity is reflected in the aggregate levels of process maturity). Maturity models can also be differentiated by the specificity of their process prescriptions. Some models define goals and attributes for each ITSM process individually (high specificity). Others only define generic attributes, which are applicable for all ITSM processes (low specificity). A third class of maturity models provides a mix of generic and specific process goals and attributes (which we label as medium specificity). Table 1 provides an overview of the four maturity models that are discussed briefly in the following.

Table 1. Comparison of maturity models

Framework	CMMI-CVS	COBIT 4.1	SPICE	ITIL
Maturity levels	Incomplete; Performed; Managed; Defined	Non-existent; Initial/ad hoc; Repeatable but intuitive; Defined process; Managed and measurable; Optimized	Incomplete; Performed; Managed; Established; Predictable; Optimizing	Initial; Repeatable; Defined; Managed; Optimizing
Attributes	Achieve Specific Goals; Institutionalize a Managed Process; Institutionalize a Defined Process	Awareness and Communication; Policies, Standards and Procedures; Tools and Automation; Skills and Expertise; Responsibility and Accountability; Goal Setting and Measurement	Process Performance, Performance Mgt., Work product Mgt., Process definition, Process deployment, Process measurement, Process control, Process innovation, Process optimization	Vision and steering; Process; People; Technology; Culture
Aggregation logic	Staged	None	None	None
Process specificity	Medium	Medium	Medium	Low

The capability maturity model (CMM) was originally designed to measure maturity in the domain of software development [19]. An extension of CMM, the Capability Maturity Model Integration for Services (CMMI-SVC) has a specific focus on a set of processes required to manage service provider organizations [33]. COBIT, a framework with a focus on IT governance, in its version 4.1 [32] defines a generic scale for the assessment of process maturity and further provides control objectives for the individual COBIT processes. ISO/IEC 15504 [37], also referred to as the Software

Process Improvement and Capability Determination (SPICE) framework, is an international standard for the assessment of software development processes. It is also applied for ITSM certification as specified in the ISO/IEC 2000 standard [34]. ITIL [38] since version 3 also provides some recommendations on how to assess the maturity of either the individual service management processes or the entire ITSM domain.

In summary, all reviewed maturity models define generic process attributes that can inform our own model development, while prior literature does not offer a synthesis of the different attribute perspectives. The six generic process attributes specified by COBIT 4.1 [32] are compatible with all four maturity models. CMMI-CSV [33], SPICE [37] and COBIT 5 [39] in addition cover specific goals and work products per ITSM process.

3 Methodology

To address our research objective of developing and validating an ITSM capability construct, we combined two different methodological approaches: In a first stage, we followed Becker et al.'s [10] recommended procedure to synthesize a model for assessing maturity on a process level from the different models we reviewed. In a second stage, we then applied standard procedures (e.g., [15, 40]) to develop a survey instrument that employs this multi-attributive maturity scale, and assessed its psychometric validity in a survey study. We argue that this two-stage approach is an appropriate one due to the abstract nature of our focal construct. That is, traditional instrument development procedures typically focus on the selection from a pool of items, whose sub-dimensions are known from theory and whose scales and are assumed a priori (e.g., Likert scales). In the case of the ITSM capability construct, however, the pool of items was given a priori (by established ITSM process taxonomies such as ITIL), while their dimensions were *not* known and their maturity scale is a non-trivial one with multiple attributes. This makes our first stage an indispensable prerequisite to the second stage.

As a starting point of our maturity scale development, we performed a comparison of the four process maturity frameworks reviewed earlier [32, 33, 37, 38] and generated brief textual descriptions for six CMM-based process maturity levels. In a first validation interview with an ITSM expert (ITIL expert level certification, 20 years of professional experience) our attention was called on the need to provide more fine-grained specifications for these maturity levels in order to ensure reliability of the measurement. In a second iteration, we therefore carried out a detailed comparison of the four frameworks regarding their generic attributes for ITSM process maturity. This comparison asserted the completeness of the six generic process attributes provided by the COBIT framework [32]. We then specified the detailed traits for each attribute on each maturity level in the course of a structural comparison of the scales provided in [33, 37, 38]. In the second iteration, we interviewed two further ITSM experts (both practitioner level, 15 and 5 years of experience) and received feedback that affirmed these attribute definitions despite some minor corrections. A third itera-

tion of the attribute model was validated in a focus group interview with three ITSM auditors, who asserted the fitness for purpose of a self-assessment through this process maturity scale.

In stage 2, we used this multi-attributive process maturity scale to assess common ITSM processes in an online survey study with ITSM key informants from 205 companies. The survey used the 26 processes of the four domains of ITIL v3 as items (including Continual Service Improvement as one separate process). In the online survey, each process was annotated with a short description (realized as a mouse-over pop-up box) and was assessed on the six-point maturity scale. The scale's levels and attributes (Table 1 with detailed descriptors), were provided on the previous questionnaire page (and as mouse-over descriptions during the assessment), where respondents had to confirm their understanding of this scale through a mandatory checkbox.

Throughout late 2013 and early 2014, members of the itSMF, a global association of Service Management professionals, from the regional chapters in Germany, Denmark, and Switzerland were invited via newsletters to participate in this study. Over this period, we received valid responses from 205 ITSM professionals with an average of 5.4 years of work experience. 83% stated to possess an ITIL/ITSM qualification of at least foundation level (foundation 34%, practitioner 12%, expert 36%, master level 1%). The median size of assessed IT provider organizations was 135 employees (mean 2,431).

In consonance with prior conceptualizations of organizational capability [5-9], we regard ITSM capability as a second-order construct that can be composed of multiple first-order dimensions (sub-capabilities). These sub-capabilities, in turn, are reflected in the multi-attributive measure of maturity of their associated ITSM processes, which corresponds to a continuous maturity aggregation logic. To assess the ITSM capability instrument regarding its (unknown) dimensionality, we first performed an exploratory factor analysis on the 26 process maturity items (KMO .94, cutoff eigenvalue>1). Only items with a loading of higher than 0.60 from their substantial factor and cross-loadings less than 0.40 from other factors were kept as measurements. These relatively strict thresholds for item selection have also been used in previous studies (e.g., [41]).

In the sense of a multi-trait validity check [42], we also compared our ITSM process maturity means with the implementation stage means reported in a global itSMF survey [4] (scale: not planned, planned next year, planned next quarter, in progress, in place) and in previous research [13] (scale: not started, early, halfway, advanced, completed). We then assessed the psychometric reliability and validity of the resulting three sub-dimensions with the 14 items that remained. Finally, we also tested the effect of these three sub-dimensions on a mean-indexed measure of all 26 items. The results of these measurement model and structural model tests are presented in Section 5.

4 A Process Maturity Scale for Measuring ITSM Capability

The process maturity scale, which is the result of stage 1 of our instrument development approach, is summarized in Table 2, with brief descriptors for each attribute and maturity level. A full version with detailed descriptors can be supplied on request.

The first attribute, *awareness and stakeholder communication*, addresses the need to recognize all process requirements and communicate them throughout the organization and to external stakeholders. On level 0, there is no perceived necessity for the process (no awareness). On level 1, issues impacting process performance are sporadically reported to relevant stakeholders in a reactive, informal manner (partial awareness). On level 2, management communicates observed overall process issues regularly (wide awareness). On level 3, there is a formal and structured communication of all process performance issues and requirements (full awareness). On level 4, there are regular reviews of process and function effectiveness completed by process managers and discussed with stakeholders to validate continued effectiveness (comprehensive reporting). On level 5, process management communicates proactively to all relevant stakeholders based on trends.

Table 2. Process maturity scale

Attribute	0. None	1. Initial	2. Repeatable	3. Defined	4. Managed	5. Optimized
Awareness and stakeholder communication	No awareness	Partial awareness	Wide awareness	Full awareness	Comprehensive reporting	Proactive communication
Plans and procedures	No process	Ad hoc process	Informal process	Process formally defined	Robust process execution	Good practice process
Tools and automation	No tools	Only standard desktop tools	Tools individually managed	Tools centrally managed	Tools fully integrated	End-to-end automation
Skills and expertise	Required skills unknown	Required skills identified	Informal ad hoc training	Formal training plan	Long-term training program	Continuous skill improvement
Responsibility and accountability	Responsibilities unknown	No responsibility allocation	Informal responsibilities	Defined responsibilities	Responsibilities fully dischargeable	Responsibilities fully harmonized
Goal setting and measurement	No goals	Unclear goals	Partial goals	Goals defined globally	Goals enforced	Proactive control

Plans and procedures covers the adoption of good practices, the documentation of processes and the institutionalization of regular improvements to policies, standards

and procedures to increase process efficiency. On level 0, there is no identified process (no process). On level 1, parts of the process activities are performed ad hoc when needed without identification of the overall process (ad hoc process). On level 2, key process work products are created informally. Parts of the process are repeatable depending on individual expertise (informal process). On level 3, formal plans and policies are commonly established and include all key process descriptions and outputs (process formally defined). On level 4, the process is operating effectively with little deviations (robust process execution). On level 5, the process is executed and controlled according to external good practice (good practice process).

Tools and automation addresses the level of automation of the process, the tools which are applied to increase process efficiency and their level of integration. On level 0, all activities are executed manually (no tools). On level 1, desktop tools are sporadically used for single purposes (only standard desktop tools). On level 2, there is some use of dedicated or self-developed tools owned by individuals (tools individually managed). On level 3, tool use is coordinated within a defined, central plan (tools centrally managed). On level 4, tools usage is linked to all key process areas to automate the process and monitor critical activities (tools fully integrated). On level 5, tools are fully integrated to automatically detect exceptions and proactively control the process (end-to-end automation).

Skills and expertise covers how skill requirements are defined and documented as well as how training and further education is organized. On level 0, minimum skill requirements for critical process areas are unknown (required skills unknown). On level 1, minimum skill requirements for process are identified but there is no training available (required skills identified). On level 2, informal on-the-job training is provided when needed (informal ad hoc training). On level 3, a formal training plan is defined outlining all required skills (formal training plan). On level 4, a training program is implemented planning, assessing and monitoring all process skill requirements (long-term training program). On level 5, a continuous improvement of skills through leading learning concepts and systems is in place, including use of external experts (continuous skill improvement).

Responsibility and accountability addresses whether responsibilities and accountabilities are defined and accepted and whether process owners are empowered to make decisions. On level 0, process responsibilities and accountabilities are not identified (responsibilities unknown). On level 1, responsibility is broadly unclear and assumed situationally (no responsibility allocation). On level 2, responsibilities are informally defined and allocated (informal responsibilities). On level 3, a formal definition of process ownership, responsibilities and accountabilities is in place (defined responsibilities). On level 4, defined persons have full authority to discharge responsibility (responsibilities fully dischargeable). On level 5, responsibilities are accepted and cascaded down throughout the organization in a consistent fashion (responsibilities fully harmonized).

Goal setting and measurement covers whether clear goals are defined for the IT process and activities. Further it is assessed whether the achievement of the objectives is measured and whether the measurement is applied for continuous improvement of the process and the efficient delivery of process results. On level 0, no process goals

are defined (no goals). On level 1, the objectives of the process remain broadly unclear and are not embedded within the organization's overall strategy (unclear goals). On level 2, goals are only defined for selected activities and stakeholders (partial goals). On level 3, goal setting is routinely performed for all process stakeholder and process outcomes are linked to business goals (goals defined globally). On level 4, formal measurement and control is fully established to assess process performance and take corrective actions (goals enforced). On level 5, goal setting, measurement and control is integrated linking IT performance to business goals by a global application of causal analysis techniques (proactive control).

These attributes were used by the survey participants to assess the maturity of the 26 ITSM processes described by ITIL. To avoid a tendency of overestimating, participants were asked to assess the maturity level of the process by taking the *lowest* maturity level of all six process attributes.

5   Empirical Validation Results

Table 3 presents the exploratory factor analysis results together with mean and standard deviation per process and, for illustrative purposes, an implementation rank calculated from [4, p. 15]. The multi-trait comparison to the implementation stage measures shows that the 26 maturity means are highly correlated both with the implementation stage means reported in [4] (r=0.86) and those reported in [13] (r=0.85). This suggests that those ITSM processes implemented at an earlier stage generally also possess a higher maturity, for which our scale provides more fine-grained levels.

The results of the exploratory factor analysis indicate that the 26 ITSM process maturity items can be explained by just three underlying factors (Table 3). After varimax rotation, it shows that the first extracted factor, primarily loads on the items of the two ITIL domains Service Strategy and Service Design. On the one hand, this finding fits the ITIL logic, in which these two categories stand at the beginning of the Service Lifecycle. On the other hand, it also makes clear that organizations implementing ITSM do not at all distinguish between these two categories. This motivates us to label this first ITSM sub-capability jointly as *service planning capability*. The ranked implementation stages (right column) inform us that these are processes with a generally lower stage of implementation.

The second emerging factor loads distinctively on most items of the Service Operation domain as well as on the change management process item, which is part of the Service Transition category (Table 3). While this appears remarkable at first sight, it becomes more conceivable when looking at the implementation rank. In fact, change management is, together with the core Service Operation processes among the first and most maturely implemented processes and thus part of day-to-day IT operations.[1] This motivates us to view the change management process, de facto, as a part of the second ITSM sub-capability, which we label *service operation capability*.

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[1] Also note that in ITIL's previous version 2, change management was part of the Service Support category, together with the other mentioned Service Operation processes.

A third factor emerges that loads distinctively on three of the processes in the Service Transition domain (Table 3). These processes have in common to deal with the preparation, deployment and post-implementation evaluation of IT services. This ITSM sub-capability, which we label accordingly *service transition capability*, might be particularly relevant for IT providers that regularly implement changes to their system landscape, e.g. custom software and application management providers (as opposed to pure IT infrastructure providers).

The exploratory factor analysis also shows that the remaining processes lay somewhat 'in-between' these three important ITSM sub-capabilities. Thus, while this does not lessen their importance for implementing ITSM, we may drop them from our survey instrument for the benefit of obtaining a parsimonious and clear-cut measurement instrument.

Table 3. Factor analysis results of ITSM processes (with implementation rank)

ITIL domains and ITSM processes		Component[a]			M	SD	Impl. rank[b]
		1	2	3			
Serv. Strategy	Service Strategy	.58	.53	.12	3.27	1.32	23
	Service Portfolio Mgt	*.61*	.40	.23	2.83	1.27	20
	Financial Mgt	*.63*	.15	.24	3.06	1.41	21
	Demand Mgt	*.70*	.14	.39	2.68	1.28	24
	Business Relationship Mgt	*.77*	.24	.20	2.93	1.33	18
Service Design	Service Catalog Mgt	.44	.53	.23	2.94	1.30	9
	Service Level Mgt	.63	.51	.08	3.26	1.39	5
	Availability Mgt	*.76*	.30	.27	3.01	1.40	15
	Capacity Mgt	*.81*	.23	.24	2.88	1.35	16
	IT service Continuity Mgt	*.67*	.29	.30	3.20	1.42	12
	Information Security Mgt	.57	.39	.25	3.50	1.48	6
	Supplier Mgt	.58	.18	.45	2.96	1.37	14
	Design Coordination	.63	.09	.48	2.45	1.27	26
Service Transition	Trans. Planning & Support	.54	.32	.45	2.80	1.31	22
	Change Mgt	.30	*.71*	.29	3.68	1.32	2
	Asset and Configuration Mgt	.21	.62	.46	3.26	1.36	7
	Release and Deployment Mgt	.23	.36	*.74*	3.20	1.34	10
	Service Validation & Testing	.27	.24	*.83*	2.91	1.30	19
	Evaluation Mgt	.34	.18	*.76*	2.86	1.37	17
	Knowledge Mgt	.40	.28	.52	2.62	1.25	13
Serv. Operation	Event Mgt	.53	.50	.21	3.23	1.47	11
	Incident Mgt	.11	*.87*	.17	4.26	1.31	1
	Request Fulfillment	.19	*.78*	.10	3.78	1.36	3
	Problem Mgt	.28	*.64*	.40	3.42	1.36	4
	Access Mgt	.40	.49	.34	3.56	1.28	8
Continual service improvement		.42	.46	.44	2.70	1.30	25

[a] varimax rotated, components with substantial loadings >0.6 and cross-loadings <0.4 highlighted

We assess the psychometric properties of these three factors spanned by the 14 items (the measurement model) by using the quality metrics recommended by the partial least squares (PLS) method, see Table 4. Criteria for convergent validity and internal reliability are above the recommended thresholds (Alpha>0.70; AVE>0.50; CR>.70), indicating that the process maturities for each competence are sufficiently related [43] . Factor correlations are below the square root of AVE and item-to-factor cross-loadings are also clear-cut (table available on request), so that we are also confident that the three dimensions are sufficiently unrelated, i.e. discriminantly valid.

Table 4. Construct validity and reliability assessment

ITSM competence	Quality criteria			Correlations (diagonal *sqrt AVE*)		
	Alpha	*AVE*	*CR*	*1*	*2*	*3*
1 Planning	.895	.657	.920	***.811***	-	-
2 Transition	.876	.802	.924	.644	***.895***	-
3 Operation	.861	.705	.905	.609	.583	***.840***

Finally, we assess the structural properties of the three factors and their relationship to an overall ITSM capability. For the purpose of comparison, we operationalize the ITSM capability variable as a mean index over all 26 process items. The three factors jointly explain R^2=96.1% of the variance of the ITSM capability index variable, which supports validity of this second-order construct. This high value also suggests that the 12 items that had been dropped are in fact negligible to measure ITSM capability. Figure 1 summarizes the structural model test results and illustrates how the developed process maturity scale feeds into this ITSM capability model.
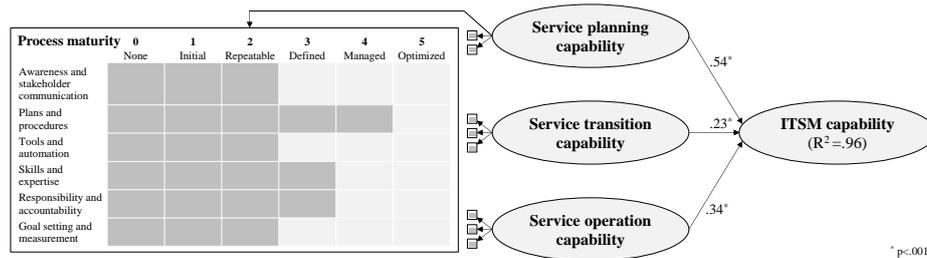

Fig. 1. ITSM Capability Model

6   Conclusion

The need for a parsimonious, yet reliable way to measure the capability of IT service providers led us to theoretically conceptualize and develop a measurement instrument

for *ITSM capability*, defined as *repeatable patters of actions in the use of assets to provide IT services to a customer organization*. This instrument comprises a multi-attributive maturity scale and suggests the existence of three service management sub-capabilities crucial for today's IT service providers: *service planning capability*, *service transition capability*, and *service operation capability*. Our empirical validation provides support for the psychometric reliability of the maturity scale and the adequacy of the three-dimensional model to sufficiently represent an organization's overall ITSM capability.

ITSM practitioners can use this instrument to benchmark organizations in a simple and reliable way and thereby obtain a comprehensive overview of their ITSM capabilities, potentially in comparison to others. Due to its inward perspective on key attributes of process maturity, this can also unveil potential areas of improvement, which makes it more flexible and less heavyweight than most commercial ITSM assessments. As one of the interviewed ITSM experts phrased it: "I think this [process maturity scale] is some of the best stuff I have seen in a self-assessment, because if you go to other self-assessment things, it's very much like this [pointing at the simple description of maturity levels]. But now you have it [i.e., a detailed multi-attribute scale] in here, […] and that could give a much better basis for having a more precise assessment."

At the same time, this second-order ITSM capability construct is theoretically grounded in a resource-based view and includes ostensive and performative aspects, which makes it considerably broader and more sophisticated than the measurements previously employed in academic ITSM studies (e.g. [12, 13]). This opens promising avenues for future research on the emerging field of ITSM, which despite high practical relevance is still regarded to be in its infancy [12]. For example, research designed at explaining the antecedents and outcomes of ITSM capability can be facilitated by our measurement instrument. Future research may also investigate potential interaction between the three ITSM capabilities, e.g. whether they simply add up or even reinforce each other.

The following limitations merit consideration: First, our validation based on self-reports of ITSM professionals, which may or may not have introduced certain biases. Second, we solely focus on ITIL as a taxonomy for ITSM processes. Although ITIL has been co-developed by numerous stakeholders and widely been accepted, one might find additional facets of ITSM capability that did not enter our factor analysis. Finally, building on the resourced-based view, we measure only inward traits of ITSM capability, not outcomes. Other researchers might also find it helpful to measure how capability is reflected in different dimensions of strategic goal attainment.

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