Schmiedel, T., vom Brocke, J., & Recker, J. (2014). Development and Validation of an Instrument to Measure Organizational Cultures' Support of Business Process Management. ***Information & Management, 51*****(1), 43-56.**

Development and Validation of an Instrument to Measure Organizational Cultures' Support of Business Process Management

Abstract

The purpose of Business Process Management (BPM) is to increase the efficiency and effectiveness of organizational processes through improvement and innovation. Despite a common understanding that culture is an important element in these efforts, there is a dearth of theoretical and empirical research on culture as a facilitator of successful BPM. We develop the BPM culture construct and propose a validated instrument with which to measure organizational cultures' support of BPM. The operationalization of the BPM culture concept provides a theoretical foundation for future research and a tool to assist organizations in developing a cultural environment that supports successful BPM.

Keywords

Business Process Management, Organizational Culture, BPM Culture, Measurement Instrument, Construct Development, Scale Development

Introduction

Business Process Management (BPM) has become a recognized field of research in the Information Systems discipline. The purpose of BPM is to increase the efficiency and effectiveness of organizational processes through improvement and innovation [1]. Early approaches in both research and practice have focused on the role of information technology (IT) in supporting BPM [2], but a more holistic understanding of BPM has been established since that recognizes the strategic and governance elements of BPM, as well as soft factors, such as people and culture issues [3]. Culture in particular has often been identified as critical to the success of business processes and IT-driven change [4], both as a driver and a potential inhibitor of BPM initiatives [5, 6].

An important concept that has been shaped in this context is the notion of a *BPM culture*, that is, a culture that is supportive of BPM objectives. While some researchers have referred to this concept in their work [7, 8], its meaning was not fully explored until recently. In a prior global Delphi study with experts from BPM research and practice, we analyzed and conceptualized the characteristics of an organizational culture that supports BPM and identified four distinct values that define the BPM culture concept [9].

Still, there is little knowledge about how various cultural concepts or conceptualizations of culture intervene in BPM projects. One possible reason for the dearth of research in this area is the lack of an appropriate operationalization of culture. Empirical studies of cultural settings and their influence on processes or outcomes of BPM require reliable and valid measurement instruments. These would also provide practitioners with an analysis and benchmarking tool that can be used to examine the extent to which their organizational culture facilitates their BPM approach.

To address this gap, *the purpose of this paper* is to develop and validate a measurement instrument with which to assess the supportiveness of an organizational culture for BPM. We follow a multi-stage approach to instrument development that involves experts from BPM research and practice around the globe. As BPM is an established management approach worldwide, we deem an international study necessary. We report on construct and scale development, operationalization, and measurement instrument validation and application, building on and extending the definition of the BPM culture concept from a previous Delphi study [9].

We proceed as follows. Next, we provide a relevant theoretical background on the main concepts of our research—BPM, organizational culture, and the notion of BPM culture—which represents the conceptual basis for our study. Then we provide an overview of the methodological approach and report on the procedure we followed in the various stages of instrument development and validation. Subsequently, we discuss our findings, reporting on the implications of our study for research and practice and pointing out the limitations of our approach. We conclude with a summary of contributions.

Background

Business Process Management

BPM is a comprehensive approach to realizing efficient and effective business processes in an organization [3]. Its process view contrasts the functional view, which originates from the division of labor in Taylorism. In focusing on transcending departmental boundaries, BPM builds on several management approaches, embracing aspects of the total quality management (TQM) approach from the 1980s and the business process re-engineering (BPR) approach from the 1990s [1]. While approaches like these differ in their specific focus (e.g., quality, radical process change), they contribute to the emergence of BPM as a holistic management concept.

BPM has not always been seen as a comprehensive approach, as early research on BPM focused mainly on technical aspects of process management, such as workflow optimization through ERP systems and technological support for process modeling [10, 11]. Only recently has awareness come to the fore that BPM requires a holistic consideration of additional factors, such as strategic alignment, governance, methods, people, and culture, (for an overview see [12]), with culture increasingly recognized as a key element in BPM's success in terms of process efficiency and effectiveness [6].

While many authors have acknowledged the importance of culture in BPM, perceptions of its role in BPM differ, as does the concept of culture, which can refer to diverse cultural groups, such as national, organizational, and work groups culture. Therefore, the following sections examine in more detail the meaning of the culture concept as it is discussed in the literature, with a specific focus on culture at the organizational level and the concept of BPM culture as a specific facet of organizational cultures.

Organizational Culture

While definitions of the culture concept differ widely, many culture researchers agree that values are the core elements of culture [13, 14]. Values are invisible guiding principles that determine visible behavior and structures in social interaction [13, 15]. In other words, typical actions and structures within a group, be it a nation, a region, a profession, an organization, or a work group, are largely determined by a set of values shared among the members of the group [14].

Individuals can belong to many cultural groups and have several cultural identities [16] that influence their value system, so a cultural group cannot be considered homogeneous in the sense that all members of the group think and act alike. Despite these differences, commonalities among the members of a cultural group are based on shared values. The complexity of the organizational culture concept also is underscored by the fact that an organization is comprised of many work group cultures that are themselves comprised of members of multiple national cultures.

Despite the complex interrelationship between organizational culture and other group cultures, our research focuses on organizational culture as one of the typical groups that is investigated in research on culture [12, 17]. Specifically, this paper addresses one particular facet of organizational culture, namely BPM culture [12]. The next section elaborates on the specifications of the BPM culture concept and provides details on the conceptual basis of our study.

BPM Culture

Several studies have referred to the notion of *BPM culture* –which is defined as a culture supportive of achieving BPM objectives [1, 7, 8, 18]. While authors like Zairi [7], de Bruin and Rosemann [19], and Jesus et al. [8] provide some insights beyond this general definition, researchers have recognized an overall lack of specification of the BPM culture concept in extant studies [12].

For example, Zairi [7] proposes a set of rules that support the development of a BPM culture, yet these give only initial ideas on the dimensions that make up BPM culture. Similarly, the BPM maturity model from de Bruin and Rosemann contains culture as an important factor in BPM [3]. The identified capability areas of this factor inform research in understanding cultural dimensions that support BPM. Jesus et al. describe on a general level how the diffusion of BPM culture can be realized [8]. While sources like these provide valuable first insights into the dimensions that make up the BPM culture concept, specific empirical research is still required that goes beyond deriving concept specifications from few literature sources [18].

This research need was recently addressed through a global Delphi study that examined and defined the characteristics of an organizational culture that facilitates BPM in realizing efficient and effective business processes (i.e., BPM culture) [9]. The Delphi study involved 27 BPM experts from academia and practice from 13 countries. Over several rounds of consensus-finding, the study identified and defined four distinct cultural values that facilitate BPM: customer orientation, excellence, responsibility, and teamwork (Table 1). They are also referred to as *CERT values* based on their acronym.

Construct	**Definition**
Customer orientation	The proactive and responsive attitude towards the needs of process output recipients.
Excellence	The orientation towards continuous improvement and innovation to achieve superior process performance.
Responsibility	The commitment to process objectives and the accountability for process decisions.
Teamwork	The positive attitude towards cross-functional collaboration.

Table 1. CERT value constructs that define the BPM culture concept [1, 7, 8, 9, 18, 19]

Building on the conceptualization of the CERT values, the research presented in this paper develops an instrument to measure the extent to which a BPM culture is part of an organization's culture. The next section describes the development of this measurement instrument in that it introduces the general methodological approach and provides insights into the various stages of our research.

Methodology

An initial analysis of the literature revealed a lack of suitable items for measuring the four defining constructs of BPM culture listed in Table 1, so we chose to develop appropriate operationalizations in an effort to design an instrument that specifically and directly measures those constructs. Building on well-recognized and comprehensive approaches for instrument development and validation (e.g., [20-22]), we employed a multi-stage approach for developing and testing a scale to measure how well an organizational culture supports BPM. We perused a variety of data collection and analysis methods to operationalize the four defining elements of such a BPM culture in order to ensure the reliability and validity of the measurement instrument. Figure 1 provides an overview of the two-phase research process we followed to *develop* and *validate* the instrument and summarizes the key techniques employed.

In the first stage of the instrument development process, item creation, we used a literature review, a survey, and in-depth interviews to create pools of candidate items that are likely to exhibit high content validity. In the second stage, we asked experts to identify domain categories (substrata) among the candidate items in order to establish convergent and discriminant construct validity among the items. In stage three, we conducted a survey to assess the degree to which the identified items measure the intended constructs (content validity) and ranked and selected items based on the results. In stage four, the selected items were sorted into categories to assess their convergent and discriminant construct validity and to revise them where necessary.

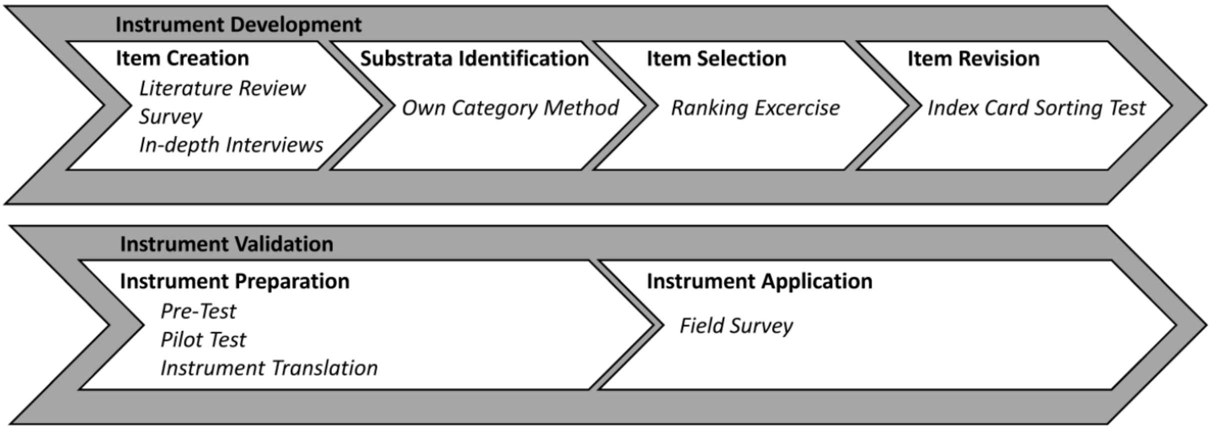

Figure 1. *Research process of instrument development and validation*

The instrument validation process consisted of a preparation and an application stage. The preparation stage was comprised of a pre-test to assess the understandability of the survey in face-to-face meetings, and a pilot test to improve the instrument based on first statistical analyses. The instrument was also translated into German to broaden its application. In the application stage, we conducted a field survey as a final assessment of the measurement instrument and confirmed the instrument's validity and reliability.

The expert panels and respondent populations involved in the various stages of the research process varied in size from 4 to 222 (Appendix A). The size of each panel or sample was based on recognized guidelines for the methods that were applied in each stage. This approach allowed us to develop the instrument in in-depth sessions with smaller expert panels and validate it in a cross-sectional survey with a larger sample of BPM practitioners as respondents. Reliance on a variety of sources of data with several panels and samples is typically recommended in construct development [20-22]. The next section provides details on the research process.

Construct Development and Instrument Validation

Stage One: Item Creation

The purpose of this stage was to create items with high content validity regarding the construct definitions [23], so we first conducted a literature review to identify candidate items in existing measurement instruments [20]. For the literature search, we combined key terms of each of the construct definitions with terms like "scale," "measure," and "instrument" in order to identify relevant sources in databases in the field of IS and management, such as EBSCO BSP, AIS Electronic Library, and Google scholar [17]. This approach generated a pool of initial items for each construct. The main sources identified from which to derive candidate items were [24, 25, 26, 27] for *customer orientation*, [24, 27, 28, 29] for *excellence*, [30, 31, 32, 33] for *responsibility*, and [25, 34, 35, 36] for *teamwork.*

It was apparent that most of the existing measurement items had little or no relationship to a business process context. Before selecting and adjusting the existing items, we therefore conducted an additional survey of BPM experts from academia and practice who had contributed to the contemporary body of knowledge in BPM, as captured in the International Handbook on BPM [37] (Appendix A). In this survey, we asked the experts to provide an explanation of the values identified as being supportive of achieving BPM objectives. Three independent researchers coded the responses we received from the BPM experts, first individually and then in consensus discussions. We used the results to create candidate items.

In addition to the literature review and the survey, we conducted semi-structured, in-depth interviews with experts from academia and practice who had contributed to the contemporary discussion on BPM at the BPM Conference 2011. In the interviews, we presented the four constructs and their definitions and asked the experts how they thought these values become visible in an organization—that is what kind of actions or structures they could identify as representing the four values. We transcribed and coded each of the interviews. Together with the survey findings, these results served as input for the creation of new candidate items.

We followed two principles in creating new items and adjusting existing items from the literature review: We applied the criteria of Ajzen and Fishbein [38] in that we specified each item by including the actual behavior (e.g., contributing to continuous improvement), the target of the behavior (e.g., business processes), the context (e.g., our organization), and where applicable, the time frame (e.g., in the past year) [20, 21]. We also followed the recommendations of MacKenzie et al. [22] in ensuring that the wording of the items was simple and precise (e.g., did not include double-barreled items like “managers are motivated and accountable”), that the items did not contain ambiguous or unfamiliar terms (e.g., “critical parameter”), and that a complicated syntax was avoided.

Following these principles, we created eleven to eighteen new items per construct from the survey and interview results. Adding the adapted items from the literature review, our initial item pools included 51 to 119 items per construct (Table 2), from which we selected appropriate candidate items in three rounds [20]: First, we excluded items that were too narrow in focus or that were applicable only in particular situations (e.g., “Close collaboration between R&D and manufacturing”). Second, we excluded conceptually or semantically redundant items (e.g., “We measure customer satisfaction,” since its content was already included in “Customer satisfaction is frequently assessed to minimize issues in our processes”). Third, we excluded ambiguous items that were likely to load on more than one factor, (e.g., “Our organization aims at improving customer processes,” which could refer to both excellence and customer orientation).

Constructs	**Customer Orientation**	**Excellence**	**Responsibility**	**Teamwork**
No. of Initially Identified Items (Literature Review)	104	51	39	53
No. of Initially Created Items (Survey and Interviews)	15	18	12	11
Total No. of Initial Items	119	69	51	64
No. of Candidate Items Selected	16	15	13	16

Table 2. Overview of item pools

Following established guidelines on instrument development, we considered item pools of at least ten candidate items per construct sufficient to cover all possible dimensions of the theoretical constructs [21] and arrived at item pools of thirteen to sixteen items per construct. Then, in a final revision cycle, we reviewed and adjusted all items to ensure they met the principles for our candidate items. Next, we report on the identification of underlying categories among the candidate items.

Stage Two: Substrata Identification

The purpose of stage two was to identify domain substrata—that is, construct categories—among the candidate items in order to ensure a high level of construct validity of the items in terms of convergent and discriminant validity [39]. The resulting domain categories represent the various dimensions of meaning that a construct may cover [21]. To determine these categories, we followed the own category method as it has been applied in other instrument-development studies [21], asking a panel of experts to identify and label domain categories among the candidate items of each item pool. The items that were sorted in one category had to be the ones that were most similar to others in the category and most dissimilar to those in other categories [20]. The number of identified categories was determined by the experts.

Following the suggestions in [21], our expert panel for the substrata identification consisted of four recognized BPM experts from four countries who were working in either academia or practice (Appendix A). The experts were sampled based on active participation in research on culture in BPM and/or in the establishment of process orientation in organizations (e.g., [12, 18]). We contacted each expert individually and conducted the categorization procedure through web-based meeting platforms. The items were presented in Excel sheets via shared screens so the experts were able to sort the items in categories and label the identified domain substrata. To ensure the categorization procedure was clear to the experts, we used a simple categorization example to demonstrate the method beforehand, similar to the approach suggested in [21].

In addition to the categorization task, we asked the experts to comment on the items' clarity and to suggest ways the items could be improved. Finally, we asked whether they would add items to cover additional facets of the construct domains. After each categorization round, we revised the items where appropriate and added items that the experts had suggested. Two independent researchers then clustered the categories the four experts had identified, with the requirement that the final categories were neither overlapping nor ambiguous. To reduce subjectivity in the consolidation process, the coders first clustered the categories individually before meeting to find consensus on the codification of the final categories [39]. In the individual clustering, the coders agreed in their placement of 80 percent of the experts' categories, reaching a Kappa value of 0.69, which indicates sufficient inter-coder reliability [20]. Table 3 provides an overview of the final categories that the coders identified for each of the four item pools.

CERT values (construct codes)	**Customer Orientation (C)**	**Excellence (E)**	**Responsibility (R)**	**Teamwork (T)**
Substrata (construct codes)	external perspective (C_e)	continuous improvement (E_ci)	accountability (R_a_)	formal structures (T_f)
	internal perspective (C_i)	innovation (E_i)	commitment (R_c)	informal structures (T_i)

Table 3. Substrata/domain categories of the CERT values

Stage Three: Item Selection

Following the identification of domain categories, we assessed the content validity of the candidate items. Based on the revised and extended item pools from stage two, we conducted a survey among BPM experts to determine whether the candidate items match our construct definitions [39]. We provided the definition for each construct, and the experts assessed the candidate items on a 7-point scale in terms of the degree to which they deemed items were helpful in measuring the construct (1 indicated a very weak measure and 7 a very strong measure.). The experts were also asked to provide comments and suggestions on how to improve the items (e.g., regarding wording, fit to the concept definition, fit to BPM).

The expert panel for this stage consisted of both academics and practitioners. We selected experts from academia who are active researchers in the field of BPM and hold a PhD degree, and experts from practice who actively contribute to BPM-related discussions and hold a senior position or key role in BPM initiatives or BPM consulting. Overall, we invited twenty BPM experts to participate in our study and received feedback from eleven, for a response rate of 55 percent. Compared to similar recent scale development reports [21], our expert panel was an appropriate size for this stage of our study.

We ranked the experts' individual responses based on the calculated averages of the perceived correspondence between the items and the construct definitions. The ranking of the candidate items provided an overview of the content validity of all candidate items and allowed us to identify items for elimination. We deemed items that received a moderate or weak average measurement rating (scores of 1 to 4 on the 7-point scale) as having little potential for content validity and removed them from the list of candidate items. We approved, revised, or deleted the remaining candidate items, considering the ranking data, the qualitative feedback, and the domain categories of the theoretical constructs that were identified in the previous stage.

Some candidate items were revised because they were ambiguous or unclear (e.g., rewording the item "Our organization studies customer expectations to incorporate them in internal processes" to "Our organization incorporates customer expectations in internal processes"), while others were deleted or merged because the statements were redundant or weak (e.g., deletion of the item "Employees of our organization take ownership of the processes they are involved in," as it was similar to and weaker than the item "Employees of our organization go beyond their formally defined responsibilities to achieve process performance targets"). In the next stage of our research, we checked the items' construct validity.

Stage Four: Item Revision

To assess both convergent and discriminant construct validity of the items, we conducted an index-card-sorting test [20], asking several groups of experts to sort the candidate items from stage three into categories. For the sorting test, it is recommended that the expert panel largely reflects the target population of the field study in order to maximize the chance that the final measurement items will be well understood [21]. Our target population for the field study includes practitioners with diverse backgrounds in BPM expertise, such as practical vs. academic knowledge and no professional experience vs. professional experience (Appendix A). We ensured that the practitioners represented a broad range of industries, including experts in the chemicals, consultancy, energy, engineering, healthcare, and information technology industries. Four experts participated in each of the four sorting rounds.

Prior to the sorting task, we gave detailed instructions and conducted a trial sorting task to ensure that the experts fully understood the procedure. For this task, we provided the experts with items in categories of nutrition (e.g., food, drinks) and asked them to sort the items according to the instructions given [20]. The sorting example also contained ambiguous and indeterminate items to demonstrate these cases.

After the trial sorting task, the items from stage three, which were printed on index cards, were given out randomly to the experts. The test was split into four rounds [20, 21], in the first and third of which the experts were given no categories—that is, they sorted the items so those with most similar meanings were together in one category and then labeled the categories. In the second and fourth rounds, the experts were given categories (i.e., the domain substrata identified in stage two) and sorted the item cards into those categories. In addition to the categorization, we asked the experts to indicate whether any items were ambiguous or indeterminate and to indicate two items per category that they deemed most appropriate for measuring the value construct to which they belonged.

The two expert groups that were to sort the candidate items in given categories received cards with the items, as well as cards with the domain categories of our constructs and with categories for ambiguous and indeterminate items. In addition, we provided green, yellow, and red cards with which the experts indicated the two most appropriate items per category to measure the construct (green), the items that were clear and appropriate (yellow), and the items that were difficult to understand in terms of wording (red). The two expert groups that were not provided with categories received only cards with the candidate items plus plain cards with which to label the categories they identified. Four of the experts required a virtual meeting, which we set up in the same way as described in stage two.

Convergent and discriminant validity was improved through every sorting round. Items were revised after each round based on the sorting results. Considerable attention was given to those items that were identified as ambiguous or indeterminate and those that were assigned to new categories, which were reworded to fit the intended category better. For this task, the expert comments and suggestions on how to improve the items served as a primary source for the item revisions. Items that were repeatedly misplaced or that showed little potential for convergent and discriminant validity were dropped [21].

To measure improvement after the item revision task, we calculated inter-judge reliability in every sorting round [20]. Table 4 provides an overview of the average Kappa and item-placement ratio values of each round. Increases and decreases in the values between the sorting rounds are due to our having alternated the sorting rounds between those in which the experts were given the categories and those in which they were not. In the latter, sorting proved to be more difficult, as was expected [21], so the Kappa and placement ratio values were lower than they were in the sorting rounds when the categories were provided. Even so, across all rounds, the values increased, indicating increased convergent and discriminant validity of the items. In round four, generally recommended inter-judge reliability levels of at least Kappa > 0.6 and placement ratio > 0.8 were achieved, suggesting appropriate levels of agreement [20, 39]. Based on the overall improvement of the items at this stage, we deemed the operationalization sufficiently valid to prepare the instrument for application.

Measure	**Round 1**	**Round 2**	**Round 3**	**Round 4**
Kappa	0.29	0.42	0.26	0.67
Placement Ratio	0.59	0.72	0.62	0.82

Table 4. Overview of inter-judge reliability in the index-card-sorting test

Stage Five: Instrument Preparation

This stage served to refine the measurement instrument through a pre-test and a pilot test. In addition, we translated the instrument to allow it to be applied in different geographic regions. The pre-test was conducted with a panel of ten experts, individuals from academia and practice, some with and some without knowledge of our study. We asked each participant to fill out the online survey in a virtual or face-to-face meeting and to provide comments and suggestions while they completed the survey on how to improve the measurement instrument further. Based on notes we took during the meetings, we revised the instrument where appropriate after each pre-test, so the understandability of the instrument was assessed and improved in an iterative process.

Following the pre-test, we conducted a pilot test to assess the validity and reliability of the instrument. The panel included mainly fully employed practitioners and students with demonstrated track records of BPM working knowledge plus several academics who were active in the BPM domain (Appendix A). Overall, 69 persons were invited in the pilot test phase, and 34 participants filled out the survey, resulting in a response rate of 49 percent. Based on the data we gained from this test, we conducted an exploratory factor analysis to assess the validity and reliability of the instrument and revised items that did not meet required thresholds.

Before applying the instrument in a field survey, we translated it into German so it could be applied more broadly, across cultural settings (e.g., North America and Central Europe). The translation was realized in an iterative process: The English version was reviewed by a native English speaker, and after minor grammatical changes were made, the instrument was translated into German by a bilingual speaker. The resulting tentative draft was then iteratively refined by two language experts whose native language was English (and who were fluent in German) and two language experts whose native language was German (and who were fluent in English). In addition, two domain experts and three potential survey participants checked the translation and provided suggestions for improvement during the translation process, ensuring the understandability of the items in a BPM context. Overall, ten people were involved in developing a valid translation of the measurement instrument. (The German translation of the items can be obtained from the authors upon request.)

Stage Six: Instrument Application

Since the purpose of the field survey was to assess and confirm the validity and reliability of the measurement instrument, we conducted a cross-sectional survey of BPM practitioners from various industries and cultural settings around the globe. The survey was administered online to maximize geographical reach and minimize response time and administration costs [40]. We contacted practitioners in the field of BPM via social networks (e.g., LinkedIn and Xing) and announced the survey in online practitioner forums (e.g., BPTrends) and online groups (e.g., BPM Forum and BPM Professionals Group). Overall, 222 practitioners participated in our survey. As the demographic statistics in Table 5 show, there was a high share of German-speaking participants in the sample. To account for potential response bias, we conducted an independent samples t-test on key demographic and survey responses, which revealed no significant differences between German- and English-speaking participants.

To examine the validity and reliability of our measurement instrument for BPM culture, we used Structural Equation Modeling (SEM) for confirmatory factor analysis. We applied the partial least squares (PLS) technique, as it is typically used when the investigated phenomenon is new and the purpose of the study is theory generation rather than confirmation

[41]. In addition, the distributional properties of our manifest variables suggested a PLS approach, which does not require normal distribution, as opposed to covariance-based approaches, which do [41]: While the univariate measures of skewness and kurtosis show only minor deviations from the thresholds for univariate normality (<|1.0|), Mardia's tests of multivariate skewness and multivariate kurtosis suggest that the assumption of multivariate normality was violated in our sample (Appendix A). In addition, the hierarchical nature of the BPM culture construct suggests a PLS approach, as the constraints of covariance-based SEM in the case of higher-order constructs models can be avoided by using PLS [42].

Industry		**Region**	
Aeronautic & Maritime	2.3%	Africa	1.8%
Automotive	7.2%	America	9.5%
Banking & Financial Services	14.9%	Asia	5.5%
Chemicals	0.9%	Australia	5.5%
Communications & Media	6.3%	Europe (German-speaking)	65.9%
Consultancy	9.5%	Europe (else)	11.8%
Consumer Goods	3.2%		
Energy	4.5%		
Engineering & Construction	14.0%		
Healthcare	0.5%		
Information Technology	17.2%		
Insurance	5.0%		
Logistics & Transportation	5.4%		
NGOs	0.9%		
Public Services	4.1%		
Retail	4.1%		

Table 5. Distribution of survey sample regarding industry and region

Based on the multidimensionality of the BPM culture construct, we model our measurement instrument for BPM culture as a higher-order construct in a reflective-formative way [43] (Figure 2). Each item was modeled as a reflective indicator of one of the eight first-order constructs, that is, the categories identified in stage two of our instrument development procedure. Following the indicator-reuse approach [44], we also modeled each item as a reflective indicator of the relevant higher-order constructs. The indicator-reuse approach for modeling higher-order construct models was required because all latent variables in a structural equation model, which includes higher-order constructs, must have a measurement model with at least one indicator [43], and it is appropriate in models where all lower-order components have the same number of indicators, as in our case.

Further, we modeled each of the eight first-order constructs as a formative construct of one of the four second-order constructs. Thus, we modeled the four BPM value constructs as aggregate constructs [45], each combining the two sub-dimensions that emanated from the substrata identification of stage two (Table 3) [46]. In turn, the second-order constructs are formative to the aggregate BPM culture construct. In other words, we modeled our measurement instrument as a hierarchical component model with reflective indicators and formative (sub)-constructs. Based on confirmatory factor analysis, we used the estimated factor scores to estimate the overall model simultaneously [45].

We performed data analysis using WarpPLS [47], as this tool provides several advantages. For instance, it allows for non-linear relationships between variables, and it offers a comprehensive report on model goodness-of-fit statistics that is not readily available in other tools. Based on the analysis with WarpPLS, we assessed our measurement instrument in terms of validity and reliability in two stages: After we evaluated the manifest items and their first-order latent constructs, we analyzed the higher-order latent constructs and the relationships between the latent variables in the model. We discuss these findings in turn.

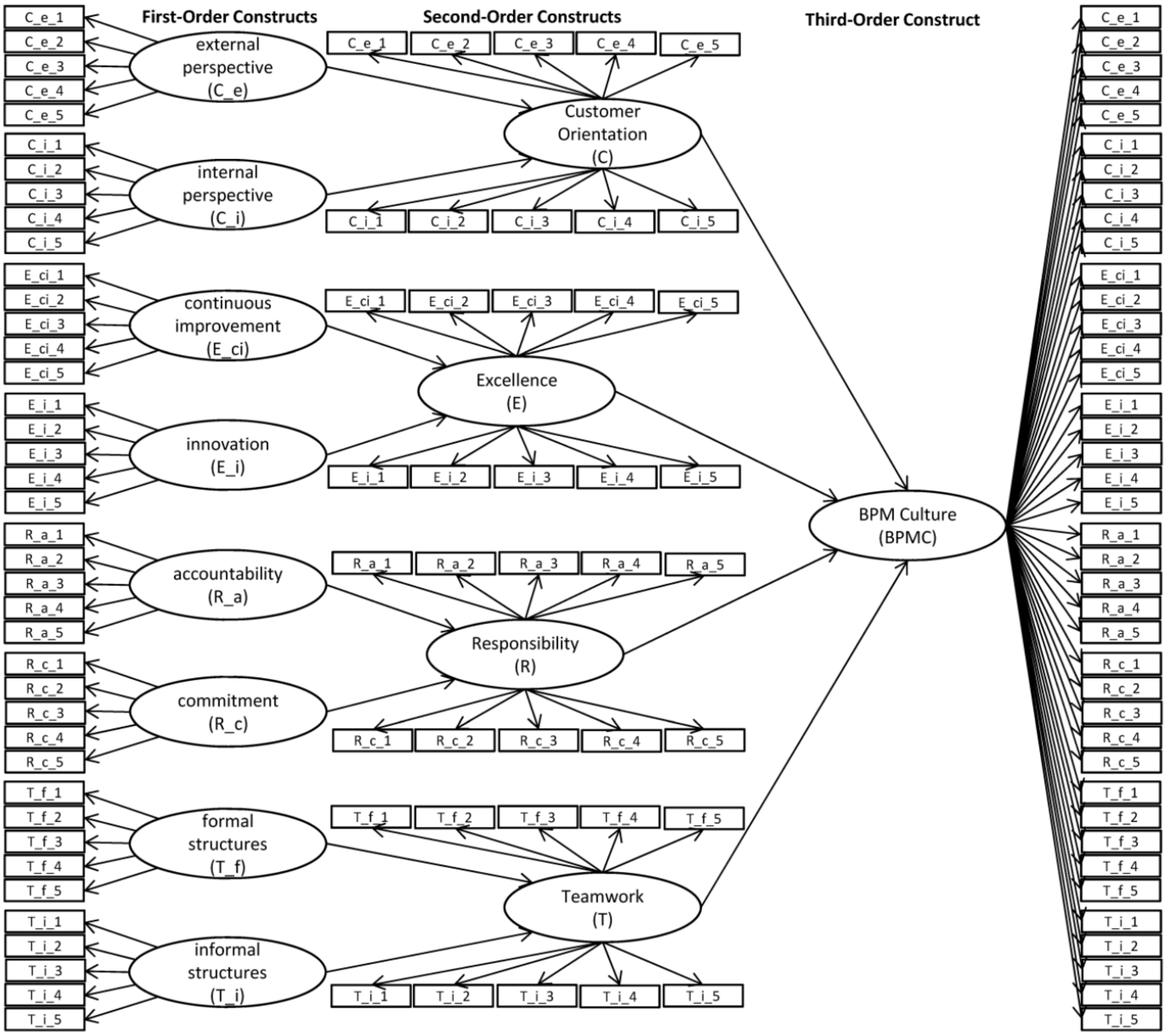

Figure 2. *Reflective-formative model of the BPM culture construct*

Evaluation of first-order latent constructs

For constructs with reflective indicators, unidimensionality is a prerequisite for validity and reliability. We examined block unidimensionality using two measures, Cronbach's α and Dillon-Goldstein's ρ [48], both of which should exceed the threshold of 0.7. Table 7 shows that our first-order constructs met these requirements, indicating unidimensionality.

We measured convergent validity using three criteria [49]: Factor loadings for all items were significant and ranged from 0.78 to 0.92, well exceeding the required threshold of 0.6 [50] (Table 6); Table 7 shows that composite reliability scores for the first-order constructs were higher than the recommended cut-off at 0.8; and the average variance extracted (AVE) for the first-order constructs ranged from 0.69 to 0.77 (Table 7), well above the cut-off of 0.50. Hence, all conditions of convergent validity were met.

Discriminant validity is ensured when the AVE for each construct exceeds the squared correlation between that and any other construct in the factor correlation matrix. Based on the data displayed in Table 7, the largest squared correlation was that between T_f and C_i, and

T_f and R_a (0.58), while the smallest AVE value was 0.69 (T_i). At the item level, the loadings of the reflective indicators on their latent constructs should be notably larger than their cross-loadings [45], which holds true for all measurement items (Appendix C).These results suggest that the test of discriminant validity was met.

Construct code	Item code	Item	Loading	Significance
C_e	**C_e_1**	The core business processes of our organization are focused on satisfying our customers.	0.83	$p < 0.001$
	C_e_2	Our organization incorporates customer expectations into its business processes.	0.89	$p < 0.001$
	C_e_3	Our organization uses customer complaints as an opportunity to reflect on the redesign of business processes.	0.87	$p < 0.001$
	C_e_4	Our organization includes our customers in the design of our business processes.	0.78	$p < 0.001$
	C_e_5	Our organization understands the processes of our customers that lead to an interaction with our organization.	0.83	$p < 0.001$
C_i	**C_i_1**	Our organization defines internal customers for all business processes.	0.82	$p < 0.001$
	C_i_2	Employees of our organization focus on the requirements of colleagues who receive their work.	0.89	$p < 0.001$
	C_i_3	Employees of our organization have a good understanding of who their internal customers are.	0.90	$p < 0.001$
	C_i_4	Managers of our organization encourage employees to meet the needs of colleagues who receive their work.	0.89	$p < 0.001$
	C_i_5	Employees treat people within our organization as customers when providing them with internal services.	0.87	$p < 0.001$
E_ci	**E_ci_1**	Our organization regularly evaluates its business processes for improvement opportunities.	0.87	$p < 0.001$
	E_ci_2	Employees of our organization strive to improve our business processes continually.	0.85	$p < 0.001$
	E_ci_3	Our organization regularly implements best practices that improve business processes.	0.84	$p < 0.001$
	E_ci_4	Managers of our organization regularly invite ideas from our employees on ways to improve business processes.	0.82	$p < 0.001$
	E_ci_5	Our organization regularly uses performance indicators to find ways to improve business processes.	0.86	$p < 0.001$
E_i	**E_i_1**	Team leaders in our organization honor cutting-edge ideas for the innovation of business processes.	0.84	$p < 0.001$
	E_i_2	Our top management rewards employees who present pioneering ideas for enhancing the performance of business processes.	0.80	$p < 0.001$
	E_i_3	Our organization welcomes concepts for fundamental innovations that increase the performance of business processes.	0.91	$p < 0.001$
	E_i_4	Our organization encourages thinking “outside the box” to create innovative solutions in business processes.	0.92	$p < 0.001$
	E_i_5	Managers of our organization are open to radical changes that enhance the performance of business processes.	0.78	$p < 0.001$
R_a	**R_a_1**	Process owners of our organization have the authority to make decisions on business processes.	0.84	$p < 0.001$
	R_a_2	Managers of our organization are rewarded based on the performance of the overall business processes for which they are responsible.	0.79	$p < 0.001$
	R_a_3	Responsibilities for business processes are clearly defined among members of our management board.	0.85	$p < 0.001$
	R_a_4	Process owners of our organization are accountable for the performance of business processes.	0.87	$p < 0.001$
	R_a_5	Our organization appoints process owners for all business processes.	0.81	$p < 0.001$

R_c	**R_c_1**	Employees of our organization go above and beyond their formally defined responsibilities to achieve the objectives of business processes.	0.82	p < 0.001
	R_c_2	Our organization highly values personal dedication to reaching performance targets of business processes.	0.88	p < 0.001
	R_c_3	It motivates employees of our organization that their actions contribute to the achievement of business process objectives.	0.92	p < 0.001
	R_c_4	Our organization uses current achievements to encourage employees' commitment to process objectives.	0.90	p < 0.001
	R_c_5	Employees of our organization feel an inner obligation to attain the performance goals of business processes.	0.88	p < 0.001
T_f	**T_f_1**	Our organization properly aligns the goals of the departments that are involved in one business process.	0.88	p < 0.001
	T_f_2	Managers of our organization routinely arrange cross-departmental meetings to discuss current topics of business processes.	0.84	p < 0.001
	T_f_3	The overall goals of a business process in our organization are binding on all departments involved in that particular business process.	0.90	p < 0.001
	T_f_4	Our organization does well in coordinating the tasks of the departments that are involved in one business process.	0.90	p < 0.001
	T_f_5	It is the policy of our organization that employees share their process knowledge with those in other departments.	0.85	p < 0.001
T_i	**T_i_1**	Employees of our organization enjoy working with their process colleagues from other departments.	0.86	p < 0.001
	T_i_2	Employees of our organization have many opportunities for informal interaction with their process colleagues from other departments.	0.83	p < 0.001
	T_i_3	Employees of our organization not only identify with their department but also with their process team.	0.86	p < 0.001
	T_i_4	Employees of our organization informally exchange information about current topics in business processes.	0.81	p < 0.001
	T_i_5	Our organization encourages informal activities that break down departmental barriers.	0.79	p < 0.001

Table 6. Item validation

	C's α	**DG's ρ**	**CR**	**AVE**	**C_e**	**C_i**	**E_ci**	**E_i**	**R_a**	**R_c**	**T_f**	**T_i**
C_e	0.90	0.92	0.93	0.71	0.84							
C_i	0.92	0.94	0.94	0.77	0.65	0.88						
E_ci	0.90	0.93	0.93	0.72	0.66	0.71	0.85					
E_i	0.90	0.93	0.93	0.72	0.67	0.71	0.72	0.85				
R_a	0.89	0.92	0.92	0.69	0.61	0.64	0.72	0.68	0.83			
R_c	0.93	0.94	0.94	0.77	0.61	0.73	0.69	0.74	0.69	0.88		
T_f	0.92	0.94	0.94	0.76	0.64	0.76	0.72	0.74	0.76	0.75	0.87	
T_i	0.89	0.92	0.92	0.69	0.64	0.72	0.70	0.73	0.68	0.74	0.73	0.83

Table 7. First-order construct validation (the right-hand part of the table displays construct correlations and square roots of AVE on the diagonal)

Evaluation of higher-order latent constructs

In determining the validity of the aggregate higher-order latent constructs, we assess three criteria:

(1) We evaluate the absolute contribution of the formative indicators to the higher-order constructs by examining the indicator weights [43, 45]. As Table 8 shows, all weights are

highly significant, indicating that the higher-order constructs are explained by the lower-order constructs. These results also confirm the appropriateness of the domain categories identified at the substrata identification stage of our measurement instrument development procedure (Table 3).

Higher order construct code	**Lower order construct code**	**Weight**	**Significance**	**VIF**	**Adequacy coefficient R^2_a**
C	**C_e**	0.55	$p < 0.001$	1.74	0.83
	C_i	0.55	$p < 0.001$	1.74	
E	**E_ci**	0.54	$p < 0.001$	2.10	0.86
	E_i	0.54	$p < 0.001$	2.10	
R	**R_a**	0.55	$p < 0.001$	1.89	0.84
	R_c	0.55	$p < 0.001$	1.89	
T	**T_f**	0.54	$p < 0.001$	2.15	0.86
	T_i	0.54	$p < 0.001$	2.15	
BPMC	**C**	0.26	$p < 0.001$	3.66	0.87
	E	0.27	$p < 0.001$	4.53	
	R	0.27	$p < 0.001$	4.55	
	T	0.27	$p < 0.001$	5.27	

Table 8. Higher-order construct validation

(2) We evaluate the relationship between the lower-order and higher-order constructs through the adequacy coefficient R^2_a [22, 46]. R^2_a should exceed the threshold of 0.50, which holds true for all second- and third-order constructs, indicating that the majority of variance in the formative indicators is shared with the aggregate construct [22]. Overall, the comprehensive analysis of our measurement instrument provides sufficient evidence for its reliability and validity.

(3) We assess the formative constructs for conceptual redundancy. As the lower-order latent constructs are of a formative nature with regard to the higher-order latent constructs, they should be conceptually distinct—that is, not collinear—if we are to be able to separate their influence on the respective construct [22]. Multicollinearity can be examined on the basis of the variance inflation factor (VIF) [43]. We note that none of the first-order constructs in our model exceeds the threshold of 10, above which multicollinearity is commonly assumed [51], nor do they exceed the more restrictive cut-off of 3.30 [52]. Therefore, multicollinearity is not an issue for the first-order constructs. However, the VIF for the second-order constructs in relation to BPMC as the third-order construct range between 3.66 and 5.27. Therefore, we applied the suggestions from Petter et al. in assessing the applicability of the four options Petter et al. provide in order to assess and mitigate potential multicollinearity concerns [52].

The first of these four options is to model the construct as having both formative and reflective indicators, yet, in our case, BPMC was developed as a construct determined by four distinct formative constructs. The conceptual definition of BPM culture would render a reflective measurement inappropriate. In addition, no reflective measurement constructs are available for reflective modeling of BPMC. The second option is to remove highly correlated indicators from the construct, but doing so would affect the content validity of the BPMC construct. In fact, many researchers caution against over-interpreting multicollinearity at the expense of content validity [53], suggesting that items be retained in advance of increased validity and at the expense of increasing the potential for measurement redundancy [53]. The third option is to collapse correlated items into a composite index, but what this index captures exactly and how it should be interpreted would be unclear [54]. In our case, a composite measure of BPMC as a linear or geometric concatenation of the second-order constructs would be meaningless, as culture cannot be assessed on the basis of a comparison of two or more value dimensions like *customer orientation* and *excellence*. The fourth option is to convert BPMC into a multi-dimensional construct, but BPMC is already modeled as a multi-dimensional hierarchical construct. An alternative option is to examine test-retest reliability, which should indicate that construct measurements do not change significantly over time (e.g., between early and late survey respondents). Following this recommendation, we assessed the potential differences in construct measures via independent samples t-tests between early (coded as 0) and late respondents (coded as 1), comparing key demographics, such as industry sector, and value reports for all higher-order constructs in our measurement model. None of the t-tests yielded significant results (p-values ranging from 0.45 to 0.71), indicating appropriate test-retest reliability of our measures. Therefore, we argue that multicollinearity, while present to some extent, does not significantly bias our findings.

Discussion

We reported on the development and evaluation of a measurement instrument to define and assess four key dimensions of an organizational culture that is supportive of BPM objectives. The feedback from the broad range of experts involved in the various stages of developing and validating our measurement instrument provides convincing evidence for the relevance of the BPM culture construct and suggests that our conceptualization of this construct is valid. In the development phase, academics agreed on the importance of operationalizing the BPM culture construct. In the validation phase, practitioners confirmed the importance of an organizational culture that is supportive of BPM and provided us with positive feedback on the online survey. Based on the rigorous instrument-development process and the confirmed reliability and validity of the instrument application, we conclude that our study provides a comprehensive instrument with which to measure BPM culture and that the four value dimensions provide a multidimensional view of the BPM culture construct. Next, several consequential questions that arose regarding the application of the instrument are discussed.

Implications for Research

Our measurement instrument enables the assessment of the degree to which an organizational culture supports BPM. Future research can build on the operationalization of the BPM culture construct by empirically studying phenomena involving this construct. Table 9 provides an overview of exemplary research fields that can be addressed based on an application of our measurement instrument. We derive these fields from a recent literature review on culture in BPM [12], and briefly discuss the areas of application of the developed scale in the following.

Previous research identifies various group cultures, including organization culture, work group culture, and national culture, that shape the cultural context of BPM initiatives [12]. Several authors report on the importance of these cultural groups in the context of BPM and identify a lack of research on the relationship between these cultural groups and BPM ([12], Table 9).

As to the research area of *organizational culture*, the instrument developed here can be used to assess the influence of different types of organizational culture (e.g., [55]) on how well these cultures support BPM. On the basis of this analysis, existing typologies of organizational culture may be useful in identifying organizational culture types of different BPM maturity.

Regarding *work group culture*, the measurement instrument can be used to assess how well an organizational culture supports BPM from the perspective of organizational sub-groups, such as departments and divisions. Differences in perceptions may then serve as a first point of reference from which to derive guidelines on how an organization can overcome potential cultural gaps in order to realize a BPM culture.

With regard to *national culture*, the instrument can be used to compare the perceptions of the organizational culture that emanate from an organization's globally diverse sites. Such an analysis would provide important insights on potential cultural gaps between national cultures and BPM culture and how to overcome them. As an interim finding, we can conclude that our measurement instrument enables analyses on the compatibility between a BPM culture and other group cultures and on the achievement of a cultural fit between the two.

Research area	**Suggested future research activities**	**Relevant literature**
Organizational culture	Assessing the impact of specific types of organizational cultures on the supportiveness of these cultures for BPM; that is, assessing how the perception of an organization's cultural fitness for BPM varies between organizational cultures of specific typologies, such as [55]	[56, 57]
Work group culture	Assessing the impact of work group cultures on the supportiveness of an organizational culture for BPM, such as assessing how the perception of an organization's cultural fitness for BPM varies between organizational sub-groups	[58, 59]
National culture	Assessing the impact of national cultures on the supportiveness of organizational cultures for BPM, such as assessing how the perception of an organization's cultural fitness for BPM varies between sites from different countries	[60]
BPM implementations	Assessing the presence and strength of the influence of BPM culture on process-related initiatives like process outsourcing, standardization, workflow implementation, and redesign, and on the type of BPM implementation (e.g., in terms of tool selection and method use)	[11, 61, 62]
BPM success / firm success	Assessing the presence and strength of the influence of BPM culture on the success of BPM initiatives or on overall firm performance	[63]

Table 9. Areas of future research

In addition to the focus on various group cultures, we suggest that future research focus on the impact of BPM culture on *BPM implementations* and on *BPM success* or firm success. Such research could include an assessment of the influence of a BPM culture on process outsourcing or workflow implementation (Table 9). In addition, previous studies suggest that BPM culture positively influences BPM success [9], and now the actual impact of a lived BPM culture on BPM success can be assessed, just as existing studies have examined process orientation as antecedent to firm performance [63]. A strong impact of BPM culture on organizational success would suggest the importance of identifying guidelines on how to develop such a culture in an organization.

Beyond these areas for instrument application, our research contains additional implications. The instrument development and validation procedure (Figure 1) that we applied to derive a measurement instrument for the BPM culture construct combines existing tools and techniques in a logical fashion. Our research demonstrated the usefulness of this construct development procedure, so our contribution as relates to methodology lies in this applied research process.

Our study specifically suggests the appropriateness of our framework for construct operationalization in studies of culture and in process management topics. Its rigor indicates the adequacy of the framework for developing constructs for other relevant concepts that pertain to BPM (e.g., process orientation) but also for other fields (e.g., knowledge management, risk management). Broadly speaking, our work suggests the adequacy of the instantiated procedure in the development of reliable and valid higher-order models with both reflective and formative constructs, so it contributes to the standing issue of appropriate construct specification (e.g., [64, 65]).

A related implication for further research refers to the construct development of a BPM-specific organizational-level concept of culture that we conducted. Future research may examine other culture concepts, such as constructs to examine organizational cultures that are supportive of risk management or supply chain management. In this regard, our research may serve as a reference for the operationalization of concepts like risk management culture and supply chain management culture.

Implications for Practice

Our research also provides implications for practitioners. Based on the application of the instrument in the validation phase, we obtained evidence that the measurement instrument serves as a reliable and valid tool with which to assess how well an organizational culture supports BPM. Therefore, practitioners can use the instrument individually to analyze their own organizational cultures (for an exemplary excerpt of assessment results, see Figure 3). Since individual results are based on the perceptions of only one person, they should be interpreted carefully, but comparing individual assessment results from several key stakeholders may carry important insights for an organization.

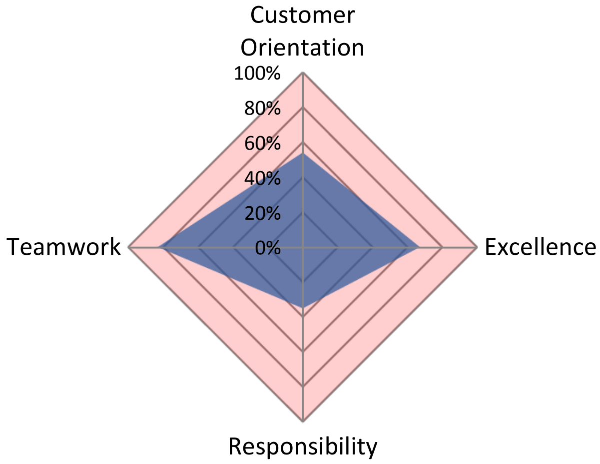

Figure 3. Exemplary spider diagram of an individual result report

In addition, our measurement instrument can be used in ways other than an individual assessment of organizational cultures, as the survey also facilitates a comprehensive analysis of the organizational culture through averaging the perceptions of employees. Such an assessment provides opportunities to compare the results of several departments or divisions. Based on an analysis of the root causes for the findings, companies can then derive measures to develop their culture in specific areas.

The measurement instrument also offers the possibility of performing various kinds of benchmarking analyses, such as that based on industry sector or company size. Figure 4 illustrates an example of an industry benchmark assessment. The graphic compares the assessment results of an organization with the five best-performing organizations in the industry and the average results of the industry sector. Such an analysis facilitates strategic decisions in terms of which cultural dimensions the organization should develop; for example, dimensions whose performance is below the average of the industry sector may be defined as a starting point from which to derive culture-development activities.

Figure 4. Exemplary spider diagram of a benchmark assessment

As the cases we have described show, the measurement instrument provides a tool with which practitioners can assess their organizational cultures and determine the gap between the as-is state and the to-be state of their cultures when following a BPM approach. Based on this assessment, practitioners can consider what they should do to fill this cultural gap, that is, how they could fully incorporate the values of BPM culture in their organizational cultures [12]. In this regard, our research shows that the operationalization of the BPM culture construct makes the concept more tangible and provides opportunities for practice to measure and manage culture as part of BPM.

Limitations

While our study involved experts from around the globe in both the instrument development process and the validation process, the validation phase in particular was over-represented in countries from Western cultures, especially German-speaking countries. This over-representation may have introduced some participant-selection bias, but we did not find such bias to be present during our analysis.

The instrument captures perceptional measures of BPM culture as experienced by practitioners engaged in BPM initiatives. Response bias may always be present in such instrument, given the cognitive and socio-historic background of the respondents (e.g., whether previous BPM initiatives were successful or not). This method bias could be overcome by relating triangulated culture data from other sources to the results. Still, culture is by nature a perceptual concept that is defined based on how it is experienced by individuals, so our reliance on perceptual measures is in line with the nature of the concept.

A quantitative measurement instrument is, by definition, a specific and detailed operationalization of selected facets of a multi-dimensional construct. We based our work on an existing empirically derived conceptualization of BPM culture and estimated a complex reflective-formative model of the construct. Still, the culture concept is fluid and might be conceptualized and experienced differently [66]. As such, we caution against relying only on a quantitative instrument in measuring and examining cultural influences. Comprehensive studies of cultural phenomena should consider multi-method designs to overcome limitations that stem from isolated research designs [67].

Finally, we caution that debates are ongoing about the issues and challenges related to construct (mis-)specification [64], formative versus reflective modeling and their interpretations [68], the use of partial least squares modeling [69], and particularly the assessment of complex higher-order constructs [64] like ours. We considered and applied guidelines that are current at the time of writing, but we recognize that related debates are active and ultimate verdicts remain elusive. One instance of a potential bias that is due to formative construct specification relates to the reported levels of multicollinearity in our data, indicating that some of the suggested and assessed measures may contain some redundancy and could benefit from further development and pruning.

Conclusion

The purpose of this study was to develop and validate an instrument with which to measure the supportiveness of organizational cultures for BPM. The results of our work contribute to the body of knowledge on culture in BPM through the conceptualization of BPM culture and enable researchers to conduct empirical studies that build on the measurement of the BPM culture concept. We identify particular fields of research in which the measurement instrument can be applied to provide insights into the under-researched role of culture in BPM. Our research results also provide new opportunities for practitioners, who can use the measurement instrument to assess the cultural fitness of their organization for process management.

References

[1] M. Hammer, What is business process management?, in: J. vom Brocke, M. Rosemann (Eds.) Handbook on business process management: Introduction, methods and information systems, Springer, Berlin, 2010, pp. 3–16.
[2] M. Attaran, Exploring the relationship between information technology and business process reengineering, Information & Management, 41 (2004) 585-596.
[3] M. Rosemann, J. vom Brocke, The six core elements of business process management, in: J. vom Brocke, M. Rosemann (Eds.) Handbook on business process management. Introduction, methods and information systems, Springer, Berlin, 2010, pp. 109-124.
[4] R.B. Cooper, The inertial impact of culture on IT implementation, Information & Management, 27 (1994) 17-31.
[5] A. Majchrzak, Q. Wang, Breaking the functional mind-set in process organizations, Harvard Business Review, September-October (1996) 93-99.
[6] P. Trkman, The critical success factors of business process management, International Journal of Information Management, 30 (2010) 125-134.
[7] M. Zairi, Business process management: A boundaryless approach to modern competitiveness, Business Process Management Journal, 3 (1997) 64–80.

[8] L. Jesus, A. Macieira, D. Karrer, H. Caulliraux, BPM center of excellence: The case of a Brazilian company, in: J. vom Brocke, M. Rosemann (Eds.) Handbook on business process management: Strategic alignment, governance, people and culture, Springer, Berlin, 2010, pp. 283-303.
[9] blinded-for-review, Which cultural values matter to business process management? Results from a global Delphi study, Business Process Management Journal, (in press).
[10] I. Im, O.A. El Sawy, A. Hars, Competence and impact of tools for BPR, Information & Management, 36 (1999) 301-311.
[11] W.M.P. van der Aalst, A. Kumar, XML-based schema definition for support of interorganizational workflow, Information Systems Research, 14 (2003) 23-46.
[12] J. vom Brocke, T. Sinnl, Culture in business process management: A literature review, Business Process Management Journal, 17 (2011) 357-377.
[13] E.H. Schein, Organizational culture and leadership, 3 ed., Jossey-Bass, San Francisco, 2004.
[14] G. Hofstede, Cultures and organizations, 2 ed., McGraw-Hill, New York, 2005.
[15] T. Parsons, E.A. Shils, Toward a general theory of action, Transaction Publishers, New Brunswick, New Jersey, 1951.
[16] H. Tajfel, J.C. Turner, The social identity theory of inter-group behavior, in: S. Worchel, L.W. Austin (Eds.) Psychology of intergroup relations, Nelson-Hall, Chicago, 1986, pp. 7-24.
[17] D.E. Leidner, T. Kayworth, A review of culture in information systems research, Management Information Systems Quarterly, 30 (2006) 357–399.
[18] J. vom Brocke, T. Schmiedel, Towards a conceptualisation of BPM culture: Results from a literature review, in: 15th Pacific Asia Conference on Information Systems (PACIS 2011), Brisbane, Australia, 2011.
[19] T. de Bruin, M. Rosemann, Using the Delphi technique to identify BPM capability areas, in: 18th Australasian Conference on Information Systems (ACIS 2007), Toowoomba, Australia, 2007.
[20] G.C. Moore, I. Benbasat, Development of an instrument to measure the perceptions of adopting an information technology innovation, Information Systems Research, 2 (1991) 192-222.
[21] J. Recker, M. Rosemann, The measurement of perceived ontological deficiencies of conceptual modeling grammars, Data & Knowledge Engineering, 69 (2010) 516-532.
[22] S.B. MacKenzie, P.M. Podsakoff, N.P. Podsakoff, Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques, Management Information Systems Quarterly, 35 (2011) 293-334.
[23] D. Straub, M.-C. Boudreau, D. Gefen, Validation guidelines for IS positivist research, Communications of the Association for Information Systems, 13 (2004) 380-427.
[24] G.D. Bhatt, M.D. Troutt, Examining the relationship between business process improvement initiatives, information systems integration and customer focus: An empirical study, Business Process Management Journal, 11 (2005) 532-558.
[25] B.J. Jaworski, A.K. Kohli, Market orientation: Antecedents and consequences, Journal of Marketing, 57 (1993) 53-70.
[26] K.N. Kennedy, F.G. Lassk, J.R. Goolsby, Customer mind-set of employees throughout the organization, Journal of the Academy of Marketing Science, 30 (2002) 159-171.
[27] P.C. Morrow, The measurement of TQM principles and work-related outcomes, Journal of Organizational Behavior, 18 (1997) 363-376.
[28] S. Caffyn, Development of a continuous improvement self-assessment tool, International Journal of Operations & Production Management, 19 (1999) 1138-1153.
[29] M. Kohlbacher, S. Gruenwald, Process orientation: Conceptualization and measurement, Business Process Management Journal, 17 (2011) 267-283.
[30] L.W. Porter, R. Steers, M., R.T. Mowday, P.V. Boulian, Organizational commitment, job satisfaction, and turnover among psychiatric technicians, Journal of Applied Psychology, 59 (1974) 603-609.
[31] K.R. Ferris, N. Aranya, A comparison of two organizational commitment scales, Personnel Psychology, 36 (1983) 87-98.
[32] N.J. Allen, J.P. Meyer, The measurement and antecendents of affective, continuance and normative commitment to the organization, Journal of Occupational Psychology, 63 (1990) 1-18.
[33] R.D. Iverson, D.M. Buttigieg, Affective, normative and continuance commitment: Can the "right kind" of commitment be managed?, Journal of Management Studies, 36 (1999) 307-333.

[34] G. Hooley, T. Cox, J. Fahy, D. Shipley, J. Beracs, K. Fonfara, B. Snoj, Market orientation in the transition economies of central Europe: Tests of the Narver and Slater market orientation scales, Journal of Business Research, 50 (2000) 273-285.
[35] A. Menon, B.J. Jaworski, A.K. Kohli, Product quality: Impact of interdepartmental interactions, Journal of Academy of Marketing Science, 25 (1997) 187-200.
[36] J.D. Sherman, W.E. Souder, S.A. Jenssen, Differential effects of the primary forms of cross functional integration on product development cycle time, Journal of Product Innovation Management, 17 (2000) 257-267.
[37] J. vom Brocke, M. Rosemann, Handbook on business process management, in: International Handbooks on Information Systems, Springer, Berlin, 2010.
[38] I. Ajzen, M. Fishbein, Understanding attitudes and predicting social behavior, Prentice Hall, Englewood Cliffs, New Jersey, 1980.
[39] J. Recker, M. Rosemann, A measurement instrument for process modelling research: Development, test and procedural model, Scandinavian Journal of Information Systems, 22 (2010) 3-30.
[40] J. Recker, Explaining the usage of process modeling grammars: Comparing three theoretical models in the study of two grammars, Information & Management, 47 (2010) 316-324.
[41] N. Urbach, F. Ahlemann, Structural equation modeling in information systems research using partial least squares, Journal of Information Technology Theory and Application, 11 (2010) 5-40.
[42] M. Wetzels, G. Odekerken-Schröder, C. van Oppen, Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration, Management Information Systems Quarterly, 33 (2009) 177-195.
[43] C.M. Ringle, M. Sarstedt, D.W. Straub, A critical look at the use of PLS-SEM in MIS Quarterly, Management Information Systems Quarterly, 36 (2012) iii-xiv.
[44] J.-B. Lohmöller, Latent variable path modeling with partial least squares, Physica, Heidelberg, 1989.
[45] R.T. Wright, D.E. Campbell, J.B. Thatcher, N. Roberts, Operationalizing multidimensional constructs in structural equation modeling: Recommendations for IS research, Communications of the Association for Information Systems, 30 (2012) 367-412.
[46] J.R. Edwards, Multidimensional constructs in organizational behavior research: An integrative analytical framework, Organizational Research Methods, 4 (2001) 144-192.
[47] N. Kock, WarpPLS 3.0 User Manual, in: ScripWarp Systems, Laredo, Texas, 2012.
[48] S. Balzano, L. Trinchera, Structural equation models and student evaluation of teaching: A PLS path modeling study, in: M. Attanasio, V. Capursi (Eds.) Statistical methods for the evaluation of university systems, Springer, Berlin, 2011, pp. 55-66.
[49] C. Fornell, D.F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, Journal of Marketing Research, 18 (1981) 39-50.
[50] D. Gefen, D.W. Straub, A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example, Communications of the Association for Information Systems, 16 (2005) 91-109.
[51] A. Diamantopoulos, Incorporating formative measures into covariance-based structural equation models, MIS Quarterly, 35 (2011) 335-358.
[52] S. Petter, D.W. Straub, A. Rai, Specifying formative constructs in information systems research, MIS Quarterly, 31 (2007) 623-656.
[53] A. Diamantopoulos, H.M. Winklhofer, Index construction with formative indicators: An alternative to scale development, Journal of Marketing Research, 38 (2001) 269-277.
[54] A. Diamantopoulos, P. Riefler, K.P. Roth, Advancing formative measurement models, Journal of Business Research, 61 (2008) 1203-1218.
[55] R. Goffee, G. Jones, What holds the modern company together?, Harvard Business Review, 74 (1996) 133-148.
[56] W. Bandara, A. Alibabaei, M. Aghdasi, Means of achieving business process management success factors, in: 4th Mediterranean Conference on Information Systems (MCIS 2009), Athens, Greece, 2009.
[57] M. Rosemann, T. de Bruin, Towards a business process management maturity model, in: 13th European Conference on Information Systems (ECIS 2005), Regensburg, Germany, 2005.

[58] R.G. Lee, B.G. Dale, Business process management: A review and evaluation, Business Process Management Journal, 4 (1998) 214–225.
[59] J.-P. Pritchard, C. Armistead, Business process management: Lessons from European business, Business Process Management Journal, 5 (1999) 10–35.
[60] M. Jayaganesh, G. Shanks, A cultural analysis of ERP-enabled business process management strategy and governance in Indian organisations, in: 20th Australasian Conference on Information Systems (ACIS 2009), Melbourne, Australia, 2009.
[61] D. Mani, A. Barua, A.B. Whinston, An empirical analysis of the impact of information capabilities design on business process outsourcing performance, MIS Quarterly, 34 (2010) 39-62.
[62] G.J. van der Pijl, G.J.P. Swinkels, J.G. Verrijdt, ISO 9000 versus CMM: Standardization and certification of IS development, Information & Management, 32 (1997) 267-274.
[63] M. Kohlbacher, H.A. Reijers, The effects of process-oriented organizational design on firm performance, Business Process Management Journal, (in press).
[64] M.I. Aguirre-Urreta, G.M. Marakas, Revisiting bias due to construct misspecification: Different results from considering coefficients in standardized form, MIS Quarterly, 36 (2012) 123-138.
[65] R.P. Bagozzi, Measurement and meaning in information systems and organizational research: Methodological and philosophical foundations, MIS Quarterly, 35 (2011) 261-292.
[66] A.L. Kroeber, C. Kluckhohn, Culture, Peabody Museum, Cambridge, Massachusetts, 1952.
[67] G. Hofstede, B. Neuijen, D.D. Ohayv, G. Sanders, Measuring organizational cultures: A qualitative and quantitative study across twenty cases, Administrative Science Quarterly, 35 (1990) 286-316.
[68] R.T. Centefelli, G. Bassellier, Interpretation of formative measurement in information systems research, MIS Quarterly, 33 (2009) 689-708.
[69] D.L. Goodhue, W. Lewis, R. Thompson, Comparing PLS to regression and LISREL: A response to Marcoulides, Chin, and Saunders, MIS Quarterly, 36 (2012) 703-716.

Appendix A. Instrument Development and Validation Phases (adapted from [21, 22])

Phase	Stage	Method	Purpose	Task	# Experts	Composition of Expert Panel	Countries of Involved Experts
Instrument Development	Item Creation	Lit. Review	Prepare content validity	Identification and selection of candidate items	-		
		Survey			26	Analyst, CIO, consultant, IT/Process expert, manager, PhD[b], professor	Australia, Austria, Brazil, Canada, Estonia, Germany, Hong Kong, Iran, Liechtenstein, Slovenia, South Africa, Sweden, USA
		In-depth Interviews			6	Consultant, manager, PhD, professor	Australia, Canada, Germany, Netherlands, Slovenia, South Africa
	Substrata Identifica-tion	Own Category Method	Prepare construct validity	Identification and labeling of domain substrata/ categories among items	4		Brazil, Germany, Netherlands, Slovenia
	Item Selection	Ranking Exercise	Assess content validity	Assessment of congruence of items and constructs	11		Australia, Austria, Brazil, Canada, Germany, Netherlands, Slovenia, USA
	Item Revision	Index Card Sorting Test	Assess construct validity	Sorting of items in categories	16	CIO, executive director, manager, master student, PhD, process expert	Austria, Germany, Liechtenstein, Switzerland
Instrument Validation	Instrument Preparation	Pre-Test	Assess under-standability	Refinement of measurement instrument	10	Manager, PhD candidate, PhD, process expert, professor	Australia, Austria, Germany, Liechtenstein, Switzerland
		Pilot Test	Assess validity and reliability		34	Analyst, assistant, consultant, IT/Process expert, manager, professor	Australia, Austria, Germany, Indonesia, Liechtenstein, Switzerland, USA
		Instrument Translation	Provide valid translation	Translation of instrument into German	10	Language expert, domain expert, potential survey participant	Austria, Canada, Germany, Switzerland, USA
	Instrument Application	Field Survey	Confirm validity and reliability	Assessment of measurement instrument	222	Analyst, consultant, IT/process expert, manager	Australia, Austria, Brazil, Canada, Croatia, Denmark, Egypt, Estonia, France, Germany, Greece, Hungary, India, Iran, Liechtenstein, Malaysia, New Zealand, Nigeria, Norway, Poland, Portugal, Qatar, Russia, Saudi Arabia, South Africa, Spain, Sweden, Switzerland, Turkey, UAE, UK, USA

[b] e.g. Research assistant, assistant professor, associate professor with PhD

Appendix B. Descriptive Statistics of Measurement Items

Item code	N	Min	Max	Mean	Std. Dev.	Univariate Skewness	Univariate Kurtosis	Multivariate Skewness	Multivariate Kurtosis
C_e_1	222	1	7	4.99	1.59	-0.68	-0.17		
C_e_2	222	1	7	4.88	1.56	-0.70	-0.08		
C_e_3	222	1	7	4.43	1.71	-0.38	-0.75		
C_e_4	222	1	7	3.31	1.85	0.37	-1.00		
C_e_5	222	1	7	4.35	1.64	-0.27	-0.61		
C_i_1	222	1	7	3.92	1.85	0.01	-1.06		
C_i_2	222	1	7	3.45	1.56	0.26	-0.60		
C_i_3	222	1	7	3.95	1.77	-0.03	-1.07		
C_i_4	222	1	7	3.86	1.65	-0.02	-0.91		
C_i_5	222	1	7	3.79	1.66	0.19	-0.81		
E_ci_1	222	1	7	4.53	1.68	-0.51	-0.62		
E_ci_2	222	1	7	4.39	1.50	-0.32	-0.55		
E_ci_3	222	1	7	3.58	1.69	0.03	-1.06		
E_ci_4	222	1	7	3.94	1.77	-0.03	-1.06		
E_ci_5	222	1	7	3.76	1.86	0.08	-1.08		
E_i_1	222	1	7	3.99	1.69	-0.13	-0.98		
E_i_2	222	1	7	3.91	2.04	-0.08	-1.32		
E_i_3	222	1	7	4.60	1.79	-0.45	-0.81		
E_i_4	222	1	7	4.31	1.89	-0.29	-1.03		
E_i_5	222	1	7	3.92	1.74	-0.11	-1.02		
R_a_1	222	1	7	4.50	1.96	-0.44	-1.06		
R_a_2_	222	1	7	3.56	2.06	0.10	-1.35		
R_a_3	222	1	7	4.23	2.03	-0.17	-1.25		
R_a_4	222	1	7	3.95	1.99	-0.06	-1.19		
R_a_5	222	1	7	4.25	2.14	-0.18	-1.34		
R_c_1	222	1	7	4.26	1.80	-0.28	-0.97		
R_c_2	222	1	7	4.05	1.85	-0.20	-1.04		
R_c_3	222	1	7	3.95	1.70	-0.11	-0.78		
R_c_4	222	1	7	3.85	1.66	-0.20	-0.87		
R_c_5	222	1	7	3.85	1.71	-0.22	-0.94		
T_f_1	222	1	7	3.68	1.65	0.16	-0.87		
T_f_2	222	1	7	3.91	1.86	0.04	-1.05		
T_f_3	222	1	7	3.92	1.81	-0.05	-1.04		
T_f_4	222	1	7	3.85	1.62	0.03	-0.80		
T_f_5	222	1	7	3.76	1.86	0.11	-1.07		
T_i_1	222	1	7	4.29	1.47	-0.29	-0.49		
T_i_2	222	1	7	4.15	1.63	-0.12	-0.86		
T_i_3	222	1	7	3.73	1.74	-0.04	-0.97		
T_i_4	222	1	7	4.20	1.64	-0.29	-0.55		
T_i_5	222	1	7	4.05	1.84	-0.21	-1.02		
								509.08 ($p<0.001$)	1962.66 ($p<0.001$)

Table 10. Descriptive statistics of items

Appendix C. Item Validation

	C_e	C_i	E_ci	E_i	R_a	R_c	T_f	T_i	Significance of loadings
C_e1	**0.83**	0.47	0.52	0.52	0.46	0.45	0.48	0.50	p < 0.001
C_e2	**0.89**	0.53	0.51	0.54	0.50	0.50	0.54	0.53	p < 0.001
C_e3	**0.87**	0.59	0.61	0.60	0.50	0.50	0.56	0.56	p < 0.001
C_e4	**0.78**	0.58	0.57	0.54	0.56	0.54	0.57	0.54	p < 0.001
C_e5	**0.83**	0.59	0.56	0.62	0.57	0.57	0.56	0.58	p < 0.001
C_i1	0.54	**0.82**	0.62	0.59	0.56	0.54	0.64	0.56	p < 0.001
C_i2	0.57	**0.89**	0.61	0.61	0.55	0.63	0.64	0.66	p < 0.001
C_i3	0.58	**0.90**	0.60	0.61	0.56	0.63	0.64	0.57	p < 0.001
C_i4	0.63	**0.89**	0.67	0.71	0.62	0.72	0.75	0.71	p < 0.001
C_i5	0.54	**0.87**	0.63	0.60	0.53	0.65	0.63	0.63	p < 0.001
E_ci1	0.60	0.58	**0.87**	0.60	0.61	0.56	0.61	0.57	p < 0.001
E_ci2	0.59	0.60	**0.85**	0.64	0.57	0.60	0.59	0.65	p < 0.001
E_ci3	0.52	0.58	**0.84**	0.54	0.57	0.52	0.54	0.50	p < 0.001
E_ci4	0.54	0.63	**0.82**	0.67	0.62	0.64	0.67	0.66	p < 0.001
E_ci5	0.53	0.63	**0.86**	0.61	0.66	0.61	0.61	0.60	p < 0.001
E_i1	0.60	0.64	0.63	**0.84**	0.59	0.64	0.68	0.65	p < 0.001
E_i2	0.44	0.48	0.54	**0.80**	0.42	0.49	0.49	0.49	p < 0.001
E_i3	0.62	0.62	0.67	**0.91**	0.61	0.67	0.69	0.67	p < 0.001
E_i4	0.58	0.68	0.67	**0.92**	0.64	0.71	0.69	0.71	p < 0.001
E_i5	0.60	0.61	0.57	**0.78**	0.61	0.62	0.61	0.59	p < 0.001
R_a1	0.53	0.54	0.57	0.56	**0.84**	0.60	0.60	0.62	p < 0.001
R_a2	0.51	0.52	0.62	0.57	**0.79**	0.61	0.62	0.54	p < 0.001
R_a3	0.46	0.53	0.58	0.59	**0.85**	0.52	0.65	0.56	p < 0.001
R_a4	0.59	0.61	0.66	0.63	**0.87**	0.64	0.73	0.61	p < 0.001
R_a5	0.45	0.47	0.55	0.46	**0.81**	0.47	0.55	0.50	p < 0.001
R_c1	0.42	0.54	0.50	0.53	0.50	**0.82**	0.57	0.65	p < 0.001
R_c2	0.57	0.69	0.60	0.69	0.63	**0.88**	0.72	0.68	p < 0.001
R_c3	0.58	0.68	0.67	0.71	0.67	**0.92**	0.69	0.67	p < 0.001
R_c4	0.60	0.71	0.66	0.72	0.64	**0.90**	0.72	0.66	p < 0.001
R_c5	0.49	0.58	0.60	0.58	0.56	**0.88**	0.59	0.61	p < 0.001
T_f1	0.58	0.70	0.60	0.64	0.65	0.58	**0.88**	0.62	p < 0.001
T_f2	0.52	0.56	0.54	0.58	0.55	0.60	**0.84**	0.58	p < 0.001
T_f3	0.55	0.67	0.65	0.66	0.70	0.65	**0.90**	0.61	p < 0.001
T_f4	0.60	0.68	0.68	0.65	0.69	0.69	**0.90**	0.66	p < 0.001
T_f5	0.56	0.69	0.65	0.72	0.73	0.76	**0.85**	0.73	p < 0.001
T_i1	0.59	0.64	0.62	0.69	0.64	0.64	0.65	**0.86**	p < 0.001
T_i2	0.45	0.52	0.50	0.56	0.50	0.55	0.59	**0.83**	p < 0.001
T_i3	0.55	0.67	0.61	0.62	0.59	0.65	0.60	**0.86**	p < 0.001
T_i4	0.52	0.57	0.61	0.54	0.55	0.66	0.59	**0.81**	p < 0.001
T_i5	0.54	0.57	0.56	0.64	0.56	0.60	0.60	**0.79**	p < 0.001

Table 11. Loadings and cross-loadings