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DEVELOPMENT OF A MEASUREMENT SCALE FOR BUSINESS PROCESS STANDARDIZATION

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Research in Progress

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Abstract

Process-oriented companies face the dichotomy of process standardization versus process diversity. On the one hand, multinational companies try to realize returns of scale by standardization. On the other hand, markets require businesses to adapt to local needs and government regulations. As of today, there is no framework available to measure the degree of process standardization. This is both a problem for companies that want to assess their degree of standardization as well as for research that aims to investigate standardization and its connection with other concepts. In this paper, we address this research gap from the perspective of scale development. We utilize a well-acknowledged method for devising a measurement instrument to specifically and directly measure the degree of standardization in business processes. Various application scenarios and future research areas are pointed out.

Keywords: Measurement Scale, Business Process Standardization, Business Process Management, Scale Development.

1 Introduction

Business process standardization (BPS) is a classic strategy of companies to improve their operational performance (Muenstermann et al., 2010), particularly in large corporations. It is often associated with scalability and reduced operational costs (Williams and van Triest, 2009). It also helps organizations to establish one face to the customer (Kundu et al., 2012), reduce organizational complexity, and increase transparency (Kampker et al., 2014). BPS thus enables better control over multinational corporations. In line with this, we adopt the definition of Davenport (2005) and extended by Schaefermeyer et al. (2010, p.2) for BPS as "the unification of business processes and the underlying actions within a company […]". In a less strict sense, researchers also refer to this phenomenon as business process harmonization (Romero et al., 2015).

Literature on BPS describes a tension between standardization and flexibility (Harmon, 2009; Tregear, 2010). Researchers argue that standardization efforts are highly dependent on various factors. First, it is argued that *creative* parts of processes, so-called pockets of creativity (Seidel et al., 2010), should not be subject to standardization efforts (Rosenkranz et al., 2010). Second, the need for slack is emphasized for both routine and non-routine processes in order to be able to cope with *ambiguity* and *uncertainty* (Lillrank, 2003). Third, *complexity* is discussed as one of the roadblocks for standardizing processes (Lillrank, 2003; Schaefermeyer et al., 2012). Research has also proposed procedure models to align different variants of a process (Kettenbohrer et al., 2013; Muenstermann and Weitzel, 2008). While all these works discuss the connection of standardization with other concepts, we observe a more fundamental research gap on how to actually measure the degree of process standardization. In particular, current measurements only consider process execution, while other dimensions, such as documentation or governance perspectives, are not taken into account. This is a problem since standardization cannot not be accurately captured with an incomplete instrument.

The purpose of this paper is to address this research gap by developing a measurement instrument for BPS. Accordingly, the research question we pursue reads as follows:

How can standardization in business processes be measured?

To answer this question we use established research methods for scale development in the information systems (IS) discipline (Recker and Rosemann, 2010a; Schmiedel et al., 2014) to identify a set of measurement items that span various domain aspects of BPS. The measurement instrument contributes to both research and practice. For research, it provides a solid foundation for future research that studies the connection of standardization with other concepts. For practice, it offers as way to estimate the the actual degree of standardization for a particular process and track standardization initiatives' success. Amongst others, this is a vitally important step prior to enterprise resource planning (ERP) implementation projects (Botta-Genoulaz et al., 2005; Loh and Koh, 2004; Umble et al., 2003).

This paper is structured as follows. In the subsequent section, we outline the research background and present the theoretical foundations of our work. We then describe the instrument development method and its application to generate a set of items to measure the degree of standardization in business processes. Next, we discuss the implications these results have for academia and practice as well as the limitations that come along with the academic work at hand. Last, the research endeavor is summarized to present a conclusion and discuss the next steps.

2 Research Background

The term process standardization refers to the alignment of different process variants towards a defined meta-process (Muenstermann and Weitzel, 2008). Vice versa, process diversity refers to a range of variants that are generated from a standard – or meta-process in order to conform with local legislation (Mocker et al., 2014) or adapt products and services to different markets (Weill and Ross, 2005; Williams and van Triest, 2009).

Lillrank (2003) differentiates business processes that are standard, routine, and non-routine. Standard processes are from an economic perspective the most effective, as they can make use of high asset specificity. Yet, these processes cannot directly handle scenarios that deviate from a predefined schema. Non-routine processes represent the opposite side of the spectrum. Being non-repetitive, a non-routine process cannot be completely described before its actual execution. In these processes, task accomplishment is the primary criterion for execution success. A similar distinction is made by Harmon (2007) and enhanced by Seidel (2009). This differentiation serves as the theoretical foundation for our research presented in the following.

Although, process standardization seems tempting, in many cases it will not be feasible. In processes being subject to great variation and variety in their environment, process standardization will be difficult to achieve (Lillrank, 2003). For this reason, empirical research on process standardization is primarily centered around the connection between standardization and process performance in terms of efficiency, e.g. Muenstermann et al. (2010) and Laumer et al. (2015). In these studies, process standardization is operationalized with a focus on the execution perspective, i.e. how activities are performed and the degree of structuredness of process flow (Muenstermann et al., 2010; Schaefermeyer and Rosenkranz, 2011). Romero et al. (2015) additionally link process standardization to information technology. However, other aspects, such as process governance (Tregear, 2010), documentation (Ungan, 2006), or the strategic focus of processes (vom Brocke et al., 2016), remain largely unconsidered. Leaving out these dimensions might give a biased impression of the actual degree of standardization. The aim of our research is thus to identify the relevant dimensions of the standardization concept and to develop a corresponding measurement instrument with high content and construct validity.

We approach the task of measurement development from a variance epistemology (Langley and Tsoukas, 2010; van de Ven and Poole, 2005). As the routines literature typically considers a dynamic process theory perspective (Pentland et al., 2017), the field has little to offer in terms of measurement items. A variance epistemology as considered in our work is valuable and complementary to this stream of research.

3 Scale Development

The research design for developing valid measurement scales comprises three phases as according to Recker and Rosemann (2010a) and Schmiedel et al. (2014). In the first phase, we identify relevant subconstructs to measure BPS and generate an initial item pool. Second, in the item selection phase, we single out items with high potential for content validity. Third, in the item revision phase, we use the index-card sorting test procedure (Moore and Benbasat, 1991) to revise items that are hard to understand and to improve convergent and discriminant validity among the items.

3.1 Substrata Identification and Item Creation

Substrata identification was the first stage of the instrument development process and was targeted to derive the different theoretical domains, i.e. those construct categories that BPS comprises. The resulting construct categories represent the various meanings the theoretical construct of BPS covers (Davis, 1989).

At the same time, items were created and grouped into these categories. Our target was to generate items with high content validity based on literature review and in-depth interviews with field experts (Straub et al., 2004). The literature review aimed at identifying items directly from existing literature on BPS, but also extrapolated items from a broader set of highly acknowledged literature in the area of business process management (BPM) to measure BPS as the target construct. In-depth interviews with field experts were conducted to assure the breadth of the construct and prevent a possible bias in the item selection process.

Particular attention was paid to ensure high convergent and discriminant construct validity among the initial set of items. Thus, items in one category had to be most similar to one another (convergent validity), while being most dissimilar from those in other categories (discriminant validity).

3.1.1 Literature Review

In order to derive a set of candidate items for the further instrument development process, a systematic literature review was conducted to identify, evaluate, and interpret the available information relevant to the research aim (Kitchenham, 2004; Kummer and Schmiedel, 2016). The selection of literature followed an iterative procedure to select relevant journal articles and conference papers.

We used the ProQuest, ScienceDirect, EBSCOhost, and IEEE Xplore databases as primary source for literature retrieval, covering journal articles, conference papers, and other publications from IT- and IS-related, and in particular BPM-related, research streams. Considering relevant articles independent of journal and discipline of publication helped to avoid a bias in literature selection. We used the search terms “Process Harmoni*” OR “Process Standardi*” to search titles, abstracts, and keywords of publications, while no time restrictions were applied.

The literature search yielded more than 250 publications. In addition, suitable articles were identified based on backward and forward search (Webster and Watson, 2002). All articles were subject to the same rigorous selection process (Grant and Booth, 2009). First, only articles in English or German were considered and retrieved. Second, duplicates were removed from the set of articles. For all remaining articles, title, abstract, and conclusion were skimmed to determine whether they were relevant for a full-text assessment. Next, we performed a detailed analysis of the remaining articles, from which in turn a set of candidate items was derived. Simultaneously, identified items were sorted into the substrata reflecting their content alignment. Where existing items did not fully cover the scope of their assigned substratum, further literature search was undertaken to close the conceptual gap. In total, more than 100 articles were used to create the initial item pool of 529 items.

3.1.2 Expert Interviews

The purpose of the expert interviews was to further examine substrata of BPS and derive potential candidate items beyond what the literature review revealed. Overall, 8 semi-structured in-depth interviews with experienced subject matter experts in the area of BPM were conducted to generate further possible measures of BPS. To derive a holistic picture, interview participants from both, academia and practice were chosen. 5 interview partners were experienced employees from a multinational manufacturing company in the German-speaking area. Among the practitioners were the 'head of process excellence and IT governance', the 'head of Human Resources management processes and systems team', as well as a global process manager for the marketing process. Their perspective was complemented by three academics; two research assistants and a doctoral candidate. All academics had a strong BPM background, as their research is centered around BPM and Process Mining, respectively. Interviews ranged from one to three hours. All interviews were recorded and transcribed.

3.1.3 Derivation of Substrata and Candidate Items

As a result of the interviews and the literature review, a set of initial items and their respective substrata were derived. While most of the candidate items demonstrated a close link to BPM already, some items needed further adaptation to a (business) process context. We also applied the item specifications recommended by Ajzen and Fishbein (1980), such as to include the target of the behavior.

In any measurement development study, understandability of the items is paramount (Tourangeau et al., 2000). For this reason, attention was paid to formulate items avoiding complicated syntax as well as terms that could be ambiguous for or unfamiliar to the target group. Items were phrased as concise and simple as possible (MacKenzie et al., 2011; Schmiedel et al., 2014). This also refers to the use of multiple-barreled items, which can be cognitively complex and thus hard to answer for the respective participant (Tourangeau et al., 2000). Therefore, only double-barreled items were considered, for which both parts of the question were semantically very similar and were found to increase the item's comprehensibility (MacKenzie et al., 2011). Further, to account for possible response bias due to social desirability (Nederhof, 1985), special attention was given to formulate items in a neutral manner without cues on what might be interpreted as right or wrong. Finally, items that could be assigned to multiple substrata were either split and revised or excluded from the overall item pool. Items with the same or very similar meaning were merged.

3.2 Identified Substrata

As a result of the described procedure, we obtained a set of 11 domain substrata. Many of them could be directly related to the six core elements of BPM (de Bruin and Rosemann, 2007; Rosemann and vom Brocke, 2010). The identified substrata spanned 7-14 measurement items, with 112 items in total. Each of the domain categories is briefly described in Table 1 below.

Domain	Description	Selected References
Process Execution	Degree of structure of process activities and process sequence.	(Beimborn et al., 2009; Harmon, 2007; Laumer et al., 2015)
Inputs & Outputs	Stability of input and output factors of the business process.	(Hall and Johnson, 2009; Wuellenweber et al., 2008; Zellner and Laumann, 2013)
Documentation	Rigor and completeness of documentation materials and trainings.	(Hammer and Stanton, 1999; Tregear, 2010; Ungan, 2006)
Data	Extent to which process data is consistent across the business process and IT systems employed.	(Bass et al., 2013; Michalik et al., 2013; Ravi, 2006)

Information Technology	Availability of a common technological platform to support the business process.	(Ross, 2003; Steinfield et al., 2011; de Vries et al., 2011)
Governance	Embedding of rules and formal control mechanisms in the business process.	(Dijkman, 2007; Lillrank and Liukko, 2004; Manrodt and Vitasek, 2004)
People & Knowledge	Knowledge and skill intensity, which the business process requires.	(Kettenbohrer and Beimborn, 2014; Seidel et al., 2007; Siriram, 2012)
Culture	Degree to which corporate and national culture is supportive of standardization.	(Finestone and Snyman, 2005; Hofstede, 1997; Williams and van Triest, 2009)
Legal	Differences and commonalities in governmental regulations across countries.	(El Kharbili, 2012; Mocker et al., 2014; Neubauer, 2009)
Collaboration & Communication	Common patterns of collaboration within and among work teams.	(Curiazzi et al., 2016; Kanter, 1994; Kwak et al., 2016)
Strategy	Strategic focus of the process with regards to standardization.	(Griffith et al., 2003; Mocker et al., 2014; Wagner and Weitzel, 2012)

Table 1. Identified Substrata

3.3 Item Selection

In the item selection phase, the items' content validity was evaluated by use of a ranking exercise (Davis, 1989), i.e. we conducted a survey among BPM experts to determine how well the generated items measure BPS. This was done using a 7–point Likert scale (where 1 is the lowest and 7 the highest score) for the level of appropriateness for each item to measure BPS (Vagias, 2006). In the survey, we added plain text fields below each set of Likert scale questions in order to gather comments and qualitative feedback. In particular, we asked participants to provide any feedback on understanding and wording of the items, so adaptations could be made.

Using purposive sampling, 13 BPM experts were invited to participate in the survey. As in the interviews, these BPM experts were chosen for their domain knowledge or BPM experience. The target sample included nine senior executives from a manufacturing company, four research assistants in IS and BPM, as well as an experienced SAP consultant. Thirteen participants completed the survey, reaching a response rate of 100%. Having 13 participants is a reasonable sample size compared to other instrument development studies (Recker and Rosemann, 2010b; Schmiedel et al., 2014).

At this stage, the objective was to obtain a set of items with high content validity. For this reason, measurement instruments with an average score below 4.5 were directly eliminated from the item pool, as they only showed low potential for content validity. After eliminating items with too low scores, items in each substratum were ranked based on the average ranking results. Taking into account the average scores and the qualitative feedback collected in form of the comments, the five best representatives of each domain substratum (55 items in total) were selected for the next stage. In some cases, items were adapted based on the comments received or merged, if they were found to be semantically very similar.

3.4 Item Revision

The last step performed in the item development process was an index-card sorting test (Moore and Benbasat, 1991). The test was carried out in a 4x4 design – four rounds with four participants each. Within each round, participants were asked to group the single items based on the similarity of their meaning without providing a predefined set of categories (open sorting – round 1) or group them into the set of construct categories derived earlier (closed sorting – rounds 2,3, and 4). Based on participants' feedback, the items were revised with regards to their convergent and discriminant construct validity after each round. Furthermore, this procedure was meant to determine those items measuring the category best and revise items' wording where necessary. Items, which were repeatedly misplaced showed little construct validity and were excluded from the overall item pool.

In the sorting test, attendees should indicate the items they considered best to measure BPS and those items, they found hard to understand and could profit from revising. To facilitate this exercise, participants were equipped with green and red stickers to mark two items in each substratum they considered best to measure the construct (green stickers), and those they perceived unclear in terms of wording (unlimited red stickers) (Schmiedel et al., 2014). Participants were asked to provide basic feedback on why they found the instrument hard to understand and how it could be improved. Round 3 was held virtually, following the same structure. The expert panel for the sorting exercise consisted out of process experts from a manufacturing company and four research assistants in IS and BPM.

For evaluating the sorting rounds, the item Placement Ratio (Moore and Benbasat, 1991) and Fleiss' Kappa (Fleiss, 1971) were utilized. The relatively low Placement Ratio (37%) and Fleiss' Kappa (0.10) reflect the circumstance of the open sorting in round 1. In the second sorting round very good results with regards to the Placement Ratio and Kappa values were achieved, already. 84.26% of the actual placements matched with the theoretical classification and Fleiss' Kappa of 0.73 showed substantial agreement in the categorization of items (Landis and Koch, 1977). Compared to recent measurement development studies (Recker and Rosemann, 2010a; Schmiedel et al., 2014), this is a very good result. Thus, it was decided to make rather small adjustments to the wording of items in the following rounds and only exclude measurements, if they were repeatedly misplaced. We also considered whether the remaining items were an appropriate representation of their substrata (Bohrnstedt, 1970). As a consequence, the Placement Ratio and Fleiss' Kappa only showed small variation in the subsequent rounds, reaching a Fleiss' Kappa of 0.71 and a Placement Ratio of 84% in the fourth and last round.

3.5 Measurement Instrument

As a result of the research process, we conceptualized BPS as a multidimensional construct. Overall, the BPS construct is operationalized into eleven domain substrata and their associated items (Table 2).

Domain	**Measurement Item**
Process Execution	This business process contains many exceptions regarding its execution. (reverse)
	This business process always follows exactly the same steps.
	Process participants always perform activities of this business process in the same way.
	This business process is highly flexible in its execution. (reverse)
Inputs & Outputs	Each time this process is executed it produces exactly the same predefined output.
	Inputs of this process are well known and predictable before the process is executed.
	Outputs of this process are custom-made. (reverse)
	In this process, task accomplishment is more important than adherence to a predefined output. (reverse)
Documentation	This process and its activities are fully documented.
	Process stakeholders continuously review the documentation of this process to ensure that it remains up-to-date.
	For this process, one common documentation and training script is available in a central repository.
	For this process, a consistent training concept is in place.
Data	Data for this process is highly consistent.
	Data used in this process is accessible via a centralized repository.
	The type of data maintained for this process is always the same.
	Process participants share a common understanding of this process' data.
Information Technology	An integrated information system supports this business process.
	Legacy information systems cause variations to this business process. (reverse)
	Information systems supporting this business process share a common technological infrastructure.
	The same set of software applications is used throughout this business process.
	In this process, many manual workarounds are needed to bridge gaps in IT systems. (reverse)
Governance	To monitor this process, our organization uses common key performance indicators.
	To steer this process, all stakeholders have clear roles and responsibilities.
	To ease control, local changes to this process are incorporated in the global standard.

	Control over the design of this business process is highly centralized.
	Decisions during runtime of this business process are made centrally.
Culture	Participants of this business process share a common organizational culture.
	Participants of this business process have a common cultural understanding of how to do business.
	Participants of this business process like to follow rules and avoid uncertainties.
	Participants of this business process strive for independence and self-reliance. (reverse)
Legal & Regulations	Differences in national regulations between countries affect this business process. (reverse)
	Local legislation relevant for this business process is homogeneous for all the business units involved.
	Differences in financial regulations between countries, such as reporting standards, affect this business process. (reverse)
	For this business process, internationally accredited standards exist.
People & Knowledge	This process requires the involved employees to apply tacit knowledge. (reverse)
	This business process empowers employee judgment and accountability. (reverse)
	Process participants know our process standard by heart.
	Process participants act according to information obtained during process execution. (reverse)
	Process participants retrieve, transform, and combine knowledge to shape innovation. (reverse)
Collaboration & Communication	Collaboration in this business process is based on a common terminology.
	Process participants know the procedures of people and teams they collaborate with.
	In this process, our organization emphasizes structured collaboration instead of occasional or informal exchanges.
	In this process, frequent discussions help to align different expert opinions. (reverse)
Strategy	According to our strategy, in this process it is more important to realize returns of scale than to respond quickly to environmental changes, such as customer demands and market dynamics.
	It is our strategy to adapt products and services of this process to the wants and needs of local markets. (reverse)
	It is our strategic focus for this process, to realize fast growth. (reverse)
	It is a strategic priority of our organization to offer the same level of quality for this process regardless of location.
	It is our strategic aim to tailor this process to the needs of each individual customer. (reverse)

Table 2. Measurement Instrument for Business Process Standardization

4 Discussion

4.1 Implications

The developed measurement instrument is relevant for both academics and practitioners. We contribute to empirical research in BPM by further developing existing operationalizations of business process standardization. By including various dimensions, such as process strategy and process governance, and refining the different substrata process standardization is composed of, our measurement instrument allows for a more accurate and complete mapping of real-world processes. This can also help to derive a sharper differentiation between process standardization and related concepts, e.g. process complexity.

Future research can build on the BPS construct to drive empirical studies in this field. For example, research can theorize on BPS and examine antecedents and outcomes of process standardization initiatives. In particular, gaining a deeper understanding how various process types mediate the effect of standardization on performance allows for valuable contributions to research and practice that can directly build on the results of this study.

Practitioners can use the measurement instrument to drive various analyses. The operationalization of the BPS construct can serve for as-is and to-be process analyses, which particularly focus on standardization. At this point, however, we caution against a normative perspective on standardization as this is the case for maturity models (van Looy, 2014; Roeglinger et al., 2012) and success factors (Trkman, 2010). The measurement items can be employed in a descriptive fashion to determine the degree of standardization of any given business process, perform stocktaking exercises of standardization levels and track the progress of standardization initiatives.

4.2 Limitations

In each phase of the research process, we used different techniques to guarantee a high level of content and construct validity among the items. For the creation, selection, and revision of items, we incorporated perspectives from other academics and practitioners to avoid possible biases. While we carefully selected participants based on their domain knowledge and BPM experience, we cannot completely rule out that choosing different participants would have led to other findings, given different industry backgrounds, job positions, and other circumstances.

This paper presented research in progress. Up to now, the developed measurement items are not statistically validated (MacKenzie et al., 2011; Recker and Rosemann, 2010b). Thus, our next step will be to examine how far the derived measurement items are ultimately valid and reliable. This also refers to the nomological validity of the presented measurement instrument and its theoretical framing. We are very eager to continue the path taken in this research in progress paper and further develop the presented results and ideas. To demonstrate the practicality of the final measurement instrument, we plan to conduct use cases, in which we apply the measurement scale to real-world business processes in different settings (organizational, geographical, etc.).

While the BPS construct developed in this study can be used to assess the degree of process standardization and trigger consecutive actions, the management of standardized processes and standardization initiatives should be supplemented with other methods. For one thing, case studies can be used to generate a deep and rich understanding when, why, and how companies successfully manage process standardization (Benbasat et al., 1987). Contrariwise, Process Mining techniques can be employed to investigate how processes are actually carried out, discover different variants of the same process, and run conformity controls (van der Aalst et al., 2011; van der Aalst and Dustdar, 2012). Altogether these different methods may finally yield to a comprehensive management cycle for BPS.

5 Conclusion

In this paper, we addressed the research question of how business process standardization can be measured. Our contribution is a measurement instrument that helps researchers and practitioners to precisely describe the level of process standardization. We built this instrument using established methods for scale development in the IS discipline, which yielded a total of eleven domain categories and forty-eight measurement items. In future research, we will validate the developed instrument and investigate the connections of BPS with important factors and performance dimensions.

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