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REVIEW ARTICLE

Conceptualizing Business Process Standardization: A Review and Synthesis

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Abstract 'Business Process Standardization' (BPS) is a practice intended to achieve consistency across underlying organizational processes, in support of service-delivery excellence and optimization of costs and benefits. Given the growing importance of BPS, there is need in both research and practice for clearer conceptual understanding of the notion. Following a systematic literature review approach, prior work on Business Process Standardization is synthesized and extended using tool-supported qualitative data analysis techniques, to derive an evidence-based, holistic conceptualization of BPS. We distil seven stages of BPS execution, propose a refined definition for BPS, and identify measures that gauge the several conceptual themes of BPS. The findings provide solid theoretical foundations, and practicable guidelines for future BPS researchers and practitioners.

Keywords Business Process Standardization · Business Process Management · Conceptualization · Definition · Measures · Structured Literature Review

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1 Introduction

Increasingly, organizations are adopting 'process-centric' thinking for operations optimization, resulting in a shift to viewing business processes as a strategic asset (Rosenkranz et al. 2010). Business Process Standardization (BPS) has proven to enable streamlined processes (e.g., Romero et al. 2015a) and to positively impact business performance (Muenstermann 2015; Wüllenweber and Weitzel 2007).

Organizations endeavour to standardize their business processes to: avoid redundancies (Tregear 2015), reduce costs and improve quality of products and services (Muenstermann et al. 2010a), improve process transparency (Kettenbohrer et al. 2013a), and reduce processing time and re-deploy that time for other value-adding efforts (Muenstermann et al. 2010a). Process Standardisation also helps to better coordinate business activities across internal task handover points and various organizational boundaries (Davenport 2005), and to comply with rules and regulations (Mahmoodzadeh et al. 2009). Standardized business processes are essential for innovative, in-demand, digital transformations such as robotic process automation (RPA) (Desai 2020; Syed et al. 2020) and blockchain-based workflow management (Fridgen et al. 2018).

Globally, companies are investing substantially in standardizing their business processes (Muenstermann and Weitzel 2008; Afflerbach et al. 2016). For example, the Chinese government in an endeavour to boost the country's economic growth rate, has been focusing on standardizing the input-output processes of projects to better enable their modernization and automation (Ji and Pultz 2016). In 2016 Barclays Bank and an Israel-based start-up, completed the first-ever blockchain-based transaction in the world, for which they standardized their transaction process thereby reducing the cycle-time of the transaction process from 7–10 days to 4 h (Guo and Liang 2016).

In spite of the widespread adoption of BPS in practice, and growth observed in BPS research, current BPS literature lacks a clear conceptual definition of BPS, with many calls made for an improved understanding of the BPS concept. For example, Muenstermann (2015, p. 78) state "*there is no real consensus among researchers about how to define business process standardization*". This is reinforced by Wurm and Mendling (2020, p. 284) who assert "*there seems to be only little clarity on the delimitation of the concept and construct of business process standardization*". With BPS increasing in practice, managers seek metrics and measures for economical evaluation and comparison of BPS practices.

Despite the significance of BPS to industry and research, BPS as a construct, yet requires a unified definition and clear conceptualization. This paper aims to address this gap by employing a systematic literature review to (i) understand what BPS is and how it is conducted, (ii) derive a definition of BPS, and (iii) identify how to measure BPS. A sound synthesis of the current BPS literature will provide the basis to derive a holistic definition and associated measures. This will yield a broader, deeper, and more accurate understanding of BPS, enabling its more effective application in research and practice.

The remainder of this paper is structured as follows. Section 2 presents summary background, introducing key concepts and related prior work. Section 3 provides an

overview of the research method employed in this study. Section 4 presents study findings. Section 5 presents a detailed discussion of the results, including future research directions. Section 6 concludes the paper.

2 Background

In this section we first explain what we mean by 'conceptualization' in this study context, and why it is important. Subsequently, we establish a common understanding of key terms underpinning BPS, namely 'business process' and 'standard', that are core to BPS. We then introduce a set of concepts that are different yet are often conflated with BPS. Finally, we discuss prior attempts to conceptualize BPS, thereby reinforcing the motivation for this work.

2.1 The Notion of 'Conceptualization' as Conceived in this Paper

Conceptualization helps to describe a phenomenon, and is an essential pre-requisite to theorizing (Gerring 2011; Van de Ven 2007). Constructs designate conceptual abstractions of a phenomenon, whose meaning is specified through conceptualization (Schwab 1980). The success of research depends on clear understanding of constructs (Zhang et al. 2016). Well-defined constructs form the basic building blocks of a theory (Weber 2012; Markus and Saunders 2007). But, unclear constructs with ambiguous meaning will jeopardize construct validity (Schwab 1980), hinder quality research outcomes and complicate comparison and accumulation of knowledge in the area. The importance of conceptualization has been well argued (MacKenzie et al. 2011; Zhang et al. 2016).

Perspectives on conceptualization vary. Zhang et al. (2016) presents a concise summary of different views on how conceptualization is understood. To many researchers, conceptualization entails providing a definition of a construct that captures its dimensions thereby communicating what it is (MacKenzie et al. 2011). This definition of the construct is then used to guide operationalization and construct validation procedures by devising a set of items that fully capture the meaning of the construct. Confused and ambiguous conceptual definitions engender misunderstanding and inconsistent measures of a concept (Wacker 2004). Many researchers commence with a seemingly clear idea, but often after considerable effort has been expended (i.e., by collecting data) come to realize their original thinking was less clear than they had first believed, where after, consequences of changes to the research can be costly (DeVellis 2012). Undetected failure to adequately define a construct may result in invalid conclusions about relationships with other constructs due to deficient indicators (MacKenzie et al. 2011), hence producing unreliable theoretical conclusions. These dangers strongly convey the need for a clear conceptual definition from the outset, to enable accurate measurement and to make valuable cumulative contributions to an evolving knowledge base.

MacKenzie et al. (2011) suggest examining how the focal construct has been used in prior theoretical and empirical research and then to use that knowledge to inform conceptualization of the construct of interest. Burton-Jones and Straub (2006)

suggest identifying the 'structure' of the concept as a first step towards conceptualization. Having identified the structure, they recommend identifying measures for each of the elements representing the construct.

2.2 Introducing Key Concepts Pertaining to BPS

A business process is commonly defined as "*a set of logically related tasks performed to achieve a defined business outcome"* (Davenport and Short 1990, p. 13). A business process comprises several events and activities. Events happen automatically and trigger the execution of a process. They do not have any duration. An activity is a single unit of work, also known as task (Dumas et al. 2018). A feature of business processes is that several activities are logically ordered and have a clearly defined input as well as output to achieve a business goal (Weske 2019). Business process activities can be performed manually by employees or with the help of information systems (Weske 2007). There are four major sub-dimensions of a business process: (i) activities—the main actions in a process, (ii) workflow—refers to the linking of activities, (iii) resources—agents that are used for adding value to activities, and (iv) entities—"*objects processed by resources*" (Muenstermann and Weitzel 2008, p. 3).

For business processes to be standardized, there must be a 'standard'—an approved referent-process to adopt and benchmark against. According to ISO (1996, p. 1) "*Standards are documents, established by consensus and approved by a recognized body, that provide, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context*". In a BPS context, the standard is usually an enhanced master process used as a point of reference, against which existing business processes (and their variants) are modelled and adapted (see Sect. 4.1 for further details).

A variant of a business process is an alternative version of the same process; it achieves the same outcome, but by following a different sequence of activities (Zellner et al. 2015b). A business process model is a graphical representation of a business process (Reijers et al. 2011), which enables visualizing the flow of activities and interdependencies occurring in the business process.

Standards, in the context of BPS should not be confused with abiding by governance standards set for process management initiatives; for example, using organization-wide modelling-notation standards (such as Business Process Model and Notation (BPMN)) when deriving process models, or using project management templates/standards to manage the BPS initiative. While modelling-notation standards and/or project management templates may be applied in BPS efforts as supporting mechanisms, BPS is quite a different notion. BPS is centred around how a business process abides by and aligns with an enhanced master process, irrespective of the use of other tools and guidelines (such as modelling, project management standards).

2.3 Related Concepts

Current discourses about BPS often use terms which are conflated with the core notion of BPS. Though related, these concepts are different to BPS and it is im-

portant that these concepts are not confused with BPS (Goel and Bandara 2016). This understanding is essential for construct clarity, for the development of precise concepts (Zhang et al. 2016; Suddaby 2010). According to Weber (2012), clearly defined constructs can delineate the boundary conditions of what phenomenon are included and what are not included, when theorizing. The need for concept clarity in the BPS context is emphasized by Goel and Bandara (2016), who through a systematic literature review, list and analyse several concepts often conflated with BPS; such as 'Process integration', 'Process Compliance', 'Process harmonization' and 'Unification of variants'. Additionally, process modularization and reference process models are also concepts that are conflated with BPS.

Process integration relates to the overall coordination of business processes and activities (Narayanan et al. 2011). It focusses on integration of systems and services as well as secure sharing of data across multiple areas of the business to derive well interconnected business processes. Process integration can serve as a useful precedent for standardizing a business process. *Process compliance* refers to business processes adherence to prescribed or agreed upon norms (Seyffarth et al. 2017; Papazoglou 2011). Process compliance is an outcome of BPS. *Process harmonization* refers to aligning variants or homogenizing variants with a standard process (Muenstermann and Weitzel 2008), which is a stage of BPS, as will be explained in Sect. 4.1. Process harmonization is also referred to as *unification of variants* by some authors (e.g., Muenstermann et al. 2010a; Davenport 2005).

The concept of *Process modularization* is another closely related concept to BPS discussed by several authors (e.g., von Stetten et al. 2008; Muenstermann and Weitzel 2008). Process modularization entails breaking a process into parts which can be recombined to create custom alternatives of a business process (Tuunanen and Cassab 2011; Böhmann et al. 2018), and **is a stage of BPS**, as will be discussed later.

Another closely related topic is the notion of *reference process model*, which by definition is a process model that is reusable, displays exemplary practices, and has universal applicability (Rehse et al. 2017; vom Brocke 2007; Dumas et al. 2018). Examples include Supply Chain Operations References (SCOR) (Bolstorff and Rosenbaum 2007) and Information Technology Infrastructure Library (ITIL) (AXELOS 2020). While most reference models, as per the examples of SCOR and ITIL, are derived and governed by external bodies (such as the Supply Chain Council for SCOR), reference models can also be derived inductively from within a company (Scholta et al. 2019) and hence need not be an external process. A company may during the BPS process, choose a reference model as their 'master process'. Even if a reference process model is chosen as a master process, additional steps need to be conducted (as will be explained in Sect. 4.1) to standardize the process. For example, the adaption of the reference model may still vary from process-to-process or case-to-case; especially at the more detailed levels. This is why simply choosing a reference process model is not the same as business process standardization.

During our analysis of what BPS is and the process of conducting BPS (as explained later in Sect. 4 'Study Findings and Contribution'), we were able to confirm that certain of these concepts are antecedents, others are consequences, and yet others are a part of the process of BPS. These concepts are revisited in succeeding discussion as useful.

2.4 Prior Attempts to Conceptualise BPS

Research with a focus on conceptualizing BPS is scarce, there being calls to improve understanding of the BPS concept (e.g., Muenstermann 2015; Wurm and Mendling 2020). Authors tend to talk around the notion of BPS, some addressing factors that influence BPS (e.g., Romero et al. 2015a; Schäfermeyer et al. 2010), with most focusing on the impact of BPS (e.g., Schäfermeyer et al. 2012; Wüllenweber et al. 2008), but with little consensus on what BPS is.

Muenstermann and Weitzel (2008) make strong arguments for the need to develop a better conceptual understanding of the BPS construct. In their attempt to conceptualise BPS, they suggest four criteria/steps essential to standardize a business process: document process, modularize process, isolate specificities, and ensure process excellence (see Table 4, p. 9 of Muenstermann and Weitzel (2008)). Their final definition of a standardized process is; "*to standardize a process means to homogenize it against a standard process*" (Muenstermann and Weitzel 2008). However, they note that they could not locate a clear definition of BPS and indicate that their four criteria are based on their professional experience, with some evidence from literature. Their limited evidence-base raises doubts regarding the sufficiency of their definition. Muenstermann (2015) reports a further attempt to address the question "What is BPS?", where 119 publications deemed related to BPS were analysed. He argues that the analysis of these definitions identified conceptual themes which substantiate their 2008 definition of BPS (Muenstermann and Weitzel 2008). Although comprehensive and rigorous, Muenstermann's (2015) analysis has limitations. First, the papers included in the pool were not all about BPS. This is evident from the definitions extracted (see Table 4 of Muenstermann (2015)), which pertained to themes such as 'IT standards', 'Work standards', 'Reference model standards' and more (the precise scope of the review cannot be ascertained as the search strategy[1] is not provided). Such a mixing of concepts is fraught. A good construct definition is derived by collating the key conceptual themes specifically pertaining to the focused-construct (MacKenzie et al. 2011). Also, there is little detail in Muenstermann (2015) on the analysis process followed (i.e., how they arrived at their definition from the conceptual themes). These identified limitations are acknowledged by Muenstermann (2015) himself who calls for future research to arrive at a '*concise and precise definition of BPS'* and to '*develop adequate measurement scales'* to empirically investigate BPS.

Romero et al. (2015a) also sought to synthesize existing research into a detailed conceptual model of BPS but focused on factors effecting Business Process Standardization and the effects of Business Process Standardization. While these antecedents and consequences of BPS are of interest, Romero et al. (2015a) give limited attention to carefully defining BPS. Their definition of BPS (as *"the unification of business processes and the underlying actions within a company", p* 261)

[1] Defining the keywords used to find literature as a part of the search strategy, has been advocated as an important step of any comprehensive structured literature review, in order to enable transparency and repeatability (Bandara et al. 2015).

is arguably weak, with 'unification' not explained further. Commencing from an incomplete notion of what BPS is, limits the utility of their model.

A clear definition is an essential basis of any conceptualization effort (MacKenzie et al. 2011). Afflerbach et al. (2016) reviewed selected existing BPS definitions to understand how BPS has been conceptualized in the literature. The authors used this understanding to create a design objective for the economic decision model that they propose. While their work is of merit, the focus of that work is not on conceptualizing BPS. The authors themselves note a lack of consensus in BPS related literature, which further reinforces the motivation of this study.

Wurm et al. (2018) attempted to develop a measurement instrument of BPS. While the structured approach they followed has merit, we observe limitations. Any measurement instrument should start from a clear definition of the focal concept (MacKenzie et al. 2011), however, they give this light treatment. Also, their definition does not align with the measures of BPS presented later. Ultimately, the measures should map readily to the dimensions of the construct for which the measurement instrument is developed. The domains (or substrata) of measures in their measurement instrument (Wurm et al. 2018) do not capture the meaning of BPS, but align more to antecedents or consequences of BPS. For example, we consider culture and strategy (dimensions within Wurm et al.'s (2018) model) to be antecedents of BPS, rather than measures. Further, the authors use "process harmoni*" and "process Standardi*" as their search keywords. However, process harmonization can refer to several different activities not specifically associated with BPS[2] (Muenstermann and Weitzel 2008), which may conflate results.

Wurm and Mendling (2020) present a theoretical model for business process standardization, which aims at providing the contextual factors that influence BPS. Their overall objective was to identify and interrelate antecedents of successful BPS and connect them to different contextual elements. While the authors provide a good start to the theoretical model, their work again gives inadequate attention to conceptualizing the core construct, BPS. Fleig (2020) is another extensive and recent BPS study. Their focus is also on the antecedents of BPS. More specifically, they address how organizations need to consider contingency factors (such as strategy, business, and application systems) in a data-driven way when making decisions about how to standardise business processes. Once again, Fleig's focus is not on the concept of BPS itself and includes a minimalistic conceptualization of BPS.

As evidenced above, prior attempts at conceptualising BPS are few and with limitations. This study addresses this lack by building on prior work with a rigorous study design which is detailed next.

3 Literature Review Methodology

This paper employed a systematic literature review approach following the guidelines of Bandara et al. (2015). The overall method is visually depicted in Fig. 1.

[2] In Sect. 4.1, our analysis confirms that process harmonization is a stage of (or a 'part of') process standardization, rather than a synonym.

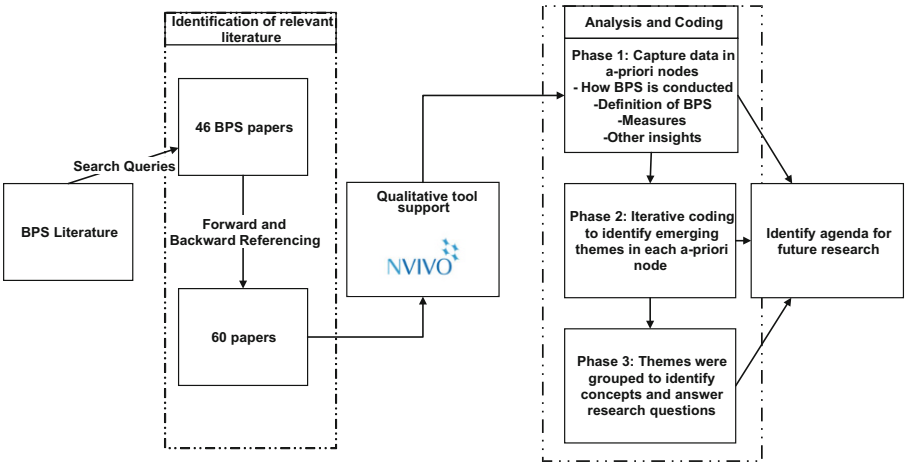

Fig. 1 Overview of Systematic Literature Review Methodology

Relevant papers were identified from prominent databases in the Management Information Systems (MIS) and general management fields. Full text peer-reviewed journal and conference articles in English were sought, using a range of search strings purposefully derived to address the study goal. Appendix A, Section A.1 provides further details regarding the steps followed in retrieving relevant articles and Section A.2 presents a profiling overview of the pool of papers included in this analysis. The search strings were looked for in the abstract, title, and keywords. Using well-defined relevance criteria, 46 papers were initially extracted. After forward and backward searching, 60 articles related to BPS were retrieved.

The selected articles were exported to NVivo, a qualitative data analysis tool. A classification sheet with descriptive information[3] about the papers, and a coding rulebook[4] (following Saldana 2012) were maintained. The coding and analysis were mainly inductive, and iterative. High level themes on what to extract were derived in conjunction with study goals, after an initial scan of the papers.

Following both MacKenzie et al. (2011) and Burton-Jones and Straub (2006), we first reviewed prior research; to extrapolate the conceptual themes pertaining to BPS (i.e. identifying the 'structure' through literature synthesis). These structural themes were then used to inform the derivation of a definition of BPS. Following this, we extracted and synthesized the measures of BPS.

The overall coding and analysis proceeded in 3 phases. Each phase of coding was done with two coders, with inter-coder corroborations set at the end of each coding-iteration.

[3] This included meta-information of the papers, such as; source and year of publication, type of paper etc., which helped in profiling the pool of articles as presented in Appendix A.

[4] A coding rule book is a document with rules outlined for coding the data to enable transparency and guide the multi-coder corroboration sessions. A copy of what was used here is available from the first author upon request.

In Phase 1, any description of how BPS occurs was captured in the 'how BPS is conducted' node[5]. Any direct or indirect definition[6] of BPS was captured in the 'definition of BPS' node. Any direct or indirect attempt to operationalize BPS (qualitatively or quantitatively) was captured under the 'measures' node. Any statement that was not relevant to these three nodes, but deemed possibly useful for understanding BPS, was captured in an 'other insights' node.

Phase 2 involved iterative coding within each of the first three main nodes, where the coded content within each node was further analysed employing an inductive coding approach allowing themes to emerge. 'In-vivo' coding (the practice of assigning a label to a section of data using a word or short phrase derived from that section itself (Given 2008)) was used to identify emerging themes. This is a form of open coding (Wolfswinkel et al. 2013) and enabled the researcher to associate the concepts as closely as possible to original terms used (Given 2008).

In Phase 3, these in-vivo codes were analysed and grouped into further groups-of-themes, where sub-categories were developed by grouping similar concepts. A sense-making approach was applied; with multiple iterations involving multiple coders (the authors), aimed at deriving a final set of categories (at similar levels of granularity) across the data set. These categories were then used to answer the investigative questions and to conceptualize BPS.

4 Study Findings and Contributions

In accordance with MacKenzie et al. (2011), we first analysed existing BPS literature to gather the state-of-the art in BPS. This unveiled how prior BPS studies predominantly describe BPS as a process, discussing the different activities pertaining to BPS. Based on this analysis, we elucidate the main stages of BPS projects as defined and reported in the BPS literature (Sect. 4.1). This holistic understanding of the process of BPS, in-turn informed the conceptualisation of BPS that followed. It also ensured that we use terms as described in BPS literature to conceptualize BPS; a recommended practice for conceptualization efforts (MacKenzie et al. 2011). Next (Sect. 4.2), we collated and analysed the current suite of BPS definitions, discussed limitations of current definitions, and subsequently present our definition of BPS. Further, we substantiate our conceptualisation by extracting and analysing measures of BPS from literature that addresses BPS operationalization efforts (Sect. 4.3), and thus provide a solid base for future BPS operationalization efforts.

[5] Note: nodes are fundamental in the NVivo tool and are like 'folders' which enable related information to be gathered to one place.

[6] A direct definition consisted of statements that specifically attempted to define BPS, examples include; "*business process standardization is" ... or "business process standardization is defined as ...*". Whereas indirect definitions were those statements that described business process standardization without declaring it as a definition.

4.1 How Is the Conduct of Business Process Standardization Described in Current Literature?

This section is presented as a narrative review (Paré et al. 2015, p. 185), which *"attempts to identify what has been written on a subject or topic …"*. In line with typical narrative reviews (Paré et al. 2015), the aim here was *not* to seek cumulative knowledge from all published resources, but to develop a simple structured understanding of what has been stated about BPS, using the published literature as the evidence-base. This understanding of what is stated in the current literature is fundamental in any conceptualisation effort (MacKenzie et al. 2011); it was also deemed essential to understand and make sense of the findings of the subsequent stages.

This analysis pointed out that most of the literature inclined on explaining the conduct of BPS. Thus, this section provides a summary overview of how the conduct of 'Business Process Standardization' is described in current literature.

The analysis suggested BPS is a staged process, where various activities need to be accomplished for Business Process Standardization to be achieved. The literature analysis revealed seven stages, as detailed following. Knowledge gaps pertaining to each stage are briefly discussed in this section and are later suggested as important areas for future research. Note that earlier mentioned concepts that are related to BPS (introduced in Sect. 2.2) and play a part in the BPS process, are revisited here.

Stage 1: Documentation of Individual Process Variants BPS commences with the documentation of all variants of the business process to be standardized (Muenstermann et al. 2010a; Ungan 2006; Muenstermann and Weitzel 2008; von Stetten et al. 2008), which is usually done in the form of business process models and supporting text. While we assume that generic process modelling support artefacts (such as modelling guidelines, a modelling tool etc.) are used here, none of the BPS literature addresses this. Once the variants are documented, they need to be checked to ensure that the documentation captures the complete process for each process variant.

Stage 2: Modularization of Documented Processes 'Modularization', refers to "*subdividing a process into meaningful and suggestive sub-processes and steps*" (Muenstermann and Weitzel 2008, p. 9), which sometimes can also take place as part of Stage 1. This stage intends to ensure that the necessary aspects of the process are captured at the required level of detail (such as who is responsible for tasks, and who is accountable for the execution of the various parts of the process), while also managing the associated complexity of maintaining such details. What is meaningful and suggestive, depends on the organizational boundaries, process logic and project contexts. For example, the goal may be to modularize components of a process based on process logic of departments within an organization. BPS literature clearly discusses the need to modularize a business process (von Stetten et al. 2008), but precise guidelines on how modularization should be done within BPS contexts are absent.

Stage 3: Identification of a Master Process Once the process variants are documented in a modularized manner, they are reviewed to identify a 'master' process. Different authors refer to the 'master process' using different terms. For example, Muenstermann and Weitzel (2008) refer to it as an 'Archetype process', while Muenstermann et al. (2010a); von Stetten et al. (2008) use the term 'prototype standard' (a process containing/combining best steps identified in the variants). Whether 'master', 'archetype' or 'prototype' process, they all refer to an initial reference point, against which other processes are to be standardized. Henceforth, we will refer to this initial internal point of reference as the 'master process.' A master process can be derived in three ways:

1. A complete internal process (one of the end-to-end process variants) can be selected as the master process (for example in the BPS case described by von Stetten et al. (2008), the recruiting process of the company's headquarter was chosen as the master process).
2. On reviewing the modules of each process variant, those modules deemed better practice across the variants may be selected and combined to form the master process (for example in the BPS case described by Muenstermann et al. (2010a), fragments from variants were synthesized based on cost, quality and time to obtain a master process).
3. A complete external process (or a reference model, as introduced in Section 2.2) can be selected as a master process, e.g., Supply Chain Operations Reference (SCOR) (Bolstorff and Rosenbaum 2007). Kauffman and Tsai (2010) give an example of an external process standard (eTOM) that was adopted by other firms for standardization.

As discussed in Section 2.2, a master process can be referred to as a process reference model. Usually some process performance indicators (such as time, cost, and quality) are used to identify what is considered the best (or better) practice amongst several master process candidates (Muenstermann et al. 2010a). However, who decides on the derivation of the Master process and how this is done is rarely discussed in the current BPS literature.

Stage 4: Isolation of Specificities Those specificities of the master process that cannot be common to all process variants need to be isolated (Muenstermann and Weitzel 2008). Specificities refer to those activities unique to an instance (variant) of a process. Some variants may have specificities that may not apply to other variants, e.g., contextual factors such as local regulation. Once isolated, the number of specificities is minimized, to reduce variability across the process variants. On introducing these changes, an enhanced version of the master process is obtained. How isolation occurs, and the typical activities involved, has received limited discussion in literature.

Stage 5: Possible Improvements to the Master Process Once the master process is identified, an organization may improve it by incorporating best practices through external consultants, competitor analysis, and more. It is likely that organizations

will target process improvements while standardizing business processes. For example, in the case 'Online' (pseudo name) of Muenstermann et al. (2010a), the activities of competitors' customer relationship management processes and systems were analysed, and those deemed superior were incorporated into the master process, which was then enhanced to create a standard process. In the case study of company 'Future' by von Stetten et al. (2008), suggestions for improvements were made by a firm of consultants.

An organization can also go through an internal Business Process Standardization effort which solely focuses on an internally derived master process; without attending to process improvements. Hence, we see Stage 5 as optional, in which case the master process (created in Stage 3 and enhanced in Stage 4) may (or may not) be subject to further improvements.

Stage 6: Approval/Acceptance of an Enhanced Master Process as a 'standard' The enhanced master process (subject to isolation of specificities and optional process improvements) derived in the previous stage(s), only becomes a standard when it is approved by a recognized body (a formal authority). The significance of this stage, preceding Stage 7—unification of variants against the standard process (i.e., enhanced and approved master process), is evidenced in the case studies conducted by Rosenkranz et al. (2010)—where only after formal acceptance of the standard, was the next stage of BPS commenced, i.e., unifying process variants. However, current literature is vague in terms of *who is responsible* for giving approval and the *forms of approval* following which a Master process can be considered a standard.

Stage 7: Unifying Process Variants with the Standard (Enhanced and Approved Master Process) The processes become standardized once the process variants are unified with a defined standard. As introduced in Sect. 2.2, 'unification' refers to the activity of aligning existing variants of a process against the standard process (Zellner and Marcus 2013). This procedure is also referred to as 'homogenization' of existing variants against the standard process (Muenstermann and Weitzel 2008; Muenstermann et al. 2010a).

Zellner et al. (2015a) suggest a procedure to manage and unify existing variants with a standard process. They advocate documenting the processes to be unified in one table and documenting the variants along with the reasons for the variations in a separate table. Through interviews in an action research approach, they show how the tables help to identify, manage, and improve variants in a BPS context. However, their procedure derives from observation of a single process in a single organization. Overall, there is a dearth of literature in the BPS domain addressing how variants are best unified with a standard process.

While Fig. 2 depicts a sequential BPS process as evidenced in literature; we also argue that these stages can take place in a non-linear and iterative way. For instance, an organization may document a process, then modularize it, which may reveal things missing, which are further documented; or the modularization can be done as the processes are documented. Should the recognized body not approve the resultant master process, additional iterations may be required until the master process is established as the standard. Nor must these stages always occur in the depicted

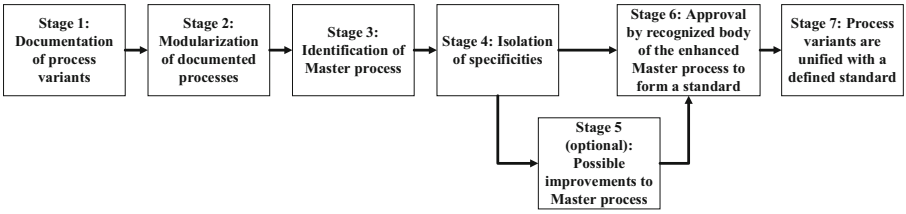

Fig. 2 Stages of Business Process Standardization (BPS)

order. For instance, specificities may be isolated before or after the identification of the master process. Also, we consider Stage 5 to be optional (which we acknowledge runs counter to the views of some authors).

Importantly, although these stages represent a synthesis of the previous literature, most of the stages lack detail, revealing gaps which demand research attention to progress BPS knowledge (see Sect. 5.1).

4.2 How is BPS Defined?

An important step in conceptualizing any concept is to arrive at a clear definition. According to Wacker (2004, p. 631) "*a 'good' definition is defined as: a concise, clear verbal expression of a unique concept that can be used for strict empirical testing*". Further, "*definitions must be carefully designed to clearly represent the abstract concept*" (Wacker 2004, p. 630). These conceptual definitions form the essential building blocks of a theory. MacKenzie et al. (2011) suggest identifying conceptual themes as a critical step to arriving at a conceptual definition. Conceptual themes are attributes or characteristics that are necessary and sufficient for something to be an exemplar of a construct. They advocate using past research to extract definitions and to uncover the characteristics associated with the construct of interest.

We later employ Wacker's (2004) rules to assess various definitions of BPS. According to Wacker (2004), there are eight rules for a good formal conceptual definition: (i) it needs to be defined using terms that are clearly understood by the reader, (ii) it should be unique and try to exclude shared terms with other definitions, (iii) it should not contain unclear and ambiguous terms, (iv) it should be short (few terms), (v) it should be as similar as possible across studies, (vi) new definitions should not expand a concept and make it broader, (vii) it should not have any hypotheses (including outcomes), and (viii) content validity should be done (only) after there is a formal definition; measures should not be a part of the definition, as such suggests premature operationalization (before adequately defining the construct).

Following the approach suggested by MacKenzie et al. (2011), we discerned 22 explicit or implicit definitions from past literature on Business Process Standardization.

Each of the 22 distinct BPS definitions extracted was reviewed in depth (see Appendix B, Fig. B.1 for the summary results); firstly, by evaluating them against Wacker's (2004) rules (mentioned above), and subsequently by extracting conceptual themes that characterize BPS. Thirteen (13) out of twenty-two (22) definitions,

included a hypothesis (such as 'process standardization results in efficient cost, time and quality') thus infringing Wacker's rule (vii). Several definitions were found to include measures, suggesting premature operationalization (before adequately defining the construct). Several use vague terms that require elaboration, without which the definition is unclear. No single definition has gained widespread acceptance (i.e., is cited by a majority of papers). These results further reaffirm the need for a satisfactory definition of BPS.

Our analysis confirmed that very little attention has to date been given to deriving a clear conceptual definition of BPS; and that there is no widely accepted formal definition of BPS. In the event of empirical measurement, some papers proceed without any formal definition of BPS (e.g. Wüllenweber et al. 2008; Chtioui 2009) raising serious concerns with the integrity of related results.

Table 1 presents a synthesis of the conceptual themes extracted from Fig. B.1 (derived from the bolded text from Column 1 of Fig. B.1). Column 1 of Table 1 lists the initial (Level 1) themes extracted from Fig. B.1. Column 2 presents supporting evidence, listing the related sources supporting the theme(s). The 'Level 1' themes were subjected to axial coding (following the guidelines of Wolfswinkel et al. (2013)), which resulted in six 'Level 2' themes (Column 3). In Column 4, the Level 2 themes are mapped against the stages of BPS (presented in Sect. 4.1, see Fig. 1) to show how current definitions use stages of BPS to define BPS. The six Level 2 themes were then further grouped yielding two main phases of BPS: (A) Derivation of an enhanced and approved master process (as the standard), and (B) Unification of process variants with the accepted master process (Level 3—Column 5).

The derived Level 2 themes closely align with the stages of Business Process Standardization (see Table 1—Column 4 and Fig. 2), instantiating all but Stages 2 and 4—'modularization of documented processes' and 'isolation of specificities' respectively. Given that modularization of documented processes and isolation of specificities are identified as key stages of the BPS process in the literature (as explained in Sect. 4.1), we argue that they should be accounted for in a complete definition of BPS. However, this is not the case within current BPS literature.

Additionally, Table 1 includes a Level 2 conceptual theme, 'best-known execution process'. As discussed in Sect. 4.1, once the organization decides on a master process, the master process *may* be subject to improvement by integrating best practices. However, this is context dependent as an organization may only be interested in standardizing its process without intending to assess and integrate best practices as part of the BPS effort. According to MacKenzie et al. (2011), a definition should only include dimensions (conceptual themes) that are necessary at *all* times for the concept to be complete. While it is important to acknowledge conceptual themes that may be relevant only to some contexts of a phenomenon (not universally relevant), its best to not include these in the definition. However, acknowledging these contextually unique themes enables researchers to integrate them, as and when the definition is to be adapted in future study contexts.

Our conceptualization of BPS has two main phases namely (A) derivation of an enhanced and approved master process, and (B) unification of variants with the accepted master process; with the former excluding the stage 'possible improvements' to the master process (optimization), which is optional. Therefore, the first phase

Table 1 High level conceptual themes derived for BPS

Level 1 Themes		Level 2 Themes		Level 3 Themes
Initial Conceptual Themes	Sources			
(1)	(2)	(3)	(4)	(5)
Definitions of metrics, common language	(Mahmoodzadeh et al. 2009)	Documentation of process specifications (*The details related to the process must be clearly documented)*	Stage 1: Documentation of process variants	(A) DERIVATION OF AN ENHANCED AND APPROVED MASTER PROCESS
Rules, guidelines or characteristics for activities or results	(ISO 1996)			
Are documents	(ISO 1996)			
Define how a process will be executed	Cited by Ross et al. (2006) in (Zellner and Marcus 2013)			
Work rules, policies and operating procedures	(Jang and Lee 1998; Fleig 2020)			
Selection of a process and a set of process variants	(Muenstermann 2015; Muenstermann and Eckhardt 2009)			
Template for all process instances	(Tregear 2015)			
No various alternatives	(Kettenbohrer et al. 2013a)	Fixed standard procedure (*The standard process is fixed and has no alternative ways of execution)*	Stage 3: Identification of master process	
Standard process	(Tregear 2015; Shaw et al. 2007)			
Regardless of who and where performed	Ross et al. (2006) in (Zellner and Marcus 2013) (Zellner et al. 2015a) (Zellner and Marcus 2013)			
Described only once	(Kettenbohrer et al. 2013b)			
Common use	(ISO 1996)			
Solutions with repeated or continuous use	(de Vries 1999; ISO 1996)			
Develop an archetype process	(Muenstermann 2015)			
Best-known method	(Kettenbohrer et al. 2013b) (Zellner et al. 2015a) (Zellner and Marcus 2013) (Tregear 2015)	Best-known execution process (*Standard process can be enhanced using best practices)*	Stage 5 (optional): Possible improvements to master process	
Efficient method	(Zellner et al. 2015a)			
Easy method	(Kettenbohrer et al. 2013b)			
Safest method	(Kettenbohrer et al. 2013b)			
External best practice knowledge	(Muenstermann et al. 2009)	Formal agreement (*The standard process needs to be approved by a recognized body)*	Stage 6: Approval by recognized body of enhanced master process to form a standard	
Approved by recognized body	(ISO 1996)			
Established by consensus	(ISO 1996)			

Table 1 (Continued)

Level 1 Themes		Level 2 Themes		Level 3 Themes
Initial Conceptual Themes	Sources			
(1)	(2)	(3)	(4)	(5)
Unification of variants	(Muenstermann et al. 2010b; Afflerbach et al. 2016) (Kettenbohrer et al. 2015, 2016; Laumer et al. 2015)	Unification of variants *(Merge/Align process variants with accepted master process.)*	Stage 7: Process variants are unified against a defined standard	(B) UNIFICATION OF VARIANTS WITH THE ACCEPTED MASTER PROCESS
Aligning existing variants against standard process	(Muenstermann et al. 2010b; Afflerbach et al. 2016; Kettenbohrer et al. 2015; Laumer et al. 2015)			
Homogenize against a standard process	(Muenstermann and Weitzel 2008; Wurm et al. 2018; Fleig 2020)			
Aligned process variants	(Muenstermann et al. 2009)			
Homogenization of business processes	(Beimborn et al. 2009)			
Unification of business processes and the underlying actions	(Schäfermeyer et al. 2010; Wurm and Mendling 2020)			
Homogenization of set of process variants	(Muenstermann 2015)			
Diffusing and adopting a standard	(ISO 1996)			

comprises 5 stages. Table 2 provides the definitions of the phases and stages. This conceptual overview of BPS has been derived by integrating two sources of evidence, namely: (i) analysis of the way BPS is conducted as described in literature in Sect. 4.1, and (ii) analysis of definitions, presented above (and in Appendix B).

The resultant BPS conceptualization aligns somewhat with Muenstermann's definitions across his three papers (Muenstermann 2015; Muenstermann et al. 2010b; Muenstermann and Weitzel 2008). Muenstermann and Weitzel (2008) define process standardization as: "*To standardize a process means to homogenize it against a standard process*". In the other two papers, standardization is defined as "*the unification of variants of a given business process by aligning the variants against an archetype process*" (Muenstermann et al. 2010b). We agree with the definition provided by Muenstermann and Weitzel (2008), but not the definitions in the other two papers, mainly due to ambiguous terminology used, as described below.

BPS is the activity of unifying process variants against an *enhanced and approved master process (standard process)*, not an archetype process (we equate archetype process with 'master process' in this paper). Recall (see Sect. 4.1) that once a master process is identified it is subject to isolation of specificities, optional enhancements, and then has to be approved as a standard by a recognized body (or accepted as a standard through consensus, where the group consenting is the recognized body), without which it is not considered a 'standard process'. This is why an archetype process is not automatically an enhanced and approved master process. Earlier on (see Sect. 4.1, Stage 3), we pointed out that the terms 'archetype process', 'prototype

Table 2 Phases and stages of the process of BPS

Phase	Stage	Definition
(A) Derivation of an enhanced and approved master process		... entails clearly documenting a modularized master process subject to isolation of specificities and formally agreed by a recognized body
1	Documentation of process specifications	... entails careful consideration and documentation of the specifications related to the process
2	Modularization of documented process	... entails sub-dividing a process into meaningful and suggestive activities (Muenstermann and Weitzel 2008)
3	Derivation of a master Process	... entails combining various modularized activities or adopting an internal or external process as a whole, which acts as the point of reference
4	Isolation of specificities	... entails identifying and sequestering the specific unique aspects of the processes that are not common to all process variants
5	Formal agreement by recognized body	... entails consensus and acceptance of the enhanced master process (with isolation of specificities) by a recognized body, declaring it as a standard
(B) Unification of variants against the accepted master process		... entails merging/aligning process variants against the accepted master process

process' and 'master process' have been inconsistently used in the literature to explain much the same thing. In example, we observe in the two definitions by Muenstermann (2015); Muenstermann et al. (2010b) use of the term 'archetype process' inaccurately.

We therefore adapt and modify the definition proposed by Muenstermann and Weitzel (2008) to derive a definition of BPS on the basis of findings from literature. Unlike prior definitions, our definition captures the conceptual themes of BPS, is in accordance with Wacker's (2004) rules of a good formal conceptual definition and has a stronger evidence base. We define BPS as follows:

Business Process Standardization (BPS) entails derivation of **an enhanced and approved master process** as a standard and unifying other process **variants** with that master process.

- An enhanced and approved master process is a clearly documented, modularized and macro-level referent process with isolated specificities, which is accepted as a standard either by a recognized body or through consensus.
- *A variant is "an observed or documented business process with a specific variation of at least one of the elements for a defined part of the overall sequence of activities"* (according to Zellner et al. (2015a)).
- Unifying means to harmonize or homogenize.

4.3 How is BPS Measured?

In accordance with Burton-Jones and Straub's (2006) two-step method for conceptualizing constructs, once the focal construct (the BPS concept) 'structure' has been

identified (i.e., see Table 2 and Sect. 4.2.1 above), the next step is to generate a set of *items* (henceforth herein referred to as *measures*) that represent and further refine the conceptual meaning of the construct (MacKenzie et al. 2011; Burton-Jones and Straub 2006). The goal of this section was to further progress the BPS conceptualization effort, by analysing how measures used in operationalizing BPS in prior research best represent the now defined conceptual domain of the construct. Ideally, a construct's measures should fully encapsulate the essential aspects of the construct's domain (and exclude concepts outside the domain); to foster research that accurately focuses on the construct of interest (MacKenzie et al. 2011; Burton-Jones and Straub 2006). Failure to identify proper measures may jeopardize progressive knowledge in the area of interest, as otherwise the concept(s) may not be correctly measured, resulting in misguided research outcomes.

In this phase of the study, we collated and analysed the existing (otherwise scattered) BPS measures from the literature with a multi-phased approach. Our analysis was conducted on the premise that ultimately, measures should fully capture the essence of the construct (MacKenzie et al. 2011), and thus could be used to both confirm or modify our understanding, and to inform the potential operationalization of BPS. The detailed evidence of this analysis is presented in Appendix C. Summary results are presented in Table 3 below.

All statements in the literature that directly or implicitly mentioned quantitative or qualitative BPS measures were captured as in-vivo codes under the 'measures' main node (see Column 1 of Fig. C.1, Appendix C) in the first round of coding. In subsequent rounds of coding, these were grouped into similar themes and hierarchically arranged when relevant (see Column 2 of Fig. C.1) forming measurement categories for BPS (see Columns 3 & 4 of Fig. C.1 and Columns 2 & 3 of Table 3). These measurement categories were then mapped to the BPS stages and core phases (as derived in Sect. 4.2). Table 3 provides a high-level overview of: suggested measurement categories (with descriptions—Columns 2 & 3) mapped against the different BPS stages (Column 1) as synthesized from the literature.

The analysis of the 60 papers within the paper pool, revealed that 26 out of 41 empirical papers reported measures (quantitative and/or qualitative in nature) used to operationalize BPS (the 15 other empirical papers did not measure BPS[7]). Our review evidenced much variation in measures across the studies. While measures can legitimately vary due to contextual differences in which BPS is studied, the diversity observed appears ad-hoc; similar to what Burton-Jones and Straub (2006) describe as 'un-disciplined diversity'—which makes the research results incomparable and difficult to (re)use, thus impeding cumulative knowledge creation. This further confirms the value from having a clearly defined starting set of measures to operationalize BPS.

[7] Out of these 15 papers, 3 included only limited discussion on BPS (see Appendix A, Section A.2, Fig. A.1 where the papers are profiled based on the level of BPS specific discussion the papers contained). The other 11 papers, though centred on BPS, did not measure BPS. For example, Seethamraju and Seethamraju (2009) in their paper discuss the varying influence of BPS on building organizational agility, but they do not measure BPS.

Table 3 Summary Synthesis of BPS measures

(1) Related BPS Stage	(2) Suggested Measurement Category (with supporting literature)	(3) Description of Category
Phase A: Derivation of Enhanced and Approved master Process		
Documentation of process specifications	A1. Presence of process document which describes activities and elements. (Muenstermann and Weitzel 2008; Nesheim 2011; Šenk and Roblek 2019; Fleig et al. 2018; Iden and Eikebrokk 2014; Iden 2012)	Establishes the existence of process documentation which may come in multiple/different forms. While the usage of process models (and flowcharts) has been proposed, clear written text that describes the processes is also required. Guidelines and work instructions were also perceived to be a form of documentation, and hence its inclusion in this theme
	A2. The process documentation should cover all essential details necessary for process awareness and its efficient execution. (Beimborn et al. 2009; Šenk and Roblek 2019; von Stetten et al. 2008; Kettenbohrer et al. 2013a; Wüllenweber et al. 2008; Rosenkranz et al. 2010)	Clear documentation of all activities, which involves the following: – All the mandatory activities associated with the process are listed. – The activities are described in the sequential order they occur – Activities are transparent and all required information is present. The roles and responsibilities related to the people involved are clear and include the following: – There is a nominated process owner or there is a someone responsible for the process – All process stakeholders understand their role and responsibilities
Modularity of business processes	A3. Process documentation is structured in a modularized manner with sufficient detail. (Muenstermann and Weitzel 2008; von Stetten et al. 2008; Nesheim 2011)	The process documentation is structured in a modularized manner, where the process is subdivided into meaningful activities (which assist with locating the process information). The modular process document must entail sufficient level of detail related to activities and elements
Derivation of the master Process	A4. Derivation of a fixed master Process that is a single point of reference. (Muenstermann et al. 2009; Kettenbohrer et al. 2013a)	There is one fixed way (documented process procedure) of conducting the processes. The process execution should be a single point of reference with it being described only once and having no various alternatives of execution
Isolation of process specificities	A5. Unique aspects associated with each process needs to be specified and isolated. (Muenstermann and Weitzel 2008; von Stetten et al. 2008)	While merging two or more processes, unique aspects associated with each process needs to be specified and taken into consideration
Agreement of enhanced master Process	A6. Process documentation is governed. (Nesheim 2011; Muenstermann et al. 2009, 2010a)	The process is not only documented, but such documentation is governed in a manner that the process execution can be conducted in a regulated way (as per the documentation). The process is controlled or directed by rule, principle, and standards

Table 3 (Continued)

(1) Related BPS Stage	(2) Suggested Measurement Category (with supporting literature)	(3) Description of Category
Phase B: Unification of variants with Accepted master Process		
Unification of Variants	B1. Degree of merging process variants (Nesheim 2011; Romero et al. 2015b)	This set of items establishes the measures for harmonization of standards in the context of BPS to merge process variants. It consists of the following: – The number of documents that are required for different processes, – The percentage of common activities among the processes being harmonized, – Different software applications deployed by the processes, and – Percentage of common and different roles involved
Other Measures		
Incorporation of best-known execution options/ Possible improvements to master process	C1. Extent of use of current knowledge and past experience to arrive at the best-known process for execution (Muenstermann and Weitzel 2008) C2. Presence of governing documentations to ensure that the process performed is the best-known execution option (Nesheim 2011)	In order to ensure that the current mode of execution is the best practice, incorporation of knowledge and experience as well as presence of controlling documentations which ensures that the process being followed *is* the best-known option of execution, is necessary
Overarching measures of BPS	D1. Highly standardized processes (Muenstermann et al. 2010a, 2009; Schäfermeyer et al. 2012; Wüllenweber et al. 2008; Laumer et al. 2015)	Evaluates if the process standardized or not in the opinion of the organization
	D2. Awareness of process standards (Muenstermann et al. 2009; Laumer et al. 2015)	The organization is aware of the standards that the process needs to adhere to in the context of BPS
Implied measures	E1. Well understood process (Ungan 2006) E2. Easily learned (Wüllenweber et al. 2008)	These measures were used by the listed papers as measures of BPS. Though they do not directly map to any of the sub-dimensions of BPS, they can be used as a proxy to the quality of the standardization of business processes

The analysis of measures revealed several interesting observations. First, while the initial literature analysis (see Sect. 4.2) revealed two main BPS phases, with the first phase having five stages (see Fig. 2), none of the studies that 'measured' BPS (25 papers) had measures that mapped against all the stages. This suggests that prior authors may not have considered all stages of BPS and/or their measures were overarching in nature (spanning multiple phases). Construct operationalization guidelines (such as Burton-Jones and Straub 2006; MacKenzie et al. 2011) describe

the importance of being clear on what aspects are being operationalized and at what level of granularity. This has not been addressed by the BPS operationalization efforts reported to date.

While no single study's BPS measures mapped against all stages, all stages were instantiated by the analysis of the pool of papers. This reinforces the pertinence of the seven stages (inclusive of one optional stage) of which BPS is comprised. The analysis also revealed measures that aligned with 'possible improvements to master process'. Recall, 'possible improvements to master process' is an optional activity in the conduct of BPS, and hence was not considered to be a core dimension of BPS. While we consider the incorporation of 'possible improvements to master process' as optional in BPS, we acknowledge that its relevance will depend on the unique context in which BPS occurs. Measures presented in this paper for 'possible improvements to master process' (see incorporation of best-known execution options/possible improvements to master process under 'Other Measures') may be adapted by researchers or practitioners who wish to assess BPS for an organization which chooses to integrate best practices as part of the BPS effort.

Several measures were overarching in nature (see second row under 'Other Measures' in Table 3). For example, 'highly standardized processes', aims to gauge whether the process is perceived to be standardized or not, without addressing the separate stages. Such overarching measures provide only a broad sense of the construct being measured (Gable et al. 2008). And though they can be valuable in certain construct validation tests (e.g., as criterion measures used in combination with dimension-specific measures), when used alone Burton-Jones and Straub (2006) refer to these as 'lean' measures; which are considered convenient to use, but have been critiqued for being inexact and not capturing rich data related to the attributes being measured.

Several of the 'other measures' were not directly about BPS. We positioned these measures as 'implied' measures; measures which can be used as a proxy to understand BPS.

Imbalance was noted in the range and detail of measures observed across stages. For example, very few measures were found in relation to the '*unification of variants with the accepted master process*' phase. One could argue that what was found here was too broad (see Phase 2 measures in Table 3); hence inviting ambiguity. Other elements such as applied modelling language, definitions of process components, and interdependencies of process activities need to be considered before merging modelled process variants, none of which are represented in the current measures. Consideration of such aspects will enable more detailed measurement, resulting in improved validity of the phase being measured (Burton-Jones and Straub 2006).

Several items mapped to the BPS stages are inadequately granular (too high-level—observed via Appendix C). For example, items for—'*modularity of business processes*', would benefit from more granular measures, to better capture the meaning of that stage. Lack of sufficient detail is also evident for '*agreement of enhanced master process*', as it has only two high-level measures ('*maintaining governing documentation*' and '*well-regulated process*'), which could be usefully further decomposed, perhaps dependent on context.

Overall, this analysis provides a solid base for future researchers as it consolidates all prior measures of BPS; an essential task when conceptualizing a construct (Burton-Jones and Straub 2006). This presents a solid foundation to derive a formative index of BPS for future research. The consolidated list of BPS measures we arrived at, and the analysis presented, is more complete (and transparent) than prior such efforts.

5 Discussion

In this section we summarize the study contributions and then acknowledge limitations whilst also outlining areas for future research.

5.1 Study Contributions

This study on business process standardization (BPS) conceptualization is a response to continuing calls for a clear(er) conceptualization of the construct. Strong conceptualization is an essential prerequisite to building theory (Weber 2012) and the progression of a field (Corley and Gioia 2011). Our work coincides with Gregor's (2006) 'theory of analyzing' and provides an in-depth explanation of what BPS entails. The primary contributions of this work are the (i) newly formed BPS definition, (ii) empirically derived 'structure' of the BPS concept, and (iii) collation of BPS measures—which provides valuable theoretical foundations to progress 'disciplined' (as explained by Burton-Jones and Straub (2006)) research in BPS.

The study comprehensively reviews prior BPS conceptualizations and definitions, identifying limitations, thereby better attuning future researchers in the area to the relative strengths and weaknesses of these past studies and of their prescriptions. With the increased insight this study achieves, prior work can be better and more appropriately leveraged.

We inventoried past related work from which we inductively synthesized the salient stages. Then we deductively applied that stage-model as a lens on past definitions of BPS, evaluating those definitions' foci and completeness, ultimately arriving at the 'structure' (Burton-Jones and Straub 2006) of BPS which informed our definition and guides any adaptations (i.e., for new definitions or BPS measurement) in future research. In addition to a more reliable definition of BPS, the work also recognises potential conflation (Sect. 2.3) with related but not fully analogous concepts and guides the reader on how to position these other notions within the context of BPS. Further, we substantiate our conceptualization by extracting and analyzing measures of BPS from literature that addresses BPS operationalization efforts, thus yielding a solid base for future BPS operationalization efforts. We recognize that the collated measures reflect extant work in the area, and that should one alternatively take a zero-based view (i.e., start from the derived dimensions, ignoring existing measures), the measures may be different. Nevertheless, this paper provides a solid base for future researchers as it consolidates all prior measures of BPS; an essential task when conceptualizing a construct (Burton-Jones and Straub 2006).

Methodologically, this study goes beyond prior attempts to conceptualise BPS. It applies a systematic literature review approach to accounts for and build on prior BPS studies and does so with increased transparency as regards the evidence-base search criteria. The study is highly specific as regards the process of analysis and synthesis of evidence, through to interpretation and outputs. Such detailed, and open description of the study approach increases the likelihood of its widespread adoption in future research and facilitates the study's extension in further work, while concomitantly increasing confidence in the current study results.

The study results are also of value to practice. With growing intent to standardize processes, clarification of BPS is important for business process practice as well. The stages presented enable an improved understanding of the process of BPS, providing guidance on the conduct of BPS and enabling organizations to plan accordingly. The definition of BPS provides a good starting point for practitioners to understand the concept of BPS. Finally, the measures assist practitioners to comprehend how they can evaluate the extent of their BPS efforts. The findings of the paper can act as input in planning, implementation, and monitoring of BPS efforts and hence support the large-scale investments involved in business process standardization efforts.

5.2 Study Limitations and Potential Future Work

In this section, we acknowledge some limitations and identify opportunities for future research. As all research, this study also had inherent limitations triggered by the study approach. A literature-based synthesis and theorizing is influenced by the set scope and applied analysis approaches. While a rigorous method was designed and followed through, selection bias (e.g., of papers selected), coder bias (e.g., on what was coded and how things were interpreted) etc., are hard to completely avoid in a qualitative study as this.

One key limitation of the work is our inattention to neighbouring domains—e.g., business process harmonization. It is acknowledged that this study relied heavily on extant research in BPS. Yet, other disciplines like the service research community have interest in standardization and modularization (e.g., Voss and Hsuan 2009; Beverungen et al. 2018). Given overlap between these communities, with a process often considered a central element in service thinking, there is symbiotic value possible from extending the work herein to these areas of expertise, both drawing from and informing their thinking. As specific example, we found that several of the stages had coarse measures (as per the BPS literature reviewed), such as modularization and isolation of specificities. While looking at proxy domains was outside the scope of this study, we urge future researchers to refer to research related to proxy domains for analogous supporting measures of these stages.

While we believe the core intent of this work has been achieved; resulting in a more rigorous conceptualisation of BPS, we also acknowledge the diverse opportunities for further research. Though a comprehensive research agenda of such potential work is outside scope, we refer the reader to the various gaps and opportunities, mentioned throughout the paper, which we observed across the structured literature review activity. The gaps and opportunities were derived following Alves-

son and Sandberg (2013, Ch. 3) and Müller-Bloch and Kranz (2015) techniques for gap/opportunity spotting.

Firstly, we call for future work that specifically focuses on the measurement of BPS. The study provides a customisable set of options that future research and practice can adapt and develop further. For example, BPS can be operationalised as a *process* (i.e., to measure how well a BPS effort is progressing) or as a *formative index* (i.e., to economically evaluate the state or degree of BPS, after a BPS effort) (Ortiz de Guinea and Webster 2014).

From a process perspective, the stages and measures of BPS presented in the paper help to understand what BPS entails and enable development of procedural guidelines for BPS. Given that the key stages defining a construct will depend on the purpose and context of each study (MacKenzie et al. 2011), we recognize and encourage the stages presented here be adapted to fit the specific purpose and context of future BPS research. Future empirical work to further test, validate, and re-specify the BPS stages presented in this paper is warranted to further establish their validity and applicability. This can be done by action design research case studies where the proposed stage-model is applied as a reference method to standardize a business process. It would be interesting to see if/how the applicability of stages (and their order) differs across different types of organizations and process standardisation purposes.

We further call for future research to further develop the measures and build the BPS conceptual model with more structured, relevant, and complete operationalizations. With this paper presenting the key dimensions of BPS, each dimension can be investigated in detail to extract specific and customisable measures and means to operationalise them (e.g., specific measurement items with different modes and forms of evidence). Furthermore, one can use the measures proposed in this paper to understand the extent of BPS at an organization, where new measures may emerge.

Secondly, we recognise that BPS occurs in diverse forms and that a clear understanding of these different types/forms of BPS can be helpful to better conceptualise, operationalise, and manage BPS. While some early related work exists (Goel et al. 2018, 2021), it is yet in its genesis and more extensive research here can usefully contribute to the field of BPS. For example, this will provide a deeper understanding on; how different forms of BPS are influenced by diverse contextual factors (across design, implementation, and maintenance decisions), and the impact of different types of standardizations on different organizational context.

Thirdly, BPS practice will hugely benefit from evidence-based actionable guidelines on the overall approaches to process standardisation. Literature points towards the need to explore the artefacts and tools required to facilitate BPS. For example, what languages, tools, and techniques can be used to document processes and which of those are most applicable to the BPS context are questions whose answers would benefit the BPS field.

Specific stages/activities within the BPS process needs expanded design knowledge. For example, while BPS literature mentions the significance of modularization in standardizing a business process, how it can be done remains unaddressed. Similarly, there is limited literature around the steps involved in the derivation of Master process. The BPS field will benefit from an understanding of how a process can be

modularized and how a master process can be derived. Additionally, the paper we raise questions about the completeness of the phase; 'unification of variants with the accepted master process'. We call for future research to understand the process of unification in more depth. Other work e.g., Romero et al. (2015b), has argued the need to understand in greater detail the process of unifying variants, but that work is yet in its genesis. Methods used herein for BPS more broadly, can be adapted to conceptualise process unification more specifically, and to derive measures of process unification. Furthermore, the significance of isolation of specificities is well understood, however, the kind of specificities that need to be taken into consideration remains inconspicuous. There is a need to understand the specificities that need to be considered for BPS, enabling smooth operationalization of BPS stages and also how best they can be managed. Moreover, there is little discussion about the governance structures regarding process standards in literature. The BPS field will benefit from an understanding of the key activities involved in the governance of process standards, the responsibilities, amongst others would benefit from research in sister domains.

6 Conclusion

Business Process Standardization (BPS) is an area of growing significance in practice. Process standardization is an essential step for digital transformation efforts such as robotic process automation, which makes understanding BPS of paramount importance. Despite the significance of BPS, research in this area is conspicuously limited; especially lacking is a clear and concise definition (and conceptualization) of BPS (Muenstermann 2015).

This paper conceptualizes Business Process Standardization (BPS) with the aim of providing theoretical foundations to progress disciplined research in BPS. We synthesize existing literature on BPS and discern BPS as a process comprised of seven stages. Next, having found little consensus on the definition of BPS in the literature, we present a more precise and harmonized definition of BPS, adhering to Wacker's (2004) rules of formal concept definition. We then synthesize measures used by prior researchers and map to the conceptual themes of BPS, thereby yielding a comprehensive set of items that can be used to measure BPS.

Overall, this paper offers significant contributions providing a better understanding of the important concept of BPS and consolidating this seemingly weak and rather fragmented research field. The paper provides a more complete and reliable effort than any prior attempt to conceptualize BPS, with the robust and transparent approaches used in this literature synthesis. It also provides a sound basis that can be used to critically evaluate existing BPS research (by looking at how BPS is conceptualized; how it has been defined and measured), which supports the cumulative knowledge building of BPS research.

Future researchers can use the provided definition and the catalogued measures to build them in accordance with the context where BPS is being studied. Inspired from the observations made from this analysis, we have also presented a series of potential areas of future work that can assist to further progress the field of BPS.

7 Appendix A Paper Extraction Process and Profile of Articles

7.1 A.1: Further Details Pertaining to Paper Extraction

This Appendix provides details on the steps followed to retrieve relevant papers for analysis.

The literature selection followed an iterative procedure. Business Process Standardization (BPS) is typically a Business Process Management (BPM) related topic, and hence BPM relevant databases were sought as a starting point. Having reviewed relevant database descriptions, as well as the search strategies of several similar BPM literature review studies (e.g., Romero et al. 2015a; Abeygunasekera et al. 2018), the following databases were selected: JSTOR, IEEE, Emerald, ABI/Inform, Science Direct, ProQuest and Springer. These are prominent databases in the Information Systems (IS) and management fields. It needs to be noted that in addition to BPM, papers related to other disciplines that BPS could potentially belong to (e.g., service science) would also have been included in this search.

Full text peer-reviewed journal and conference articles in English were sought, using a range of search strings purposefully derived to address the study goal. The search was conducted for articles until April 2021. The search keywords were broad to start with and were iteratively refined—e.g.

- Process AND standard* in abstract, title and key words
- "Business Process" AND standard* in abstract, title and key words
- Process AND standardization in abstract, title and key words
- "Business Process" AND standardization in abstract, title and key words

This yielded 1097 initial articles, which were then reviewed in detail for relevance.

Relevance checking is important to assess how closely the papers' topic relates to the scope and purpose of the review (Bandara et al. 2015). First, the abstract of all papers was reviewed, and papers that were clearly not BPS related were removed. The study's aim was to conceptualize BPS, which is why articles related to BPS only were selected for analysis. This was to ensure that we gain clarity on the construct, BPS. Articles related to concepts conflated with BPS such as those discussed in Sect. 2.3 were not included for analysis. The key words; 'process' and 'standard' sometimes yielded papers outside the context of Business Process Standardization[8]. This screening round reduced the relevant paper pool to 179. These papers were then read in full. If articles addressed other forms of standardization (e.g., data/software standards and standards for application development), they were excluded, thereby further reducing the number of relevant articles to 46. Relevancy checking was conducted independently by two authors, with intermediate corroboration sessions, to quality assure the inclusion of articles.

[8] For instance, some papers from other (diverse) domains had conducted a quantitative study and had described their research 'process', and results using words such as 'standard'-deviation. Hence, both words 'process' and 'standard' were present but not in the relevant context of the study.

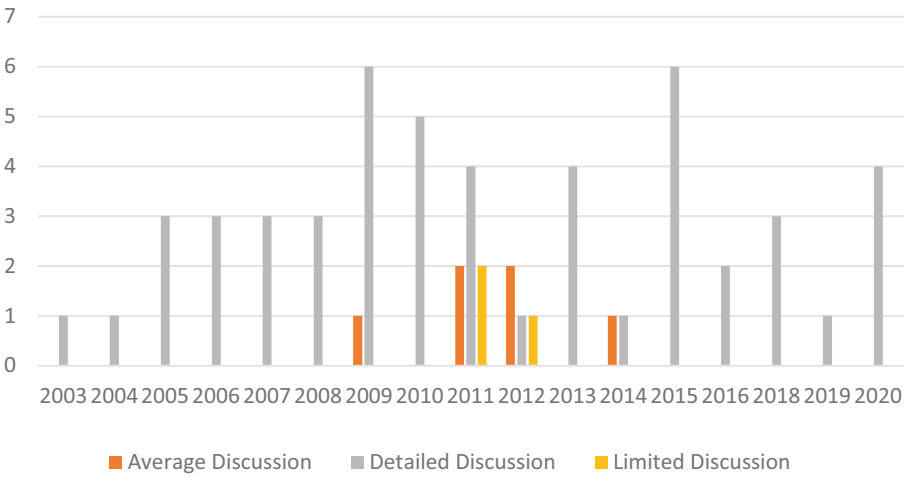

Fig. A.1 Extent of Discussion of BPS in Retrieved papers

Once this initial corpus of 46 papers was obtained, a forward[9] and backward[10] search was done using Scopus and Web of Science. The search pointed to 3 book chapters, 2 paper from AIS electronic library (AISel[11]), 3 papers from Gartner and 1 paper from Harvard Business Review (Davenport (2005)). Although the initial search was limited to peer reviewed journal and conference articles, the above-mentioned resources were found to be prominently cited across several of the peer reviewed papers. Though book chapters, and articles from sources such as Harvard Business Review and Gartner are considered as 'grey literature'[12], their inclusion is recommended for completeness and enhanced analysis (Benzies et al. 2006), hence they were added to the final data-set. Given these additions, Harvard Business Review, Gartner and AISel were further searched using the keywords presented above, yielding 3 additional papers from AISel and 2 from Gartner. This resulted in a total of 60 relevant articles. These references are provided in a supplementary file made available at https://tinyurl.com/bpcspe2n.

7.2 A.2: A Profile-Overview of Articles Included in the Analysis

Profiling assists in creating a vivid picture of the papers being studied, which can usefully influence interpretation of the analysis results. Profiling strengthens the literature review by enabling "*quality assurance, transparency and mitigation of*

[9] "*In forward searching, tools such as Google Scholar and Web of Science are used to identify papers citing the papers identified in the previous steps*" (Bandara et al. 2015).

[10] "*In backward searching, the citations in the relevant papers identified in the initial sample are carefully reviewed to learn about older papers that may be relevant*" (Bandara et al. 2015).

[11] AISel is the "central repository for research papers and journal articles relevant to the Information Systems community" http://aisel.aisnet.org/journals/.

[12] Grey literature is defined as "*publicly available, foreign or domestic, open source information that is usually available only through special channels*" (Benzies et al. 2006); they may not be peer reviewed.

Table A.1 Conferences publishing BPS papers, with their ratings

Conference name	# of papers	Rating (CORE)	Ranking (JOURQUAL 3)
Hawaii International Conference on System Sciences	8	A	C
Americas Conference on Information Systems	4	A	D
European Conference on Information Systems	3	A	B
Pacific Asia Conference on Information Systems	1	A	C
International Conference on Information Systems	1	A*	A
International Conference on Information Resources Management	2	B	Not ranked
International Conference on Multimedia Computing and Systems	1	A	Not ranked
International Enterprise Distributed Object Computing Conference	1	B	Not ranked
Wirtschaftsinformatik Proceedings	1	Not ranked	C
BPM Workshop	1	C	Not ranked
BPM Forum	2	Not ranked	Not ranked
BPM Conference	1	A	Not ranked
Workshop on E-Business	1	Not ranked	Not ranked

selection bias" (Gaffar et al. 2015). Here, we profiled the articles based on; level of discussion of BPS, timeline, outlet of publication, and research method used.

Figure A.1 profiles the 60 papers based on level of discussion (limited, average, detailed) by year of publication. It is observed that BPS is a relatively new concept, first appearing in the early 2000's. Earlier papers were mostly limited to discussion on the 'importance' of BPS. The first 'seminal' paper was by Davenport (2005) in which he elucidated the concept of process standardization and its importance for firms that article subsequently being referenced widely. Lyytinen and King (2006) in their special issue of *MIS Quarterly*[13] suggested potential for research in the field of process standardization. Other than a 'relative' burst in articles in 2009 and 2010, the incidence of 'focused' articles on BPS in the pool has been reasonably steady (and low) across the 13 year period at approximately 3 per year.

The ranking of the outlets of the publications was analysed: (i) as a further quality test of the pool of papers, and (ii) to understand which outlets were more receptive to research associated with BPS. This also enabled us to understand the range of interest in this topic across various (sub-) disciplines.

Of the 60 papers, 27 were conference papers, 3 book chapters, 5 commercial reports (from Gartner), 23 journal articles, and 2 theses.

Table A.1 provides an overview of the conference papers indicating the conference CORE[14] and JOURQUAL 3[15] rank. The papers spanned Business/Management

[13] Special issue was on making standards calling for research on standardization in various contexts.

[14] The computing research and education association of Australasia, CORE, is an association of university departments of computer science in Australia and New Zealand. See http://www.core.edu.au/ for further details on CORE. The CORE ranking services is an ongoing activity that provides assessments on major

Table A.2 Journals publishing BPS papers, with their rankings

Journal name	# of papers	Ranking (Scimago)	Ranking (JOURQUAL 3)
Business Process Management journal	5	Q2	C
Journal of Operations Management	1	Q1	A
Government Information Quarterly	1	Q1	Not ranked
Information and Software Technology	1	Q1	Not ranked
Information Systems Research	1	Q1	A+
Information Systems Frontiers	1	Q2	B
International Journal of Business Research	1	Q2	C
International Journal of Accounting Information Systems	1	Q2	C
Harvard Business Review	1	Q2	C
Knowledge and Process Management	1	Q3	Not ranked
Business & Information Systems Engineering	2	Q1	B
Business Research	1	Q1	B
Journal of Economics and Business	1	Q1/Q2	Not ranked
Electronic commerce research and applications	1	Q1/Q2	C
MISQ	1	Q1	A+
International journal of IT standards and standardization research	1	Q4	Not ranked
Journal of Business Logistics	1	Q1	B
Journal of Business Economics and Management	1	Q3/Q4	Not ranked

and IT/IS disciplines. Based on the CORE ratings, 17 were level A (top tier) conference papers, and three level B (second tier) conference papers, suggesting the BPS conferences papers were published in well regarded conference proceedings. Based on JOURQUAL 3 ranking, one was level A conference, one B, three C, and one D.

Scimago[16] and JOURQUAL 3 ratings were used to assess the journal articles. Based on Scimago, of the 23 journal papers; eight were in Q1 (1st quartile) level journals ('Business Process Management Journal' publishing most) and eleven were Q2 (see Table A.2). For JOURQUAL 3, two were A+ journals, four B journals, and five C journals.

In summary, the analysis summarized in Tables A.1 and A.2 suggests a generally high quality of the papers analyzed.

conferences. (a Web portal maintained by Professor Alistair Moffat of University of Melbourne (President), The ranking categories are A* (highest), A, B, C and not ranked).

[15] JOURALQUAL 3 is a ranking scheme for journals and conferences by more than 1000 members of the German Academic Association for Business Research (VHB). See https://vhbonline.org/en/vhb4you/vhb-jourqual/vhb-jourqual-3/complete-list for further details. This scheme provides an overview of ranking from business research perspective. The ranking categories are A+, A, B, C, D, and not ranked.

[16] Scimago is an international ranking scheme, which ranks journals on the number of citations received by the journal and the prestige of the journals cited. See http://www.scimagojr.com/ for further details. The rankings are given as Quartiles (Q1–Q4; Q1 been the highest).

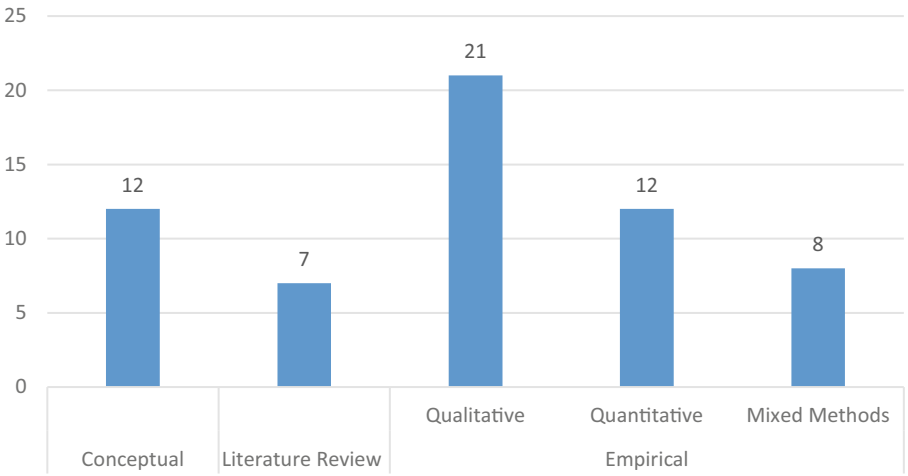

Fig. A.2 Research Method Employed

The research methods described in the papers (see Figure A.2) were categorized in accordance with Recker (2012) framework. He divides research methods into three categories: conceptual (non-empirical research that emphasizes ideas and concepts), literature-based (focusses on literature reviews) and empirical (answers research questions based on qualitative, quantitative or mixed data[17]). Figure A.2 presents a summary of the analysis.

As Figure A.2 illustrates, 41 (of the 60) papers were empirical. A closer look at the papers analyzing empirical evidence showed that (apart from three papers, and one book chapter which are critiqued in Sect. 2), these empirical papers were focused on finding the antecedents, outcomes, or contingency factors of BPS, and seldom carefully articulated what BPS is.

8 Appendix B: Critical Evaluation of BPS Definitions and Derivation of Conceptual Themes

Figure B.1 presents a summary of analysis of BPS definitions (as explained in Sect. 3.2). Column 1 includes the original definition and uses the following annotations to represent some content analysis results.

[17] The mixed-method category involves a mix of qualitative as well as quantitative methods and also encompasses Design Science research.

(1) Definition	(2) Source	(3) Re-used by	(4) Critical analysis of definition	(5) Conceptual themes extracted
*"Standardization then is defined as the activity of **diffusing and adopting a standard**."* ... *"Standards are **documents**, **established by consensus** and **approved by a recognized body** that provide, for **common** and **repeated use**, **rules**, **guidelines** or **characteristics for activities** or their **results**, aimed at the achievement of the optimum degree of order in a given context" (ISO 1996).*	(ISO 1996)	(Münstermann , Eckhardt & Weitzel, 2009)	This definition is clear and concise (iv). It provides the definition of standards and then uses it in defining process standardization, which makes it unambiguous for readers. However, the definition of standards is weak as it includes measures and outcomes. The definition of standardization does not have any faults per say but depends on the definition of 'standard' (and its weaknesses are hence inherited).	-Are documents -Established by consensus -Approved by a recognized body -Common repeated use – Rules, guidelines or characteristics for activities or results -Diffusing and adopting a standard
*"The degree to which **work rules, policies, and operating procedures** are formalised and followed"*	(Jang and Lee 1998)	(Fleig 2020)	The definition conveys that standardization involves formalization of rules, policies and operating procedures. While beneficially brief (iv), it is more an indication of how to measure/ observe BPS - as it uses the words "the degree to….".	-Work rules, policies and operating procedures
*"Standardization is the activity of establishing and recording a limited set of solutions to actual or potential matching problems directed at benefits for the party or parties involved balancing their needs and intending and expecting that these **solutions will be repeatedly or continuously used** during a certain period by a substantial number of parties for whom they are meant"*	(Henk J. 1999)	(Rosenkranz et al. 2010)	This definition provides an overview of standardization in terms of its measures, outcomes and new conceptual themes. It does not address the characteristics/ conceptual themes of standardization.	-Solutions will be repeatedly or continuously used
-"business process standardization can facilitate communications about how the business operates, to enable handoffs across process boundaries in terms of information, and to improve collaboration and develop comparative measures of process performance"	(Davenport, 2005, p.102)	(Fleig 2020; Schäfermeyer et al. 2012)	This definition is mentioned in many papers and is adopted in one paper as its definition; however, it focuses more on outcomes (hypotheses) by mentioning 'why' firms adopt BPS [hence violating rule (vii)].	
"BPS as a means to change business processes from where they are to a standard business process"	(Shaw et al.) as cited in (Muenstermann et al. 2010b)		The definition is a mixture of how to achieve BPS and the outcome, but does not define the term BPS and outline conceptual themes associated with it. As already critiqued by Muenstermann et al. (2010) this definition does not provide a clear understanding of BPS, as what BPS is and how the BPS process takes place is left open for people to decide.	
*"To standardize a process means to **homogenize it against a standard process**"*	(Muenstermann and Weitzel 2008)	(Wurm et al. 2018; Fleig 2020; Stetten et al. 2008)	The definition abides by the rules of Wacker (2004).	Homogenize against a standard process
"Business process standardization (BPS) means to make "process activities transparent and achieve uniformity of process activities across the value chain and across firm boundaries"	(Wullenweber et al. 2008)	(Kettenbohrer et al. 2013b)	The definition focusses only on outcomes of BPS.	
*"**Aligned process variants** that **incorporate external best practice knowledge**, e.g., by adopting (parts of) an external reference process (..),and are verifiably considered to be the time-, cost- and quality-optimal way of achieving the business process' goal"*	(Muenstermann and Eckhardt 2009)		Part of the definition points to measures and consists of a hypothesis, violating rules (viii and vii).	-Aligned process variants -External best practice knowledge
*"Process standardization is both the process and the result of achieving transparency and **homogenization of business processes** within a firm or even across multiple firms"*	(Beimborn et al. 2009)		The definition is short (iv); however, it has a hypothesis [indicating a relationship; BPS achieving transparency, hence violating rule (vii)] and uses an ambiguous term (i.e. 'homogenization') which is not defined.	Homogenization of business processes
*"Process standardization contains general **definitions of metrics**, **common languages** enabling organizations to gain the integrity of business rules, process logic, and data"*	(Mahmoodzadeh, Jalalinia, & Yazdi, 2009, p.852)		The definition is short (iv). However, it includes a hypothesis [violating rule (vii)]. Furthermore, the definition does not define key concepts (such as metrics, common language), resulting in ambiguity.	-Definitions of metrics, common languages
*"Standardization is the process of producing an **agreement on technical and business specifications** to be used consistently across the enterprise to ensure that processes, information, format and systems are interconnected and interoperable"*	(Seethamraju & Seethamraju, 2009, p.5)		The definition includes a hypothesis [violating rule (vii)].	- Agreement on technical and business specifications

Fig. B.1 Critical evaluation of BPS definitions and derivation of conceptual themes. Column 2 indicates the source(s) of the definition, and Column 3 illustrates if and where the definitions were reused in later literature. Column 4 summarizes our critique of the definition, with comments on accordance with the Wacker rules. The final column (Column 5) lists conceptual themes extracted from the definition

*"business process standardization as the **unification of business processes and the underlying actions** within a company in order to facilitate communications about how the business operates, to enable handoffs across process boundaries in terms of information, and to improve collaboration and develop comparative measures of process performance"*	(Schäfermeyer et al. 2010)	(Romero et al. 2015a; Kettenbohrer et al. 2016; Wurm and Mendling 2020)	This definition brings forth terms associated with BPS and does not use ambiguous terms. However, it consists of hypotheses as well as measures, failing to appropriately define the construct. It is also an extension of Davenport (2005)'s definition, an attempt to make it broader [violating rule (vi)]. Though the definition adds defining characteristics, it appends a hypothesis (in the form of outcomes) and measures.	- Unification of business processes and the underlying actions
*"We define "process standardization" as the **unification of variants** of a given business process by **aligning the variants against an archetype process.** The archetype process against which the process variants are aligned can either be created or selected within the focal firm or be based on/adopted from an existing external reference/best in class process"*	(Münstermann et al., 2010, p.31)	(Kettenbohrer et al. 2013a) (Afflerbach et al. 2016, p.339; Kettenbohrer et al. 2015, p. 295; Laumer et al. 2015, p. 430)	The definition abides by the rules of Wacker (2004)	- Unification of variants - Aligning the variants against an archetype process
***"**Business process standardization**"** to be the activity of **aligning existing variants against a standard process**".*	(Muenstermann et al. 2010b)		It is a short (iv) and clear definition that does not violate any of the rules. However, it lacks conceptual themes and we question it's completeness.	-Aligning existing variants against a standard process
*"Business process standardization (BPS) tries to implement the same process in the overall organization." it is important that a standardized process "is **described only once** and that there are **no various alternatives**"*	(Kettenbohrer et al. 2013b)		The definitions adheres to the rules, however, it uses the word 'tries' making it ambiguous for the reader. It also includes a hypothesis that BPS implement the same process.	-Described only once -No various alternatives
*"Business process standardization is the **definition of the exact execution of business activities** in order to reduce process variants. On the basis of current knowledge, the standard process derived **represents the best-known method** to accomplish the business process with regard to customer expectations. Furthermore, standardized processes can be **executed regardless of where or by whom they are performed**"*	(Zellner & Laumann, 2013, p.4)	(Zellner et al. 2015a)	This definition provide conceptual themes associated with BPS. However, it also focusses on the outcomes (has a hypothesis). It is also long. Furthermore, the meaning of the word 'current knowledge' is vague, and implies the definition is applicable only for a certain period of time.	- Definition of the exact execution of business activities - Represents the best-known method - Executed regardless of where or by whom they are performed
*"defining exactly how a **process will be executed regardless of who is performing the process or where it is completed**"*	Cited by Ross et al. (2006) in (Zellner and Marcus 2013)		This definition comprises of conceptual themes, but lacks several themes identified earlier, hence is questionable on its completeness. Overall is a sound definition with no violations of the rules.	- How a process will be executed - Regardless of who is performing the process or where it is completed
*"Standard process can be defined "as the currently **best-known method** for accomplishing the work. This assumes that it is the […] **most efficient method** to do the work that meets the required level of quality"*	(Zellner et al., 2015, p. 4130)		The definition has a hypothesis and has an ambiguous expression; 'required level of quality'.	- Best-known method - Most efficient method
BPS *"means the development of a **standard or best-practice process** to be used as a **template for all instances of the process** throughout the organization."*	(Tregear 2015)		This definition is comprised of conceptual themes, but lacks several themes identified earlier, hence is questionable on its completeness.	- Standard or best-practice process - Template for all instances of the process
"BPS establishes "*the **best, easiest, and safest way** to do an activity.*"	(Kettenbohrer et al. 2013b)		This definition is comprised of conceptual themes, but lacks several themes identified earlier, hence is questionable on its completeness.	- Best, easiest, and safest way
"*Business process standardization comprises the activities of* *• Selecting a process P and a **set of process variants P1, …, Pn** of the given process P to be standardized,* *• **Developing archetype process** candidates against which the set of process variants P1, …, Pn can be homogenized and selecting an archetype process A,* *•**Homogenizing the set of process variants** P1, …, Pn against the defined archetype process A.*"	(Muenstermann 2015)		The definition abides by the rules of Wacker (2004)	-Set of process variants -Developing archetype process -Homogenizing the set of process variants
"*Process standardization involves creating standardized processes*"	(Kauffman and Tsai 2010, p. 306)		This definition is tautological and focusses on outcomes. It does not explain what standardized process, inhibiting understanding of BPS. Violates rule iii and vii.	

Legend:
Bolded text: depict conceptual themes;
Greyed text: depict unclear or ambiguous terms [violation of rule (iii)];
Underlined text: depict a hypothesis [violation of rule (vii)];
Boxed text: depict measures [violation of rule (viii).

Fig. B.1 (Continued)

9 Appendix C: A Deeper Analysis of Literature Based Measures of BPS

Figure C.1 and C.2 below presents the summary evidence of the BPS measures-analysis effort. This analysis made it clear that many of the existing BPS measures map with the delineated BPS stages (as presented in Sect. 4.2); those measures that align with the BPS stages are presented in Fig. C.1 and measures that did not relate to the BPS stages are presented in Fig. C.2.

Column 1 of Figs. C.1 and C.2, present the in-vivo statements extracted from the literature that directly or implicitly mentioned BPS measures. Column 2 of Figs. C.1 and C.2, show how the in-vivo themes (from Column 1) were combined into groups-of-themes. Note that the extracted measures were arranged in a hierarchical manner (see Columns 2–4 of Fig. C.1), according to their perceived level of granularity. For example, if we look at measure A2 in Column 4 of Fig. C.1; '*process documentation should cover all essential details necessary for the purpose of process awareness and efficient execution*', it spans a range of component measures numbered hierarchically in Column 2. The descriptions presented in Column 3 briefly rationalize why these lower-level themes were clustered together, forming the different measurement categories presented in Column 4 of Fig. C.1[18].

Note that during our efforts of 'sense-making', we suggested combinations of measures that could be logically grouped as a higher-level measure (highlighted in orange) based on the lower-level measures discerned from the evidence. These higher-order *derived* groups have no corresponding evidence in Column 1—e.g., "Presence of process documentation" (Column 2, of Fig. C.1).

Furthermore, some measures were found to be used interchangeably as they essentially measured the same thing. These measures have been denoted using the same number but appended with a letter. For instance, 2.2.2a and 2.2.2b are measures that can be used to measure the same aspect; order of activities in the process. Such measures and their evidence have been merged together.

Finally, we have also bolded the keywords in each measure, to denote what was emphasized when they were operationalized by the original authors.

[18] NOTE: Due to perceived ambiguity in Wurm et al.'s (2018) substrata (dimensions the measures are assigned to), we have not included their measures in our measurement analysis (Sect. 2 describes this concern). Some substrata were considered valid, but they were overlapping with other prior studies and were integrated by default (their inclusion would have been redundant).

~ *Analysis of current literature* ~			~ *Recommendations derived* ~		
(1)	(2)	(3)	(4)	(5)	(6)
Level 1 Coding: **Measures from Literature**	**Level 2 Coding:** **Grouping the extracted measures across different themes**	**Description of groupings**	**Suggested Measurement category**	**Stage**	**Phase**
	1.1 *Presence* of process documentation;	This set of items establishes the existence of process documentation which may come in multiple/ different forms. While the usage of process models (and in particular flowcharts) have been proposed, clear written text that describes the processes is also required. Guidelines and work instructions were also perceived to be a form of documentation, and hence its inclusion in this theme.	**A1.** *Presence of a process document which describes activities and elements* (Extent of clarity of process specifications)	Documentation of process specifications	(A) Derivation of an enhanced and approved master Process
"Degree to which the business process in question is ***modelled****"* (Muenstermann and Weitzel 2008)	1.1.1 … as **Models**				
"Implementing of a new ***flow-chart*** *based system for describing and governing work processes"* (Nesheim 2011)	1.1.1.1 …using **Flow Chart** representation				
"Degree to which the business process in question is documented in ***written*** *form"* (Muenstermann and Weitzel 2008) *"Standardized procedure means that the rules and tools/equipment were* ***documented and prescribed (laid out in advance)****"* (Šenk and Roblek 2019)	1.1.2 …in **written** form				
"standardization can be achieved by the application of formalities, e.g. by ***creating guidelines*** *or* ***work instructions****"* (Heug et al. 2018, p. 230)	1.1. 3…in **guidelines** or **work instructions**				
*"****Explicit goals*** *for the processes and what types of goals"* (Iden 2012)	2.1 Explicit **goals** for processes are present	Clear documentation of all activities, which involves the following: - All the mandatory activities associated with the process are listed. - The activities are described in the sequential order they occur - Activities are transparent and all required information is present.	**A2.** *The process documentation should cover all essential details necessary for process awareness and its efficient execution* (Extent of clarity of process specifications)		
	2.2 *Clearly documented* *activities*				
"There are ***mandatory specifications*** *for each process steps of the financial advisory interview"* (Beimborn et al. 2009) *"Standardized procedure means that the rules and tools/equipment were* ***documented and prescribed (laid out in advance)****"* (Šenk and Roblek 2019)	2.2.1 Specification of **Mandatory process** steps				
"Activities and their ***chronological sequence*** *were identified and documented in detail"* (Stetten et al. 2008) *"****Order of activities*** *to be performed to achieve the process result"* (Kettenbohrer et al. 2013a) *"the* ***order of carrying out activities*** *was also prescribed (determined in advance)"* (Šenk and Roblek 2019)	2.2.2a Identification of **chronological sequence** of activities 2.2.2b Identification of **order of activities**				

Fig. C.1 Harmonization of measures of BPS extracted from the literature

~ Analysis of current literature ~			~Recommendations derived ~			
(1)	(2)	(3)	(4)	(5)		(6)
Level 1 Coding: **Measures from Literature**	**Level 2 Coding:** **Grouping the extracted measures across different themes**	**Description of groupings**	**Suggested Measurement category**	**Stage**		**Phase**
"The activities of the process are transparent and ***comprehensible****"* (Willenweber et al. 2008)	2.2.3 **Comprehensible** activities					
"The activities of the process are ***transparent*** *and comprehensible"* (Willenweber et al. 2008)	2.2.4 **Transparent** activities					
	2.3 *Clearly documented* ***roles and responsibilities***	The roles and responsibilities related to the people involved are clear and include the following: - There is a nominated process owner or there is a someone responsible for the process, and - all process stakeholders understand their role and responsibilities.				
"Presence of ***nominated process owner****, an experienced process owner was defined* ***who was responsible*** *for the correct definition of the process"* (Rosenkranz et al. 2010) *"Standardization for interviewees is a description of a proceeding for which a* ***responsible person exists*** *who manages all the connected things"* (Kettenbohrer et al. 2013a)	2.3.1a Presence of **Nominated process owner** 2.3.1b **Responsible person** exists		**A3.** *Process documentation is structured in a modularized manner with sufficient detail*	Modularity of business processes		
"Everyone ***knows which responsibility*** *he/she takes and what he has to do"* (Kettenbohrer et al. 2013a)	2.3.2 Everyone knows about their **responsibilities**					
*"****Modularity*** *in product and process plays an important role in determining the effectiveness of standardization"* (Muenstermann and Weitzel 2008)	3.1 Documentation of **modularized processes** (Muenstermann and Weitzel 2008; Sletten et al. 2008)	The process documentation is structured in a modularized manner, where the process is sub-divided into meaningful				

Fig. C.1 (Continued)

~ *Analysis of current literature* ~			~ *Recommendations derived* ~			
(1)	(2)	(3)	(4)	(5)		(6)
Level 1 Coding: **Measures from Literature**	**Level 2 Coding:** **Grouping the extracted measures across different themes**	**Description of groupings**	**Suggested Measurement category**	**Stage**		**Phase**
"To enhance the archetype process to a standard process (the task) *is the* ***modularization*** *of the process. Future subdivided the whole recruiting process* (and documented it)" (Stetten et al. 2008)		activities (which assist with locating the process information).	(Extent of modularity of business processes)			
*"**Level of detail** in the description, monitoring, and control of standards and work processes [is]"* (Nesheim 2011) *"A process should be modeled in layers of increasing detail"*	3.2 Modularized process documentation to be in **sufficient level of detail**	The process document must entail sufficient level of detail related to activities and elements.				
"We have established a ***fixed procedure*** *for the collaboration between HR and the operating departments"* (Muenstermann et al. 2009)	4.1 Presence of **fixed** procedure	There is one fixed way (documented process procedure) of conducting the processes	**A4.** *Derivation of fixed master Process that is a single point of reference* (Goodness of the master process)	Derivation of the master process		
"Standard process ***is described only once*** *and that there are no various alternatives"* (Kettenbohrer et al. 2013a)	4.2a The process is **described** only **once**	The process execution should be a single point of reference with it being described only once and having no various alternatives of execution.				
"Standard process is described only once and that there are ***no various alternatives*** *"* (Kettenbohrer et al. 2013a)	4.2b The process has **no** various **alternatives**					
*"**Concentrate/fence specificities** which only reveal a low probability of being reused, i.e. of being applicable to a lot of process instances, to the lowest number of process activities possible"* (Muenstermann and Weitzel 2008) *"To achieve enhanced archetype process isolation of process specificities is the next step"* (Stetten et al. 2008)	5.1 Isolation of **process specificities**	While merging two or more processes, unique aspects associated with each process needs to be specified and taken into consideration.	**A5.** *Unique aspects associated with each process needs to be specified and isolated* (Extent of isolation of process specificities)	Isolation of process specificities		
"Establish and maintain ***governing documentation****"* (Nesheim 2011) *"We have a* ***well-regulated process cycle*** *for applicant tracking in our staff recruitment"* (Muenstermann et al. 2010a, 2009)	6.1a Maintaining **governing documentation** 6.1b **Well-regulated process**	The process is not only documented, but such documentation is governed in a manner that the process execution can be conducted in a regulated way (as per the documentation). The process is controlled or directed by rule, principle and standards.	**A6.** *Process documentation is governed* (Agreement of enhanced master process)	Agreement of enhanced master process		
"Standardization includes ***harmonization of standards*** *and work processes from the two previous organizations by the use of this system"* (Nesheim 2011)	1.1 ***Harmonization*** of standards.	This set of items establishes the measures for harmonization of standards in the context of BPS in order to merge process variants. It consists of the following:	**B1.** *Degree of Merging process variants of two or more processes* (Extent of unification of variants against a standard process*).*	Unification of variants	(B) Unification of variants with the accepted master process	
"The number of ***different documents*** *used as input for the same process"* (Romero et al. 2015b)	1.1.1 **Data** involved in different processes	-The number of documents that are required for different processes,				

Fig. C.1 (Continued)

Fig. C.1 (Continued)

~ Analysis of current literature ~			*~ Recommendations derived ~*		
(1)	(2)	(3)	(4)	(5)	(6)
Level 1 Coding: Measures from Literature	**Level 2 Coding: Grouping the extracted measures across different themes**	**Description of groupings**	**Suggested Measurement category**	**Stage**	**Phase**
"The percentage of ***common activities*** *in the process"* (Romero et al. 2015b)	1.1.2 **Activities** of processes	-The percentage of common activities among the processes being harmonized,			
"The number of different ***software applications*** *in used in the process"* (Romero et al. 2015b)	1.1.3 **Information technology** used in different processes	-Different software applications deployed by the processes,			
"The percentage of ***common roles*** *in the process"* (Romero et al. 2015b)	1.1.4 **Resources** involved in different processes	-Percentage of common and different roles involved.			

~ *Analysis of current literature* ~			~*Recommendations derived* ~	
(1)	(2)	(3)	(4)	(5)
Measures from Literature	**Grouping the extracted measures across different themes**	**Description of groupings**	**Suggested Measurement category**	**Aspect being measured**
"*If available incorporate* ***knowledge and experience*** *supposed to be "best practice" or "best in class" into the process in focus*" (Muenstermann and Weitzel 2008)	Incorporation of **knowledge** and **experience**	In order to ensure that the current mode of execution is the best practice, incorporation of knowledge and experience as well as presence of controlling documentations which ensures that the process being followed is the best-known option of execution, is necessary.	**C1.** *Extent of use current knowledge and past experience to arrive at the best-known process for execution*	(C) Incorporation of Best-Known Execution Options (Possible improvements to master process)
"*Establish and maintain* ***governing documentation*** *based on* ***best practice*** *in the group* " (Nesheim 2011)	Governing documentation for **best practice**		**C2.** *Presence of governing documentations to ensure that the process performed is the best-known execution option*	
"*We have established* ***highly standardized procedures*** *in our staff recruitment*" (Muenstermann et al. 2010a, 2009; Schältermeyer et al. 2012; Wüllenweber et al. 2008; Laumer et al. 2015, p. 439)	Highly standardized process	Is the process standardized or not in the opinion of the organization	**D1.** *Highly standardized*	(D) Overarching Measures of BPS
"*We already work with* ***process standards*** *in our staff recruitment*" (Muenstermann et al. 2009; Laumer et al. 2015, p. 439)	Awareness of process standards	The organization is aware of the standards that the process needs to adhere to in the context of BPS	**D2.** *Awareness of process standards*	
"*Process documents must be created to standardize a process, they should be* ***well understood***" (Ungan, 2006, p.138)	Process is well understood	These measures were used by the listed papers as measures of BPS. Though they do not directly map to any of the sub-dimensions of BPS (A or B above), they can be used as a proxy to the quality of standardization of business processes. It is based on the logic that if the business processes are well standardized then they should be well understood and easy to learn.	**E.1** *Well understood process*	(E) Implied Measures
"*Process can* ***easily be learned*** *via documentation and trainings*" (Wüllenweber et al. 2008)	Process is easily learned		**E.2** *Easily learned*	

Fig. C.2 Other measures extracted from literature

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