A META-ANALYSIS OF THE "PURCHASING AND SUPPLY MANAGEMENT PRACTICE–PERFORMANCE LINK"

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Resource-based theory (RBT) suggests that purchasing and supply management (PSM) practices can help buying firms enhance their performance. Consequently, the PSM practice–performance link has undergone intense empirical investigation over the last two decades. Although most studies report a positive relationship between PSM practices and firm performance, it remains unclear whether and to what extent PSM practices relate to performance. We assess the empirical literature by conducting a meta-analysis of 99 PSM studies from an RBT perspective. Our results indicate strong support for the positive relationships among PSM practices and firm performance. Our findings contribute to the literature by underlining the relevance of PSM, identifying aspects of the PSM function that can be considered strategic and detecting areas that require additional empirical investigation. Our research also provides guidance to managers as to which PSM practices demonstrate the strongest potential for contributing to buying firm performance.

Keywords: *purchasing and supply management practices; firm performance; meta-analysis; resource-based theory*

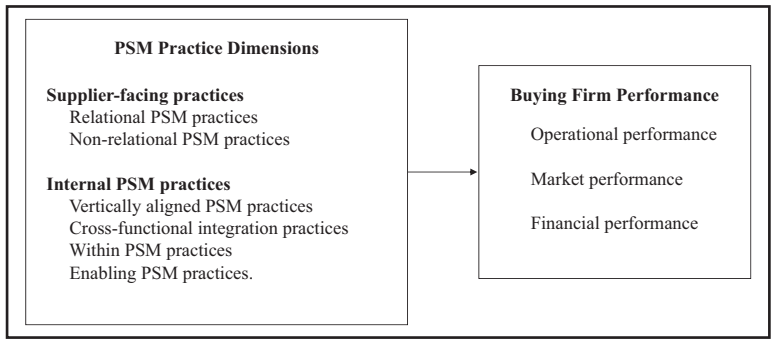
INTRODUCTION

The outsourcing surge has led to the recognition of the purchasing and supply management (PSM) function as a potentially valuable contributor to superior firm performance (Carter & Narasimhan, 1996; Trent & Monczka, 1998). Indeed, since the mid-1980s, PSM has evolved from an administrative function to a strategic function (Kerkfeld & Hartmann, 2012; Paulraj, Chen, & Flynn, 2006). Despite this evolution, some researchers have debated whether and to what extent PSM can shape performance (Mol, 2003; Ramsay, 2001; Ramsay & Croom, 2008; Rozemeijer, 2008). Moreover, the question of whether PSM practices, defined as activities that relate to the purchasing–supply base interface (Narasimhan & Das, 2001; p. 594), contribute to corporate success has received substantial attention (Das & Narasimhan, 2000; González-Benito, 2007; Shao, Moser, & Henke, 2012). As a result, the "PSM practice–performance link" has undergone substantial empirical investigation (Chen, Paulraj, & Lado, 2004).

We leverage insights from resource-based theory (RBT) (Barney, 1991) and the relational view (Dyer & Singh, 1998) to argue that PSM practices are important determinants of performance. In particular, we aggregate extant results via meta-analysis (Hunter & Schmidt, 2004). Meta-analysis statistically combines results about a relationship of interest and provides an estimate of the strength (i.e., the effect size) of a relationship (Hunter & Schmidt, 2004). Thus, we believe that meta-analysis is the best available tool to synthesize extant results and, in doing so, help resolve the ongoing debate over whether sourcing in the upstream supply market positively contributes to superior buying firm performance and, thus, whether PSM can be truly considered a strategic function (Barney, 2012).

The main research question guiding this study is as follows: What is the impact of the different PSM practice categories on buying firms' economic performance (see Figure 1)? As the evidence of this study permits, we indicate where relationships do or do not exist, the strength of these relationships, and whether moderating variables affect certain "PSM practice–performance links." Furthermore, we took stock of published works in this research domain, which allowed us to identify under-researched fields that require further research and fields that have already reached saturation regarding unambiguous findings. Last but not least, we contribute to RBT in validating which practices of the PSM function can be regarded as "strategic" and a source of superior performance.

FIGURE 1
Conceptual Framework



The remainder of this article is structured as follows: First, we present our conceptual framework and develop our research hypotheses based on RBT. Next, we describe our methods of data collection, coding, and data analysis before presenting our hypothesis testing and post hoc robustness tests. As we conclude the study, we present the theoretical and practical contributions of our research and highlight potential areas for further research.

CONCEPTUAL DEVELOPMENT AND THEORETICAL FOUNDATIONS

We introduce RBT as the theoretical foundation of the study. We are interested in determining the magnitudes of relationships between PSM practices and performance (see Figure 1). Because the small sample sizes in previous studies often do not have sufficient explanatory power, more valid conclusions can be drawn by undertaking a meta-analysis with a suitable conceptual framework that combines a variety of studies on PSM practices and their links to performance (Hunter, 2001).

The PSM Practice–Performance Link and Resource-Based Theory

The genesis of RBT emerged following a reflection on the economic theories of Penrose (1959), who identified firms as collections of resources. Such resources can be physical assets, human talent, organizational processes and capabilities, as well as knowledge possessed by the firm (Barney, 1991). A "strategic" resource is defined as being valuable, rare, imperfectly imitable, and nonsubstitutable, also referred to as the VRIN criteria (Barney, 1991). Imperfect imitability and nonsubstitutability have been identified as the most important criteria for a resource to sustain its value over time (Amit & Schoemaker, 1993).

RBT assumes that firms have imperfect ex ante knowledge about strategic resources and limited access to them (Barney, 1986; Dierickx & Cool, 1989), otherwise the anticipated returns resulting from the possession of these resources would disappear through competition a priori (Peteraf, 1993). Barney (2012) recently argued that supply chain management practices have the potential to enhance buying firm performance. He argued that PSM practices can be VRIN because these practices help firms work together and share key attributes across firms. Because these practices help develop idiosyncratic attributes that are time-consuming to develop and are costly to imitate, RBT appears helpful in explaining the performance differences via specific PSM practices (Knudsen, 2003).

To structure our analysis of the performance implications stemming from the multitude of PSM practices, we distinguished between (1) external supplier-facing PSM practices and (2) internal PSM practices (Day & Lichtenstein, 2006). Based on this differentiation (see Figure 1), we further categorized supplier-facing and internal PSM practices into more finite categories, as suggested by the extant literature (Narasimhan & Das, 2001; Terpend, Tyler, Krause, & Handfield, 2008).

Supplier-facing practices include *relational PSM practices* where the effectiveness of the intended PSM practice is dependent on the mutual deployment of resources by the buyer and the supplier (Dyer & Singh, 1998). Such practices encompass knowledge sharing or joint product development. The other group of supplier-facing practices, labeled *nonrelational PSM practices*, include supply base reduction or supplier evaluation and selection practices that only require resource deployment from the buying firm rather than from both sides (Terpend et al., 2008).

Internal PSM practices include four subcategories: (1) *vertically aligned PSM practices*, (2) *cross-functional*

integration practices, (3) *within PSM practices*, and (4) *enabling PSM practices*. Based on Watts, Kim, and Hahn (1995) and later contributions (Baier, Hartmann, & Moser, 2008; Day & Lichtenstein, 2006), PSM should align vertically with corporate strategy to effectively contribute to firm success. It has been established that PSM should be informed and take influence in the strategic planning processes (Rozemeijer, 2008) to align the function's practices throughout various management levels and firm sites based on the buying firm's strategic priorities (Moses & Åhlström, 2008).

In addition, it has been established that PSM practices also include horizontal internal integration, namely *cross-functional integration practices* with other functions of the company's internal value chain, such as production, R&D, or marketing (Cousins & Spekman, 2003; Ellram & Liu, 2002). The purpose of the PSM function's collaboration with internal stakeholders in the purchasing process is said to enhance PSM's understanding of internal and external customers, which then enables PSM to effectively address their priorities in the supply market (Van Weele, 2005).

Beyond the internal integration of practices, PSM also performs internal practices within its functional boundaries, such as parts bundling across firm buying centers, preparing for negotiations, or order processing. These practices are termed *within PSM practices*, which are typically referred to as the coordination of purchasing agents across buying centers or business units that do not involve resources from other internal functions or from external suppliers (Das, Narasimhan, & Talluri, 2006; Keough, 1993).

The fourth internal category, *enabling PSM practices*, encompasses practices such as employee performance measurement, skill development practices, and information technology installation (Carr & Pearson, 2002; Foerstl, Hartmann, Wynstra, & Moser, 2013).

To link these six groups of PSM practices to buying firm performance, we classified performance into the three dimensions most frequently studied in PSM and SCM research: *operational performance*, *market performance*, and *financial performance* (Gunasekaran & Kobu, 2007; Vachon & Klassen, 2006). This categorization is also consistent with other meta-analytical studies in the field of SCM (Golicic & Smith, 2013), for example:

- operational performance (e.g., quality, capacity utilization, unit cost of purchased item, delivery speed)
- market performance (e.g., market share, customer satisfaction)
- financial performance (e.g., ROI, EBITDA, profit)

Hypothesis Development

At this stage, it is important to note that we are investigating whether firms can achieve performance advantages based on different PSM practices rather than on competitive advantage. Most prior studies did not measure competitive advantage directly; thus, we interpret the buying firm performance measure as a proxy as to whether it attained a temporary competitive advantage based on the reported performance advantage (Crook, Ketchen, Combs, & Todd, 2008). Due to the lack of available studies on the link between PSM practices and competitive advantage, our elaboration of RBT to PSM is considered the best available, yet an imprecise test, of Barney's (1991) initial RBT. The next step is to evaluate whether PSM practices are also potentially VRIN in the sense that they contribute to achieving higher levels of firm performance (Grant, 1996; Hartmann & De Grahl, 2011). Based on the number of publications that conceptually argue for a positive "PSM practice–performance link" (e.g., Carter & Narasimhan, 1996; Watts et al., 1995) and this link's empirical support for a wide array of PSM practices (e.g., Narasimhan & Das, 2001; Paulraj, Lado, & Chen, 2008), we hypothesize a positive performance effect resulting from PSM practices.

H1: PSM practices are positively associated with buying firm performance.

Despite the potentially strategic nature of PSM practices, we acknowledge that not all categories of PSM practices drive performance with equal strength. Hence, we seek a more nuanced reasoning for different magnitudes of the firm performance impact exerted by the specific categories of PSM practices. The relational view has emerged as a substream of RBT by extending it to interfirm relationships between the buying firm and its suppliers (Dyer & Singh, 1998). It is argued that relational PSM practices, applied in conjunction with supplier resources, are more complex and more tacit in nature, which makes them harder to configure and, at the same time, more difficult to imitate. Thus, advantages attainable through relational supplier-facing PSM practices (where the supplier also contributes resources to the relational exchange) have greater potential to be sustained due to their complex causes (Mesquita, Anand, & Brush, 2008). Relational rents can be generated through investments in relation-specific assets, such as interfirm knowledge exchange and joint learning, and combinations of other complementary but scarce capabilities between a buying firm and its suppliers (Jap, 2001; Terpend et al., 2008). These resource combinations result in the joint creation of superior processes and/or lower transaction costs that could otherwise not be created

by the buying firm alone (Carr & Pearson, 2002; Zajac & Olsen, 1993).

As supplier-facing relational PSM practices are more socially complex and resource-consuming to acquire, they should potentially provide greater performance payoffs to the buying firm (Badaracco, 1991) compared to nonrelational outward-facing PSM practices (Dyer & Singh, 1998; Kaufman, Wood, & Theyel, 2000). Nonrelational outward-facing PSM practices such as supplier selection or supplier evaluation are less socially complex and less resource-consuming to acquire. Thus, we argue that the performance that is attainable from supplier-facing PSM practices primarily manifests its magnitude in relational supplier-facing practices compared to nonrelational PSM practices. Hence, we hypothesize:

H2: Outward-facing relational PSM practices have a stronger positive association with buying firm performance than nonrelational outward-facing PSM practices.

Moreover, to enhance understanding of the relationship between PSM practices and performance, we investigated the extent to which PSM practices considered *strategic resources* according to Barney's (1991) VRIN criteria differ in their performance effects from PSM practices that do not meet VRIN criteria. This is important in the context of our conceptualization of PSM practices because not only outward-facing relational PSM practices but also internal PSM practices (Mol, 2003), such as strategic integration and cross-functional integration, are potentially a source of superior buying firm performance. The inimitability of the VRIN PSM practices stems from complex interaction processes inside the firm that are more difficult to observe and disentangle for outsiders in comparison with the PSM practices that do not meet VRIN criteria, such as the use of standard IT tools that are openly accessible in the market or practices that involve widely established, standardized procedures such as volume bundling. Practicing a more elaborate configuration of such VRIN PSM practices is assumed to lead to superior performance in itself (Kerkfeld & Hartmann, 2012). Moreover, their causal ambiguity and social complexity, which primarily result from human and social interaction, prevent their immediate imitation, which in turn supports continuously higher levels of performance (Crook et al., 2008; Makadok, 2001). Thus, internal PSM practices (see Figure 1) that meet VRIN criteria might also be a source of superior buying firm performance (Barney, 2012). Based on previously outlined theoretical grounds, we hypothesize:

H3: PSM practices that meet the VRIN criteria have a stronger positive association with buying firm performance than PSM practices that do not meet the criteria.

RESEARCH METHOD

Study Selection and Data Collection

To ensure methodological rigor with regard to the study selection and data collection processes, we adopted principles following a systematic literature review (Denyer & Tranfield, 2009). To compile the empirical studies, we employed keyword searches and defined a comprehensive search string,[1] using terms such as "suppl*," "purchasing;" "sourcing*," "vendor manag*," "procur*," "vertical allianc*" or "performance." We searched articles in the EBSCO Business Source Complete, Science Direct, and Emerald Management Xtra databases. We included top-tier peer-reviewed journals that are known to have published PSM-related research. To supplement the keyword search, we added articles recommended by knowledgeable authors in the field of PSM and SCM and searched through the reference lists of the most frequently cited studies to identify more potentially usable studies that remained undetected by our search in the mentioned databases. This search yielded 659 potentially usable studies for inclusion in our analysis.

We set up criteria for inclusion and exclusion of studies regarding the methodological approach, the scope of the research topic, and the availability of data. We eliminated 244 articles due to non-meta-analytic compatible methodologies, such as case studies, conceptual papers, literature reviews, mathematical modeling, and simulation papers. Also excluded were an additional 269 articles in which the PSM practice definition or the performance definition did not fulfill our respective definition criteria. In most of these cases, the scope of the respective studies was too wide, focusing on supply chain management in

[1]Search string: ("suppl*" OR "purchasing" OR "sourcing*" OR "vendor manag*" OR "procur*" OR "vertical allianc*") AND ("performance") AND ("empiric*" OR "survey" OR "construct" OR "path anal*" OR "correlat*" OR "sampl*" OR "regression*" OR "sem" OR "structur* equation modeling" OR "factor analysis") AND (JN "Journal of Operations Management" OR "Production & Operations Management" OR "Journal of Supply Chain Management" OR "International Journal of Production Research" OR "International Journal of Production Economics" OR "Journal of Purchasing & Supply management" OR "International Journal of Operations & Production Management" OR "International Journal of Physical Distribution & Logistics Management" OR "Journal of Business Logistics" OR "Industrial Marketing Management" OR "Decision Science" OR "Omega" OR "British Journal of Management" OR "Management Science" OR "Journal of the Academy of Marketing Science" OR "Supply Chain Management: An International Journal" OR "Administrative Science Quarterly."

general, instead of reporting specific performance effects resulting from PSM practices. Therefore, in these excluded articles, it was unclear whether the measured practice only related to the upstream PSM function, the internal value chain, or downstream customers; for example, it was unclear if IT integration practices were directed toward suppliers or customers. A remainder of 41 articles focused on the PSM function but did not provide correlations between the variables of interest, which were necessary for our analysis. After contacting the authors of these articles, we were able to gather some of this missing data. As a result of our search and screening process, we identified 108 suitable articles containing 99 independent studies leading to a total sample size of 22,971 buying firms.

Coding Procedures

All studies were coded by two authors. The authors coded the first 10 studies together to calibrate and fine-tune their coding approach. The remaining studies were independently double-coded. In addition, the authors compared their codes after a batch of approximately 20 studies. This enabled us to discuss special cases and to ensure consistency throughout the five batches. This iterative process of coding and discussion led to an inter-rater reliability of 94 percent for the double-coded PSM practice and performance categories. Ambiguities were resolved in discussions between the authors. Our coding covered detailed definitions for each subcategory of PSM practices.

We evaluated whether the constructs and measures of the respective studies were consistent with our definitions. If a 75 percent content validity threshold was not reached, the construct relationship was excluded from our analysis (Hunter & Schmidt, 2004). The final studies providing data to test our hypotheses are listed in Table 1.

In accordance with RBT, the PSM practice constructs included had to express an active deployment of resources by the buying firm. To be considered a relational supplier-facing PSM practice to test Hypothesis 2, the measures had to capture an active deployment of resources of both the buyer and the supplier in the measure. For relational supplier-facing PSM practices, we captured measures such as knowledge sharing or joint product development (Terpend et al., 2008). For nonrelational supplier-facing PSM practices, we captured measures such as supply base reduction or supplier evaluation (Terpend et al., 2008). To test Hypothesis 3, we distinguished between VRIN and non-VRIN PSM practice measures (Crook et al., 2008). For VRIN PSM practices, we captured measures such as strategic integration and cross-functional integration (Barney, 2012). For non-VRIN PSM practices, we captured measures such as standardized IT solutions or widely spread operational procedures. Conceptually, these measures are easy to imitate and therefore less valuable (Mol, 2003). In line with the prior literature, we assumed that it is sufficient to assess whether a PSM practice is inimitable and potentially valuable in order to assess whether the PSM practice is strategic in nature (Crook et al., 2008). Inimitability was met if one of the three conditions (path dependence, social complexity, or ambiguity) mentioned above was found. The next step was to evaluate whether the PSM practice is potentially valuable. According to Crook et al. (2008), we accepted the value claim provided in the study. In cases where the value claim was not explicitly stated, we coded the practices based on their underlying definition and operationalization. As a resource that is difficult to imitate is rare by definition (Hoopes, Madsen, & Walker, 2003) and substitution is considered a special form of imitation (Barney, 1995), these two criteria suffice to code PSM practices accordingly.

Meta-Analytic Approach

We followed the meta-analytic approach presented by Hunter and Schmidt (2004) because it corrects for artifacts that attenuate correlations. We applied random-effect meta-analysis with artifact distribution to correct for sampling error or measurement error. It is assumed that information on all artifacts, except for sampling error, is only partly available in the involved studies. We computed the artifact corrected mean true score correlations ($\bar{\rho}$) using the reported study correlations (r). If there were multiple correlations between the same subgroups within a single study, the correlations were averaged to obtain a single estimate of a correlation between a respective PSM and a respective performance category per study (Crook et al., 2008; Hunter & Schmidt, 2004).

Once we calculated the effects, we applied the 90 percent, 95 percent, and 99 percent confidence intervals and checked whether zero was included within these intervals to assess whether the hypotheses were supported or rejected (Whitener, 1990). If a confidence interval contained zero, it suggests that no effect is present. Moreover, the differences in effect sizes postulated in Hypotheses 2 and 3 were analyzed by assessing if the low end of the confidence intervals for relational or VRIN practices did not overlap with the high end of nonrelational or non-VRIN practices. To examine whether moderating variables exist, we checked whether the credibility intervals included zero (Hunter & Schmidt, 2004). Furthermore, we calculated the fail safe number for all analyzed groups. The fail safe number is a proxy measure for the number of studies that would have to be found to potentially revoke our findings. To obtain this number, we conducted the file drawer test (Rosenberg, 2005;

TABLE 1

Summary of Original Study Data

a	k	Paper	Categorization
1	1	Azadegan (2011)	(BG) 1
2	2	Baier et al. (2008)	(BCDEFI)* 1
3	3	Barnes et al. (2011)	(ABI)* 8
4	4	Barnes and Liao (2012)	(AG)* 5
5		Liao et al. (2010)	(ABGI)* 1
6	5	Bernardes (2010)	(ACH)* 1
7	6	Braunscheidel and Suresh (2009)	(AG)* 2
8	7	Cai et al. (2010)	(ABG)* 9
9	8	Cai et al. (2011)	(AG)* 9
10	9	Carr and Kaynak (2007)	(ABFGI)* 13
11	10	Carr and Smeltzer (2000)	(CFGI)* 1
12	11	Carr and Pearson (2002)	(ACI)* 13
13	12	Chan et al. (2012)	(BH) 8
14	13	Chen et al. (2004)	(ABCGI)* 2
15		Paulraj and Chen (2005)	(ABCGI)* 1
16		Paulraj et al. (2008)	(CI)* 2
17	14	Corsten and Felde (2005)	(AI)* 12
18	15	Cousins and Lawson (2007a)	(AH)* 11
19		Cousins and Lawson (2007b)	(ABGH)* 11
20		Cousins et al. (2008)	(ABH)* 13
21	16	Cousins et al. (2006)	(AG)* 2
22	17	da Silveira and Arkader (2007)	(AG)* 13
23	18	da Silveira and Cagliano (2006)	(FG) 13
24	19	Dabhilkar et al. (2009)	(AG)* 9
25	20	Danese (2013)	(AG)* 10
26		Danese and Filippini (2010)	(AG)* 13
27	21	Devaraj et al. (2007)	(AG)* 2
28	22	Droge et al. (2004)	(AG)* 2
29	23	Eltantawy et al. (2009)	(AFI)* 8
30	24	Fawcett and Scully (1995)	(BXI) 4
31	25	Field and Meile (2008)	(FG) 13
32	26	Flynn et al. (2010)	(AGI)* 2
33	27	Flynn et al. (1995)	(AG)* 6
34	28	Foerstl et al. (2013)	(DEFGI)* 13
35	29	Frohlich and Westbrook (2002)	(AI)* 2
36	30	Gimenez et al. (2012)	(ABG)* 5
37	31	Goh et al. (1999)	(ACDH)* 1
38	32	Gulati and Sytch (2007)	(AG)* 16
39	33	Handfield et al. (2009)	(ABCDGI)* 13
40	34	Hartmann et al. (2012)	(EXI) 9
41	35	He et al. (2012)	(AI)* 5
42	36	Hollos et al. (2012)	(ACG)* 4
43	37	Huang et al. (2010)	(ABGI)* 13
44	38	Hult et al. (2003)	(CDEGI)* 2
45	39	Humphreys et al. (2004)	(ABCG)* 10
46		Li et al. (2007)	(ABGH)* 5
47	40	Inman et al. (2011)	(BGHI) 2
48	41	Jap and Anderson (2003)	(AH)* 7
49	42	Johnson (1999)	(CH)* 14

(continued)

TABLE 1 (continued)

a	k	Paper	Categorization
50	43	Johnson et al. (2007)	(BDFI)* 2
51	44	Johnston et al. (2004)	(AG)* 2
52	45	Kannan and Tan (2005)	(BGHI) 10
53	46	Kaynak and Hartley (2008)	(BGH) 2
54	47	Kerkfeld and Hartmann (2012)	(BEG) 12
55	48	Kim et al. (2008)	(AG)* 6
56	49	Krause et al. (2007)	(AB)* 2
57	50	Kusaba et al. (2011)	(BG) 1
58	51	Kwon et al. (2009)	(FG) 11
59	52	Lau et al. (2010)	(AI)* 13
60	53	Lawson et al. (2009)	(ACDG)* 4
61	54	Mishra and Shah (2009)	(AGH)* 2
62	55	Modi and Mabert (2007)	(BG) 2
63	56	Narasimhan and Das (2001)	(BCG)* 2
64	57	Narasimhan and Jayaram (1998)	(BGI) 2
65	58	Nyaga et al. (2010)	(AGH)* 2
66	59	Omar et al. (2012)	(AGI)* 3
67	60	Ordanini and Rubera (2008)	(DFI)* 13
68	61	Osmonbekov et al. (2009)	(FH) 8
69	62	Paulraj (2011)	(ACI)* 1
70	63	Prajogo et al. (2008)	(BG) 13
71	64	Quesada et al. (2006)	(AG)* 1
72	65	Ryu and Eyuboglu (2007)	(ABG)* 8
73	66	Saeed et al. (2005)	(ABDG)* 6
74	67	Salvador and Villena (2013)	(AG)* 1
75	68	Sánchez-R. and Martínez-L. (2004)	(BDEFGI)* 13
76	69	Sanders (2007)	(AG)* 2
77		Sanders and Premus (2005)	(AG)* 3
78	70	Schoenherr and Swink (2012)	(AGI)* 2
79	71	Shao et al. (2012)	(AGHI)* 5
80	72	Singh et al. (2011)	(BG) 2
81	73	Smirnova et al. (2011)	(DH)* 8
82	74	Song and Di Benedetto (2008)	(AHI)* 2
83	75	Song et al. (2011)	(AGH)* 2
84	76	Squire et al. (2009)	(AI)* 11
85	77	Sriram and Stump (2004)	(ABFG)* 10
86	78	Stouthuysen et al. (2012)	(BG) 2
87	79	Swink et al. (2007)	(AH)* 2
88	80	Tai et al. (2010)	(AG)* 4
89	81	Tan et al. (2010)	(ABI)* 12
90	82	Tan et al. (1998)	(ABGHI)* 4
91	83	Tang and Rai (2012)	(AH)* 2
92	84	Tomlinson and Fai (2013)	(AH)* 5
93	85	Tracey (2004)	(ADGI)* 1
94		Tracey and Tan (2001)	(AGH)* 15
95	86	Vachon and Klassen (2008)	(AG)* 5
96	87	Vereecke and Muylle (2006)	(AG)* 13
97	88	Vonderembse and Tracey (1999)	(DG)* 1
98	89	Wagner (2011)	(BG) 2
99	90	Wiengarten et al. (2013)	(ABG)* 5

(continued)

TABLE 1 (continued)

a	k	Paper	Categorization
100	91	Wong et al. (2011)	(AG)* 2
101	92	Wu et al. (2010)	(BG) 2
102	93	Wu et al. (2003)	(FH) 14
103	94	Yang et al. (2010)	(BG) 5
104	95	Yao et al. (2009)	(AG)* 1
105	96	Yeung et al. (2013)	(AG)* 5
106	97	Zacharia et al. (2009)	(AG)* 3
107	98	Zacharia et al. (2011)	(AG)* 2
108	99	Zhu and Sarkis (2004)	(BI) 2

a = articles; k = independent samples; A = Relational PSM practices; B = Non-relational PSM practices; C = vertically aligned PSM practices; D = Cross-functional integration practices; E = Within PSM practices; F = Enabling PSM practices; G = Operational performance; H = Market performance; I = Financial performance; (1) Journal of Supply Chain Management (2) Journal of Operations Management (3) Journal of Business Logistics (4) International Journal of Production Research (5) International Journal of Production Economics (6) Decision Science (7) Management Science (8) Industrial Marketing Management (9) Journal of Purchasing & Supply Management (10) Omega (11) British Journal of Management (12) International Journal of Physical Distribution & Logistics Management (13) International Journal of Operations & Production Management (14) Journal of the Academy of Marketing Science (15) Supply Chain Management: An International Journal (16) Administrative Science Quarterly;
*Indicates that the study contained at least one PSM practice that meet definitions of RBT's criteria.

Rosenthal, 1979) to test publication bias in a way similar to that presented by Leuschner, Rogers, and Charvet (2013) and Golicic and Smith (2013).

RESULTS

All results testing our hypotheses are reported in Table 2.

Hypothesis Testing

Hypothesis 1, which predicted that more elaborate PSM practices are positively associated with buying firm performance, was supported with $\bar{\rho}$=.335 at p<.01. Hypothesis 2 suggested that relational supplier-facing PSM practices exert a stronger positive impact on performance than nonrelational supplier-facing PSM practices. Hypothesis 2 was also supported; the difference in effect sizes between outward-facing relational (.359) and outward-facing nonrelational (.286) PSM practices on performance was significant at p<.10. The individual effects exerted by relational and nonrelational PSM practices on performance are both significant at $p < .01$. Hypothesis 3 predicted that the positive effect on performance is stronger for PSM practices that meet VRIN criteria than for practices that do not meet these criteria. This hypothesis must be rejected due to the overlapping confidence intervals for the effect of VRIN PSM practices on performance ($\bar{\rho}$ = .344) and non-VRIN practices on performance ($\bar{\rho}$=.309). While the effect of VRIN practices is higher in magnitude, it is not statistically different from the non-VRIN effect on performance. The individual effects exerted by VRIN and non-VRIN PSM practices on performance are both significant at $p < .01$.

TABLE 2

Hypothesis Testing

	PSM practice	Perf.	*N*	*k*	$\hat{r}$	$\bar{\rho}$	95% Cred. interval	90% Conf. interval	95% Conf. interval	99% Conf. interval	Fail safe no.
H1	ALL	ABP	22,971	99	.280	.335	.024: .646	.261: .299	.256: .305	.251: .309	1,708
H2	SRP	ABP	15,509	64	.303	.359	.037: .681	.279: .327	.272: .334	.266: .340	1,072
H2	SNRP	ABP	8,647	39	.236	.286	−.047: .619	.204: .268	.195: .277	.187: .285	540
H3	VRIN	ABP	18,102	76	.288	.344	.026: .663	.265: .310	.259: .316	.254: .322	1,279
H3	Non-VRIN	ABP	10,775	50	.254	.309	−.048: .666	.224: .284	.216: .293	.208: .300	747

ALL, all identified PSM practices; SRP, supplier-facing relational practices; SNRP, supplier-facing nonrelational; ABP, aggregated buying firm performance; *N*, total sample size of buying firms; *k*, independent samples; $\bar{\rho}$ = mean true (corrected) score correlations; $\hat{r}$=sampling error corrected observed effect size.

Post Hoc Robustness Tests

Given that performance is a multidimensional construct (Venkatraman & Ramanujam, 1986), we conducted post hoc robustness tests concerning the influence of PSM practices, relational versus nonrelational practices, and VRIN versus non-VRIN practices on the three subcategories of buying firm performance (i.e., operational, market, and financial). We sought to understand whether the PSM performance relationship differed when studying the performance subdimensions in isolation. PSM practices (H1) affect all three performance categories of operational performance ($\overline{\rho}$ = .355), market performance ($\overline{\rho}$ = .272), and financial performance ($\overline{\rho}$ = .264).

Hypothesis 2 test results are also robust given that the true correlation $\overline{\rho}$ is higher for relational compared to nonrelational PSM practices when studying operational performance ($\overline{\rho}$ = .350 versus $\overline{\rho}$ = .314), market performance ($\overline{\rho}$=.300 versus $\overline{\rho}$=.268), and financial performance ($\overline{\rho}$ = .309 versus $\overline{\rho}$ = .160). Similar to the previous findings, Hypothesis 3 was rejected across all three performance dimensions, while the effect of VRIN was always higher than for non-VRIN practices for operational performance ($\overline{\rho}$ = .359 versus $\overline{\rho}$ = .358), market performance ($\overline{\rho}$ = .288 versus $\overline{\rho}$ = .268), and financial performance ($\overline{\rho}$ = .282 versus $\overline{\rho}$ = .227). Overall, we conclude that these findings provide robustness to the hypotheses tests.

In addition, due to the consistently highest effect size between PSM practices and operational performance compared to the other estimations, we conclude that the effect of PSM practices on buying firm performance primarily manifests itself in operational performance improvement, after which it cascades further to market and financial performance improvements (Ray, Barney, & Muhanna, 2004). Next, we disaggregated PSM practices into six categories (see Figure 1) to study their individual effects on aggregate performance as well as on operational performance, market performance, and financial performance, which were all statistically significant in a 99 percent confidence interval. Consistent with the previous findings, all PSM practices show a stronger effect on operational performance (range between within PSM practices $\overline{\rho}$ = .545 and vertically aligned PSM practices $\overline{\rho}$ = .373) compared to financial performance (range between within PSM practices $\overline{\rho}$ = .225 and enabling PSM practices $\overline{\rho}$ = .183).

DISCUSSION

Theoretical Implications

Leveraging insights from RBT, we use meta-analysis to provide a synthesis of role and ability of PSM as a determinant of buying firm performance. In particular, we show whether and to what extent PSM practices matter, and we also provide a more nuanced and differentiated view of how strongly specific PSM practice categories contribute to buying firm performance. We were also able to distinguish effects between different PSM practices and buying firm performance categories. When interpreting effects, it is important to put them in relation to other known relationships (Aguinis et al., 2010). Thus, we contribute to RBT and to PSM research by providing evidence that PSM practices relate to performance at $\overline{\rho}$=.335. Based on the relatively large sample size in this study, we are able to conclude with high explanatory power that the "PSM practice–performance link" exists, thereby contributing to the conclusion of the mentioned theoretical debate. When comparing our effect to the effects of other meta-analyses, the PSM performance effect is larger than the performance effects of other strategic resources, such as research and development ($\overline{\rho}$ = .27, see Crook et al., 2008) or human capital ($\overline{\rho}$ = .21, see Crook, Todd, Combs, Woehr, and Ketchen Jr (2011). This suggests that the PSM function is an important strategic resource and that it has a strong effect on buying firm performance. Based on post hoc analysis, we can also conclude that PSM practices have their strongest impact on buying firm operational performance. At the same time, we find that across all studies, the hypothesized performance link to market performance and financial performance is statistically supported, although it is of a lower magnitude.

Furthermore, we find support for the relational view as a substream of RBT. In particular, we find empirical support for the higher performance attainable from relational supplier-facing PSM practices compared to nonrelational supplier-facing practices (Hypothesis 2). Thus, advantages that are attainable through relational supplier-facing PSM practices (where the supplier also contributes resources to the relational exchange) bear stronger performance implications for buying firms. Such a combination of resources supports greater creation of value for the buying firm than arms-length and nonrelational practices that appear more easy to imitate (Dyer & Singh, 1998; Kaufman et al., 2000). Nevertheless, the direct effect of nonrelational PSM practices was also supported across all three performance categories.

In line with arguments brought forward in RBT (summarized in Hypothesis 3), empirical evidence supports our assertion that VRIN PSM practices have a stronger effect on buying firm performance. However, when compared to the effect size exerted by non-VRIN practices, its effect is not significantly stronger. Hence, both of these categories of PSM practices appear vitally important to performance. However, both credibility intervals for the effect of nonrelational and non-VRIN PSM practices on performance overlap with

zero (see Table 2), which indicates that the positive performance impact is contingent on the presence of certain moderators, whereas the significant impact of relational and VRIN practices is not subject to moderation effects.

Managerial Implications

We provide evidence that supplier-facing practices with relational and mutual efforts yield, on average, stronger performance advantages than nonrelational activities. Thus, it is highly likely that proficiency in such practices is beneficial or worthwhile in terms of operational, market, and financial performance. Hence, PSM practices that are involved in complex resource interactions with suppliers, such as knowledge sharing and joint product development, are harder to replicate than nonrelational PSM practices, such as supplier selection, supplier evaluation, or supplier incentives.

Moreover, performance is not limited to complex resource interaction with suppliers but is also enabled through inward-facing practices. Theory suggests that the more complex and tacit the internal PSM practices are, the greater their average performance impact. However, this tendency was not found to be significant. Thus, both categories of VRIN and non-VRIN PSM practices are suggested to reap similar and significant performance effects.

Regarding the effects on different facets of firm performance, we identified a consistent pattern across almost all PSM practices. While performance effects are statistically significant regardless of which performance measure we applied, the effect of PSM practices categories on the three performance categories differs consistently in magnitude. PSM has the strongest impact on operational performance followed by market performance and then financial performance. In general, PSM effects on market performance and financial performance are weaker. Therefore, we suggest that PSM most likely contributes to overall firm performance by its effects through enhanced operational performance. In other words, operational performance might mediate the PSM-overall performance relationship, where operational advantages might eventually yield enhanced profitability and sales (e.g., Foerstl et al., 2013). A key implication is that the mediating effect of operational performance was not investigated in this study but deserves more attention in further research.

Implications for Further Research

The estimation of effect sizes also allowed us to detect blind spots and under-researched topics in the existing literature. Recent publications urge that PSM practices should contribute to buying firms' top line, or market performance, in addition to operational performance and financial performance. Our review demonstrates that the relationship between internal practices and supplier-facing PSM practices on market performance is largely unexplored. To fill this void, more research on PSM practices that make an impact on market offerings of the buying firm seem warranted (e.g., innovation and technology sourcing). Studies of practices that are proposed as contributions to the top line are limited to some notable exceptions (Wagner, 2012).

Because PSM rarely makes sourcing and supplier decisions without consulting the production, logistics, or R&D departments (Trent & Monczka, 2003), we recommend investigating cross-functional resource deployment within the buying firm. However, internal coordination and cross-functional integration are modestly researched, while most studies focused on performance implications of outward-facing PSM practices as summarized in Tables 2 and 3.

Moreover, we studied the performance gains from PSM practices, but we did not consider the costs and investments associated with acquiring and deploying resources. The implementation costs are likely to vary across the PSM practice categories. Thus, for a more complete picture, future research should focus on the actual costs and opportunity costs of resource deployment of the respective PSM practices and perhaps discount the performance effect accordingly. Doing so will provide a better sense of the overall value the PSM function contributes and likely necessitate leveraging ideas from finance—such as discounting cash flow and assets—to move the literature forward.

In addition, enabling practices and *vertically* aligned PSM practices, as catalysts of PSM's ability to contribute to a firm's financial performance, require further investigation (Giunipero, Handfield, & Eltantawy, 2006; Paulraj & Chen, 2005). The catalyst role of these PSM practices draws attention to the related topic of mediating affects in the study of the "PSM practice–performance link." A meta-analytical structural equation model, which was beyond the scope of this research, could be set up to analyze mediating effects based on the relatively large amount of available studies in this field (see Table 1). Moreover, the mediating role of operational performance on the link between PSM practices and financial performance could be an alternative causal mechanism (Swink, Narasimhan, & Wang, 2007). Ideally, such an examination would involve lagging performance effects (see Table 3). Thus, we encourage research into temporal effects to identify the time spans until effects materialize and how long they are sustained. Furthermore, only a few notable studies have used stock market or accounting-based financial data to validate the "PSM practice–performance link" (e.g., Baier et al., 2008; Ellram & Liu, 2002). Most studies have relied on self-reported perceptual performance data.

TABLE 3

Identified Areas for Further Research

1. Under-researched PSM Practice–Performance Relationships	2. Mediation Effects and Complementarity of PSM Practices	3. Moderation Effects on PSM Practice–Performance Relationships
• Outward-facing PSM practices and market performance • Internal PSM practices (vertically aligned, cross-functional, within, enabling) and operational, market, and financial performance • Costs associated with implementing the different PSM practices to discount their performance effect accordingly	• Role of mediating variables, such as vertically aligned or enabling practices, in particular on market performance and financial performance • Value of coexistence of PSM practices • The moderating role of operational performance variables in achieving market and financial performance	• Macrolevel variables: economic prosperity, geographic location, or industry-specifics such as hostility, resource scarcity, munificence, or dynamism • Microlevel variables: end-product complexity, stage in product life cycle, purchasing category, supply market complexity, or purchase novelty

Finally, our results yield moderating effects for some of the studied relationships (see Table 2 and post hoc analysis). This finding indicates that the study of moderating variables on the "PSM practice–performance link" deserves more attention in SCM research (see Table 3). The list of potential moderators is long and stretches from potential macroeconomic, geographic, or industry-specific influences to the microlevel of the firm, namely its product-market offerings and the specific purchasing categories the company procures in the supply market. While most studies report and control for regional and industry effects, few studies assess product-specific moderators such as product complexity, supply market complexity, or the stage of the life cycle of input components and output products. Kraljic's (1983) contribution stressed that the value of PSM practices is context specific. Despite this, few studies have embraced this approach, for instance in contrasting the effect of arms-length versus relational supplier-facing practice at the purchasing product group level. Moreover, by analyzing the value of PSM practices during specific time periods, it could be determined in which stage of the macroeconomic business cycle the PSM function contributes more or less to firm success. This in turn requires the study of different countries and industries to deduce causality. In Table 3, we summarize topics for future research that emerged from this meta-analysis.

CONCLUSIONS

The "PSM practice–performance link" has undergone intense empirical investigation over the last two decades. However, ongoing debate remained as to whether PSM, as a function, can contribute to buying firm performance. We shed light on this debate based on a meta-analysis of 99 independent empirical studies yielding a total of 22,971 observations on the PSM practice–performance relationship. Our results indicate general support for the positive link between PSM practices and buying firm performance and that supplier-facing relational practices exhibit larger effects than nonrelational PSM practices. The difference in magnitude of effect sizes regarding VRIN and non-VRIN practices was not empirically substantiated. Based on the study's findings, our post hoc analysis, and the comparability of PSM practices to other important determinants of performance, we hope to bring the conceptual debate about the strategic relevance of PSM closer to a conclusion.

As with all empirical research, our research is not free of limitations. Although we were able to test our hypotheses on different subcategories drawing on a large sample size, some data limitations prevented us from exploring other interesting relationships, such as the effect of internal PSM practices on market performance. Furthermore, it is possible that we did not collect all relevant research articles that investigate the effects of PSM practices on performance. To avoid this problem, we defined an extensive search string and filtered out articles carefully. In addition, the file drawer test revealed that the effect of missed studies is not likely to be a limitation of our research.

In closing, our initial research question, "What is the impact of the different PSM practice categories on buying firms' economic performance?" has been answered. Despite these findings, our hope is that future research resulting from this study will find

appeal in the academic community such that we will be able to define PSM's performance implications even more clearly in the future.

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